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FINAL
Supplemental Studies Investigation
Volume I - Work Plan
Middletown Airfield NPL Site
Harrisburg, Pennsylvania

Under Contract with
U.S. Army Corps of Engineers
215 N. 17th Street
Omaha, Nebraska 68102-4978

Prepared for:
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Response to
U. S. Environmental Protection Agency Comments
Nick DiNardo, RPM
Draft Middletown Airfield Supplemental Studies Work Plan
Dated 18 March 1994

In Volume 1, Section 1:

Page 2 - It should be noted that Gannett Fleming conducted the 1988 RI for EPA not DOD.

Response: The suggested clarification will be made.

Page 3 - At the top of the page, it states "The first phase of the RI". The text should reflect the fact that the RI was not originally intended to be phased. The distinct areas investigated were selected based upon an historical review of present and past site operations.

Response: The suggested clarification will be made.

Page 5 - Please identify and, if appropriate, explain the significance of two prehistoric archaeological sites being located near this NPL site.

Response: This information was taken from the RI Report, it is not significant to the Supplemental Studies Investigation and will be deleted.

Page 10- First paragraph, last sentence: The airport production wells (i.e. HIA-l through 14) have a deeper range than that reported in this narrative per information contained in the Remedial Investigation (RI). Per the RI, the reported range of their total depth should be 450 to 800 feet. Please correct the narrative to reflect this.

Response: The text will be corrected to indicate the deeper range.

Page 11- The GW treatment system currently in use is vastly different from the original one installed back in the mid-1980s. It should be stated that the system currently in use is capable of treating all of the HIA production wells.

Response: The suggested clarification will be made.

Page 13- Section 1.4.1.2 states that water in the bedrock aquifer would be relatively unaffected by a high river stage. USGS states that although the bedrock aquifer may not be directly affected by high river stage, river water could enter the water-table aquifer during high flow and eventually flow into the aquifer.

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Also in the last paragraph, please clarify the "hydraulic character" referred in the last sentence.

Response: The last paragraph in Section 1.4.1.2 will be revised to acknowledge interconnection between the river and the bedrock aquifer and reword the sentence containing "hydraulic character".

This section was taken directly from the Gannett Fleming RI report which has been approved and accepted by EPA. Further definition of the interconnection between the River and the bedrock aquifer can best be answered at the end of the investigation.

Page 14- In Section 1.4.1.3, it is stated that aluminum, iron, and zinc exceed EPA's AWQCs for those metals. It is my understanding of the data, that these hits were upgradient of the site and therefore are probably not site related.

Response: This statement was taken from page ES-8 of the RI Report. The suggested clarification will be made.

Page 18- In Section 1.4.4.3, please specify the type of contamination detected at well RFW-01.

Response: Organic compounds detected in the ground water sample from RFW-01 were TCE and DCE.

In Section 3:

Page 1 - In addition to outlining the tasks, it is recommended that the objectives of this investigation be included in this narrative.

Response: The reader is referred to Section 2 where the discussion of project objectives is provided.

Page 1 of Figure 3-1 - In the third bullet, "location" is misspelled.

Response: The text will be corrected.

Page 3 - Section 3.1.1 discusses a camera survey of Bldg. 142's pipeline. Although Bldg. 267's pipeline is no longer in use, a camera survey identifying potential breaches in the pipes integrity could help identify hot spots. Is it possible to include a camera survey of Bldg. 267's pipeline?

Response: USACE believes that the number of direct push soil vapor and soil sampling locations scoped for the Waste Sump House, Building 267 will provide adequate coverage of the pipeline to identify areas where releases may have occurred. Therefore, a camera Survey of the Building 267 pipeline is not necessary.

AR302693

Page 6 of Figure 3-1 - Since modeling will play a big role in determining what, if any, remedy is necessary, it seems that current soil data in the Runway area would be important. Can soil sampling be performed in this area?

Response: USACE has discussed the potential with EPA of drilling and sampling four soil borings in the Runway Area. Locations for these borings will be discussed with EPA prior to sampling. The sampling approach will be identical to that used for the soil boring program in the Main Building Area.

Page 8 of Figure 3-1 - The U.S. Air Force is required to provide quarterly monitoring at the Site until 1999. This document should state this fact even if the task is to be ultimately accomplished under a separate contract. The wording on page 34 in Section 3.15 and on page 50 in Section 4.16 should also be changed to reflect this requirement.

Response: The suggested clarification will be made.

Page 17 - After the bullets, the word "upon" is misspelled.

Response: The text will be corrected.

Page 18 - In the eighth line from the top, change the word "no" to "any".

Response: The text will be corrected.

Page 11 - In Section 3.1.1, because the topographic relief at the Site is low, USGS recommended that a detailed topographic survey be performed to delineate contributing areas to the storm sewer.

Response: A base map is being prepared for the site with 2 foot contour intervals which will permit the evaluation recommended by USGS.

Page 14 - USGS recommends that 10-20 of the 70 CPTs to be collected at the North Base Landfill be placed between the landfill and MID-04, in order to adequately determine potential contaminant migration towards the production well.

Response: USACE agrees that CPTs should be collected between the landfill and MID-04. USACE plans to relocate 5 or 6 of the CPTs to that area.

Page 15 - In section 3.4.2, USGS recommends that at a minimum, the deeper well in the nest should be as deep as the producing zone for the MID-04 well. This will enable the sentinel wells to sufficiently monitor any potential contamination from the landfill. In addition, USGS recommends that piezometers be installed prior to the placement of the sentinel well nests. This will allow placement of the nests more accurately on a potential flow path to the MID-04 well. USGS is concerned that standard

hydrologic analyses will be insufficient to accurately locate the sentinel wells. USGS recommends the use of nontraditional techniques (tracer tests, advanced borehole geophysical logging) to ensure accurate location of the wells in these hydrogeologically complex units.

In Section 3.4.3, USGS recommends that one more piezometer nest be installed prior to the installation of the sentinel wells. At least three piezometer locations are needed to identify effects of anisotropy on ground water flow and the analysis of piezometer data would help to site the sentinel wells at locations better suited to monitor potential contaminant movements. Also, geophysical logs of the piezometers would help to locate water-bearing zones where potential interconnection between bedrock bedding planes occur.

Response: Based on discussions with EPA, USACE agrees to install a third piezometer nest to gather data. The maximum depth of the piezometer will be the current depth at which the pump is set in MID-04 plus a maximum of 50 feet.

USACE agrees that installation of the three proposed piezometer nests prior to sentinel well installation is a way to optimize the placement of the sentinel wells.

USACE does not plan to use nontraditional techniques mentioned in the comment to locate the wells.

Page 19 - In Section 3.6, it should be stated that the VOCs detected in the Susquehanna River were all below MCLs, and that the metals, which exceeded AWQCs, were probably from upgradient sources.

Response: The suggested revision will be incorporated.

Page 20 - In Section 3.7, USGS recommends borehole logging as many of the HIA wells as possible. This would help in refining the hydrogeology of the Site and improve the conceptual and digital model of the ground water flow system.

Response: The HIA production wells are grouped on the eastern and western portions of the site with HIA-13 centrally located. The current scope calls for logging one well from each of the eastern and western groupings of productions wells and from well HIA-13. The wells within the groupings are sufficiently close that logging of more than one well per grouping will not likely provide sufficient additional information to justify the cost. In addition to the three HIA production wells, geophysical logs

will also be obtained from seven intermediate depth wells at the North Base Landfill and six deep wells installed within the Industrial Area as part of the capture zone analysis. Logging of this many wells should provide adequate data to understand site geology. EPA will be kept informed of the information obtained from geophysical logging. If EPA considers the data to be insufficient, USACE will log additional wells at EPA's request.

Page 28 - In Section 3.12.3, USGS recommends that following the calibration of the model and during the "model scenarios" that flowpath analyses be conducted to assist in the modification of HIA production well configurations and pumping rates.

Response: Some form of flow path analysis will be performed as part of the modeling effort.

Page 33- Since an exact location has not yet been determined for the SVE, EPA would like to suggest that the Runway area, because of the presence of VCM, be included in the list of possible locations. This topic is discussed again in Section 4.14.

Response: USACE acknowledges EPA's comment.

Page 35- Under Section 3.16, a Feasibility Study is discussed for the first time. The Project Schedule (Figure 5-2) makes no reference to either projected start or delivery dates for this report.

Response: Reference to a Feasibility Study will be deleted.

In Section 4:

Page 30 - In Section 4.10.2, it is recommended, that in all deep borings 300 feet or greater, flow logging be performed.

Response: Geophysical logging is proposed for appropriate deep wells to determine stratigraphy, structure, and potential water bearing zones. Packer testing is also planned for deeper wells which also will provide an indication of flow. Flow logging was proposed for only the depth specific sampling task for the HIA wells. USACE does not feel that flow logging is necessary in all deep wells used to characterize the site.

Page 31- In Section 4.11.2.1, Please describe the field procedure to sample occurrence and thickness of Non Aqueous-Phase Liquid (NAPL)).

For sample collection, EPA recommends that a low flow purging and sampling program be utilized with a low flow positive displacement bladder pump. Attached is a very draft directive on the procedures for low flow purging and sampling.

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To determine whether an adequate amount of water is purged from each monitoring well for obtaining representative ground water samples, other parameters such as eh and dissolved oxygen should be measured and monitored for stabilization. The enclosed directive discusses purging methodology.

Response: An interface probe will be used to detect NAPL in the wells and measure the thickness. If NAPL is detected, a sample will be obtained using a dual check valve bailer. The water in the bailer will be removed via a bottom valve assembly and the remaining product collected in 40-ml vials.

USACE is concerned about the ability of a bladder pump to evacuate water from the intermediate and deep bedrock wells and the potential for purging to take an extended period of time to complete if the field parameters do not stabilize while pumping at only 0.2 to 0.5 liters/minute. USACE plans to purge the wells per the description provided in Section 4.11.2 of the Work Plan.

Page 33 - As a general comment, all VOC sample containers are to be cooled to at least 4°C prior to sample collection.

In Section 4.11.2.2, a well survey within a half mile radius of the edge of known contamination should be completed prior to choosing the residential wells which will be sampled. Please include in the Work Plan, the Well Survey form that will be used to perform this task.

Response: ERM acknowledges EPA's comment regarding cooling the samples to 4°C. The sample containers are stored in the air conditioned field office trailer prior to being placed in the cooler with ice and taken to the job site. A total of eight wells will be sampled; five wells which were previously sampled by EPA and three wells yet to be determined. These three wells will be selected based on discussions with EPA and available information from DER's Water Well Data System and Borough of Middletown Water Department.

Page 54 - At the end of the first sentence in Section 4.19.1, EPA recommends the following words be added "and placed in a secured area onsite prior to final disposition". Also in the same Section, a discussion is presented on the use of an OVA to determine appropriate disposition of any excavated "background" soils. The use of an OVA for this purpose does not appear to be appropriate. In order to meet the LDR for TCE (91 ppb), a common site contaminant, the concentration of the contaminant in the soil would have to be less than 1.82 ppm if the "1 to 20" TCLP rule of thumb is used. This is the

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approximate field detection limit of the OVA. EPA proposes that these soils also be stored in the roll-offs until final disposition of all of the excavated soils is determined.

Response: Limited area is available at HIA for storage of cuttings and IDW . Every attempt will be made to store IDW in a "secured" area, but may not always be possible. Disposal of IDW will occur throughout the course of the field investigation.

Regarding containerization of cuttings from background soil borings, ERM planned that the background soil borings would be located outside of the Industrial Area and that EPA would be present at the time the boring locations are selected. ERM proposes that the decision regarding whether or not these cuttings should be containerized is made after the boring locations are selected. The discussion of the use of the OVA to screen soils will be deleted.

In Section 5:

Figure 5-2 - The chart shows mobilization and field work beginning in May, 1994. As evidenced by Mr. S.L. Carlock's December 6, 1993 letter to me, EPA extended the delivery date of the draft Work Plan to a date selected by USACE with the proviso that field work would begin in April, 1994. USACE entered this arrangement with the knowledge that EPA has 30 days to review this draft document. Any delay in the start date will result in a breach of the signed Administrative Order on Consent and could result in EPA issuing stipulated penalties against the U.S. Air Force.

Response: USACE acknowledges EPA's comment.

Figure 5-2 - The delivery date of the OU#2 Work Report, as mentioned in Section 3.17, is not shown here. If item #27 is this report, then the GW modeling shown as item #56 in Figure 5-3 would be completed after the preliminary report is submitted.

Response: Item #27 is this report and the delivery date would be 4 August 1995. The ground water modeling task shown on Figure 5-3 as item #60 will be completed 21 April 1995. Therefore, the ground water modeling will be conducted before submission of the report.

Figure 5-3 - In this Figure, do items #58 and 59 refer to the "Work Report" as opposed to the "Work Plan"? If not then what is the "Work Plan" that is referenced in these items and when is the "Work Report" due?

AR302698

Response: Items #58 and #59 refer to the Ground Water Modeling Work Plan (#56) which will be prepared and submitted for EPA approval prior to actually conducting the pumping tests and modeling. EPA review of the Modeling Work Plan is identified as #57.

In Volume 2, Section A:

Figure 7-2 - The detection limits shown for the 8260 method analysis are above both the method's own minimum detection limits and the health based values approved by EPA. For VCM, the detection limit actually exceeds the MCL by a factor of 5. Method 8260 is an acceptable analytical method for water analysis, however the methods lower detection limit is necessary when analyzing GW collected from potable production wells.

Response: The laboratories will report aqueous analyses results for vinyl chloride at less than the QAPP-specified quantitation limit of 10 µg/L, but greater than 1µg/L. Concentrations between 10µg/L and 1µg/L will be reported as estimate concentrations (J).

In Section C:

Page 1 - In the first sentence the word "Plan" should be placed after "... Safety and Health".

Response: The first sentence will be revised to read "Site Safety and Health Plan".

Table 3-1 -Was any consideration given to the potential for explosive gas in the Bldg. 141 pipeline and the Industrial Area Storm Sewers.

Response: The scope of work for the Building 142 pipeline integrity survey has been changed and the pipeline will no longer need to be accessed by ERM personnel. The potential for explosion has been decreased because the survey will be completed using colored dyes instead of having to access the pipeline at various locations between Building 142 and the lagoons to insert a camera.

Explosives gases encountered during the industrial storm sewer sampling are discussed in Section 8.6 of the SSHP.

On page 1, two bullets are left blank. Why?

Response: The applicable potential contaminants will be added next to the bullets on Page 1.

What does the term "N/A" will be removed from the table and the appropriate potential contaminants will be added.

Response: The term N/A will be removed from the table and the appropriate potential contaminants will be added.

Why do the geotechnical samples pose a different contamination threat to the field workers?

Response: Geotechnical samples pose the same threat to the workers as other soil samples collected onsite; therefore, the appropriate potential contaminants will be added to Table 3-1.

On page 8, Potential Contamination for the SVE Pilot test should be "To Be Determined".

Response: The potential contamination section of the SVE Pilot Testing will be revised from N/A to "To Be Determined".

Section 6, Page 1 - A copy of the training and medical requirements form should remain onsite and available for OSHA and EPA review.

Response: A copy of the "Contractor Occupational Safety and Health Certification" will remain on onsite for OSHA and EPA regulatory review. A sentence will be added to reflect this in Section 6.0 of the SSHP.

Response to
U. S. Environmental Protection Agency Comments
Nancy Rios, Toxicologist
Draft Middletown Airfield Supplemental Studies Work Plan
Dated 23 March 1994

I. Data Evaluation:

- Please use the EPA guidance "Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening to evaluate contaminants of concern for all media under investigation (see attachment). Note that the health-based screening levels in the guidance are based on a cancer risk of 1E-06 and a hazard index of 0.1 (not 1).

Response: Comment acknowledged. All screening to select constituents of potential concern will be performed using the methodology outlined in the referenced guidance. However, to account for updates in toxicological data, the screening levels will be calculated using the most recently revised HEAST and IRIS.

- The EPA Region III does not consider "background level at a concentration greater than three times the maximum observed site-specific background concentration" an appropriate methodology for comparing background levels with site-related contaminant levels. Please refer to the memorandum dated March 22, 1994 (Beryllium and Cobalt Protection Level) for an explanation on how to handle background.

Response: The use of a background value, or range of values, that is both representative of natural conditions on the site and acceptable to the USEPA is our goal. We are unfamiliar with the recently released memo on derivation of background levels and recently received a copy in order to evaluate its applicability to the diverse soil types on this site.

- It is not clear what is meant by "water is expected to mix completely. Therefore, background water samples are assumed to be representative of all of the water on the Site, and the screening level will be the maximum detected concentration in a background surface water sample." How many background surface water samples are going to be used for comparison with site-related contaminants in surface water? Why is the maximum concentration used? What type of statistical analyses are going to be employed? Are the water

samples ground water samples or a mixture of ground water and surface water samples? This section needs clarification.

Response: Two background samples will be collected, one each from the perennial stream at Meade Heights and the Susquehanna River.

The phrase "water is expected to mix completely" was included in the workplan to differentiate between the use of three times the maximum concentration detected in background samples to define background concentrations in soils and the use of one times the maximum detected in background samples to define background concentrations in ground water. This approach is proposed in order to account for constituents' ability to diffuse and disperse more readily in a liquid matrix than in a solid one.

Two background samples will be taken from surface waters upgradient from the site. One sample will be taken from the Mead Heights area and will be used as a point of comparison for surface waters in this area. The other will be taken from the Susquehanna River. This sample will be used to evaluate other river samples. Due to the difference in these water bodies, no attempt will be made to combine the background data; therefore, no statistical analysis will be performed on these data.

Ground water will be treated separately from surface water. Background samples for ground water (from wells located hydraulically upgradient) will also be collected and all ground water data will be compared to these data.

Clarification of this section will be provided incorporating USEPA's comments.

- Is the stream used for fishing? If so, the Ambient Water Quality Criteria (AWQC) for contaminants in the organism should be used as the risk-based concentration. If the surface water is used as a drinking water intake and for fishing, then the AWQC for water and organism or the risk-based concentration for drinking water should be used as the screening concentration (whichever is lowest).

Response: Two surface water bodies will be sampled; the perennial stream at Meade Heights and the Susquehanna River. The Meade Heights stream is neither used for fishing or as drinking water source. The Susquehanna River is used for fishing but not as a drinking water source.

The Susquehanna is used for fishing, and it is possible that there are down stream drinking water intakes; however site related impacts to downstream water intakes are not expected (Gannett Fleming, 1990). The smaller streams on the site may or may not provide suitable habitat for fish, but they are expected to support other types of

aquatic organisms. Therefore, all surface water data will be compared to: AWQC for aquatic life, AWQC for consumption of fish, all applicable federal Maximum Contaminant Levels (MCLs), and the risk-based screening concentration for drinking water.

- The risk-based concentrations (not the ARARs) for drinking water in the screening guidance should be used to screen for contaminants of concern in ground water.

Response: Ground water concentrations will be compared to risk-based drinking water screening levels to identify any areas with potentially unacceptable risk.

II. Quantification of Exposure:

Ground water modeling to determine exposure point concentration at the receptor is not acceptable. The 95% upper confidence limit of the mean concentration for each contaminant present in each aquifer in question should be calculated and used in the risk assessment.

Response: Comment noted. If monitoring data are available for the ground water, then these data will be used for exposure point concentration estimation. Exposure point concentrations will be determined statistically from ground water that is believed to be associated with the same aquifer or hydrologic zone.

III. Risk Characterization:

Please refer to the "Guidance on Risk Characterization for Risk Managers and Risk Assessors, February 26, 1992" when evaluating the uncertainty inherent in the risk characterization. Note that it is necessary to calculate both the average and upper-bound risk for each medium being evaluated in the risk assessment in order to address the uncertainty in risk per the guidance.

Response: This comment will be incorporated into the work plan. Both the maximum and average risks will be calculated for each exposure scenario.

Response to
Comments of Pennsylvania
Department of Environmental Resources
Draft Middletown Airfield Supplimental StudiesWork Plan
Dated 15 March 1994

1) Table 3-1 - for the Industrial Area, the plan states that soil and soil vapor samples will be analyzed for specific VOCs, which are listed. The plan omits carbon tetrachloride and 1,2-dichloroethane (1,2-DCA), which are also required to be analyzed for by the Scope of Work. These compounds should be added here and in the discussions of the work that is to be conducted at the site.

Response: These two compounds will be added to the list of analyses being performed by the field laboratory.

2) Section 3.6, Pg 19 - The Scope of Work states that in the event results from the surface water and/or sediment sampling identify the presence of site-related contaminants exceeding appropriate documented levels, an aquatic survey of the river will be performed. This contingency is not discussed in the work plan.

Response: An aquatic survey of the river will be performed in a subsequent work effort if sampling results indicate an impact. Text addressing the subsequent work has been added to Section 3.6.1..

3) Section 3.17, Pg. 36 - The plan states that upon EPA's acceptance of the report, ERM will prepare a draft Record of Decision. Is this correct? Won't the draft ROD be prepared by EPA?

Response: The draft ROD will be prepared by USACE

4) Figure 4-5 - The acronym SWMU should be identified.

Response: The use of this terminology is inappropriate and will be replaced with "area".

5) Health and Safety Plan, Figure 10-2 - The map to the hospital is incorrect. The "Airport Connector" as shown on the map doesn't exist.

Response: The map will be corrected.

Response to
Comments of Pennsylvania
Department of Transportation, Bureau of Environmental Quality
Draft Middletown Airfield Supplimental StudiesWork Plan
Dated 23 March 1994

1. Section 1.2.5.1, pg. 9 of 19:

   In the fourth (4th) paragraph it states that production well HIA-13 is used for drinking water. I believe this is incorrect and that this well is used for industrial purposes only, at the Chloe plant. Please clarify this with the Bureau of Aviation.

Response: Based on converstations with Mr. Tim Alloway of the HIA Water Department, water from HIA 13 is blended with water from two to three other production wells and treated by the Water Department prior to distribution in the potable water system.

2. Section 1.4.3: Fire Training Pit (FTP)

   We disagree with the statement that the Remedial Investigation (RI) adequately characterized this area, and as such, was not included in the scope of work of the work plan.

   Page 5 of the 1992 ESD states;

   > "The supplemental study has been expanded. The scope of this study is as follows:
   >
   > - The potential impact of contaminated soil on the ground water will be addressed. This assessment <u>will include</u> consideration of the impact on ground water from contaminated soils in and around the Sump House in the Industrial Area, as well as the soils in the North Base Landfill, Runway, <u>and Fire Training Pit Areas</u>. ... This investigation should include sufficient additional soil sampling these areas as is necessary to determine the impact of soil contamination on ground water."

The only soil analysis conducted at the FTP area during the Gannett Fleming RI was one (1) surface soil sample, where contaminants were detected. The dashed area identified as the FTP in the RI report is misleading and does not reflect the <u>actual pit</u>, but an arbitrary area <u>around the pit</u>.

The dashed area encircles the three (3) monitoring wells installed and falsely leads one to believe that the FTP soils have be evaluated through

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the analysis of well soil borings. We therefore feel that the supplemental study investigation should include the FTP area, as required.

Response: Based on conversations with EPA, USACE learned that a cap or low permeability layer exists at the site. Therefore, EPA does not recommend that the cap be penetrated by drilling soil borings. No additional intrusive activities are planned for this area.

3. Sec. 3.0, Supplemental Studies Site Investigation Tasks

   The Fire Training Pit should be included here, as discussed in comment #2.

Response: USACE acknowledges this Bureau of Environmental Quality comment. See above response.

4. Sec. 3.4, North Base Landfill (NBL)

   In the second paragraph, except for the first sentence, discusses the Meade Heights area, which is not related to the NBL and therefore should be deleted.

Response: The second paragraph will be deleted.

5. This work plan proposed at a minimum 68 additional monitoring wells. This in addition to the 48 existing wells at the site. Due to the complex stratigraphy and hydrogeologic setting at the site many of the proposed wells are necessary or required.

   However, we believe the six (6) nested piezometers for the capture zone analysis of the Middletown water supply well (MID-4) can be eliminated <u>and/or</u> is not required by the ROD or ESD. The 1990 ROD only required that a monitoring well be installed between the NBL and the MID-4 well to monitor impact to this water supply well. The capture zone analysis was required only for the HIA production well system.

   We feel the two (2) sentinel well nests can be utilized to determine whether MID-4 is drawing contamination from the NBL plume. If the sentinel wells do not show any response to pumping of the Middletown well, then the intent of installing the piezometer well nests would be satisfied.

Response: The work plan incorrectly identified six well nests when only three nests will be installed. The piezometers will be used for capture zone analyses of MID-04 relative to the North Base Landfill and also assist in placement of the sentinel wells.

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Response to
Comments of USACE
Gill Scholl CEMRO-ED-GH
Draft Middletown Airfield Supplemental Studies Work Plan
Dated 30 March 1994

General

1) Drilling techniques that were prepared for deeper wells should be included somewhere in the report so that this field document can be followed

Response: Details regarding the borehole size, casing size, and general drilling procedures will be incorporated into Section 4.9.3.2.

2) Drilling lubricants are not mentioned here that I saw. Any lubricants that are used for downhole work must be approved prior to mobilization to the site so there is time to modify while not in the field. For example, hammer lubricants, pipe dope lubricants, etc. are not to be used until USACE approval has been received. Commercially available, non-contaminating, non-polymer, non hydrocarbon based lubricants are available even for hammer drilling. Likewise, air filters are required on the air drilling rigs. These are all common things in the environmental industry, but thought they should be mentioned even if they are not in the workplan.

Response: ERM acknowledges this USACE comment.

Volume I- Work Plan

Section 1

<u>Section 1.1 (page 3 of 19)</u>

1) Third paragraph. Some of these requirements are ROD related also.

Response: The last sentence of the third paragraph on p. 3 of 19 will be modified to indicate that ROD requirements are also being satisfied in the Work Plan.

Section 2

No comments

Section 3.0

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Section 3.4 (page 13 of 36)

1) Second paragraph. Most of the second paragraph applies to the Meade Heights area not the North Base Landfill. Should place this in section 3.5 if at all

Response: The second paragraph will be deleted.

Section 3.4.2 (page 15 of 36)

2) Paragraph 3. The intermediate depth sentinel wells are planned for 200 feet depth not 100 feet.

Response: The text will be corrected to reflect the 200 foot depth.

Section 3.4.3 (page 16 of 36)

3) Paragraph 2, sentence 1. The depth relationship stated here is incorrect. Look at comment #2 above.

Response: The text will be modified to correct the error.

Section 3.4.4 (page 17 of 36)

4) Third, fourth, and fifth bullets. The depths are not as scoped. If you think that the wells should be installed at different depths, that needs to be discussed, because USACE and ERM already negotiated the contract for the scoped depths. Existing well RFW 01 already showed TCE to a depth of at least 20'. Based on CPT water samples the depths may be adjusted, but until that point the depths should stay as scoped.

Response: The text will be modified to correct the error and indicate the intermediate depth wells will be installed to a depth of 100 feet.

Section 3.5 (page 18 of 36)

5) The next to last sentence in top paragraph should not contain the word "no" to be correct.

Response: The word "no" will be deleted.

Section 3.7 (page 21 of 36)

6) The detail for estimated pumping rate percentage should be addressed. The concern is that such a low flow rate may be used by ERM and only the most prolific zone will produce. Lower conductivity zones may contain some of the contaminant also and then they would not be represented in the flow rate. With geologic variability across the site, 1) low conductivity zones at one well may

have higher conductivity at other locations, thus 2) allowing for the chance to have movement of contaminants close to a well even though the conductivity in a zone of a well appears low.

Response: The comment is somewhat unclear but ERM interprets it to mean that a low pumping rate will induce preferential flow from a highly conductive zone rather than from a low conductivity zone which may also be contaminated. The best that can be expected is that a well is pumped at its sustainable rate with out dewatering the well resulting in a composite water quality indicative of that location. The water quality at any location is a function of the mass of contaminants which enter the well from all zones.

Section 3.13.1.5 (page 31 of 36)

7) The amount of piezometers should be 3, 3, and 3, not 6, 6, and 6.

Response: The text will be modified to correct the error.

Section 4

Section 4.11.2.1 (page 32 of 56)

1) 1st paragraph. If there is a turbidity problem, gentle pump placement, removal and bailing will be very important. Turbidity may be problem if you set the pump exactly on the bottom with a low yield well.

Response: ERM acknowledges this USACE comment.

Section 4.11.2.1 (page 33 of 56)

2) Turbidity shall be measured also for the sampling event.

Response: The text will be revised to indicate that turbidity will be measured during the sampling event.

Section 4.11.2.3 (page 34 of 56)

3) 1st paragraph. Typo, 4th line, HIA-5 through HIA-14 should be HIA 6 through HIA-14.

Response: The text will be modified to correct the error.

Section 4.11.2.3 (page 34 of 56)

4) Number 4. What is the decontamination procedure and the sampling device type?

Response: The sampler will be decontaminated per the procedure in Section 4.17.2. A reference to this section will be added to the text on

AR302709

p. 34 of 56. The sampling device is designed and built by Welenco, but is not specifically named.

Section 4.11.2.3 (page 35 of 56)

5) Number 6. What certainty of depth control do you have without running the gamma ray tool to tie the whole suite of logs together especially when the well is flowing. Are weight bars going to be needed with expected flow velocities?

Response: The down hole logging tools weigh approximately 50 pounds. It is uncertain if upward flow velocity from a pumped well would be sufficient to affect the accuracy of the logging tool depth meter. ERM will check with the subcontractor to determine if weight bars are needed to stabilize the tool.

Section 4.11.2.3 (page 35 of 56)

6) Number 7. What results trigger taking a sample. It is not envisioned to capture all of the samples in the top 300 feet if only clean samples are indicated by logs below 300 feet. Part of the study is to understand if the contamination goes to the full depth of the well which may be 800 feet.

Response: Geophysical logging will be used to identify significant potential water bearing zones. These data will be used to select potential zones throughout the full depth of the well for sampling.

Section 4.12.2. (page 35 of 56)

7) It is expected that HIA-13 will probably be one of these.

Response: ERM acknowledges this USACE comment.

Section 4.17.2. (page 52 of 56)

8) How often will the field person get rid of decon waters for sampling equipment, at least between each new hole?

Response: At a minimum, fresh decon water for sampling equipment will be used between each hole, typically however, the water will be changed two to three times per hole.

Section 5.0 (Figure 5-3)

9) SVE implementation seems like it should not be so far out in future if the data is available before the fall. From the schedules it appears that chemical analysis data would be back by mid-September at the latest.

AR302710

Response: Prior to performing the SVE pilot study, a recommendation as to whether a SVE pilot study should be performed has to be submitted to USACE and if approved than a workplan prepared for USACE and presumably EPA and PADER approval. ERM was concerned that by the time approval was given of the workplan, the weather conditions may not be optimum for conducting the pilot study. That is the reason the SVE pilot test was scheduled for the spring of 1995.

AR302711

Response to
Comments of USACE
Anita Meyer CEMRO-ED-EH
Draft Middletown Airfield Supplemental Studies Work Plan
Dated 22 March 1994

1. General. There is a general lack of detail throughout this workplan, it has always been my impression that the workplan is to be used in the field as a guide for doing the work. There is not sufficient detail in many portions of the document to allow it to be used in this way. The Corps also prefers a more detailed document to avoid confusion later about what was to be accomplished.

Response: ERM acknowledges this USACE comment. The scope of the study is sequential with the results of the first task influencing the second task and so on. With this approach, it is difficult to be specific. The exact location of certain sampling points was not specified (piezometers at North Base Landfill) because insufficient information was available at the time of workplan preparation. Finally, the workplan is organized such that Chapter 3 presents the scope of work and Chapter 4 presents the methods for how different activities will be performed.

2. Section 3.5. Correct double negative in the first paragraph.

Response: The double negative in the first paragraph will be corrected.

3. Section 3.4.3. Where are the piezometers going to be placed? Please include a map showing their locations.

Response: The exact location is not known at this time. Additional information such as the pumping rate of MID-04, the extent of the fill, and accessibility need to be considered prior to selecting locations.

4. Section 3.5.2. There is not enough detail given in this section. I can't tell what is actually going to happen. How are the samples going to be taken? Will diversity and abundance be determined for all locations or just the background?

Response: Refer to Section 4.8.3 for sampling locations, methods, and analysis (diversity and abundance) for the fish and macroinvertibrate survey.

5. Section 3.5.1 and 3.5.2. The sampling locations are given as approximate, please list the factors that might cause these locations to change.

AR302712

Response: At the time the workplan was written, a site visit was not conducted to evaluate and verify the sampling locations along the stream near Meade Heights. Surface water and sediment sampling and the biological stream survey were intended to be conducted at the same time so that the results of the chemical analyses could be correlated with the results of the biological survey. The combined results will provide the necessary information to assess the quality of the stream. Factors that might cause a change in these sampling locations are discussed below.

- Habitat variables such as substrate composition, flow, stream bank vegetation, aerial canopy cover (stream shading), stream bank stability and other variables should be similar for each station so that the biological data collected during the macroinvertebrate and fish surveys can be compared equally. If it is determined that habitat differences between stations would affect the results of the biological surveys, the station locations will be changed to reflect similar conditions. The general sampling approach of one background station, 2 stations located along Meade Heights, and one downstream for the surface and sediment sampling and 3 stations (background, adjacent, and downstream) for the biological surveys will not change.
- The availability of depositional sediments at each of the stream stations will also be a factor in establishing the final station location. The availability of stream sediments will be determined during the field reconnaissance survey.
- If a seep is detected along the stream downstream of the approximate location, then the sampling location will be moved to just downstream of the seep so that the affects of the seep can be evaluated by bracketing the seep.

6. Sections 3.5.1 and 3.6.1. What sort of sampling device is going to be used to sample the sediment?

Response: Refer to Section 4.8.2.3 for a detailed discussion on the types of sampling devices that will be used to collect the sediment from the Meade Heights stream and the Susquehanna River. This section discusses the use of decontaminated stainless steel trowels and a decontaminated sediment core sampling device (Wildco Hand Core Sampler).

7. Risk assessment (human and eco.), general. Please save us all some grief and include as much detail as possible in this plan for the risk assessment. Using the past RI documents and a site visit you should be able to include a lot more than what is presented. The plans submitted here are just not sufficient for the Corps and the EPA to

know what is actually going to be done. If there is a firm agreement up front we will save a lot of time further down the road.

Response: ERM acknowledges this USACE comment. In order to provide sufficient information to the Corps and EPA, a telephone conference was held 22 June 1944 with Martha Boss of USACE and ERM. Pursuant to this conference, we will prepare a letter outlining our probable approach to risk assessment on this site. This outline will allow the USACE to evaluate specific details of the risk assessment and provide input into exposure scenarios and other decisions relating to the risk assessment. This letter approach will still provide the USACE sufficient flexibility with the USEPA to allow for the sequential nature of this study.

8. Section 4.15.1.1. There is not an adequate description of evaluation of data, i.e. how will qualified data be treated, lab contaminants etc. The first paragraph does not give enough detail.

Response: Data generated for ten percent of the samples collected during the investigation will undergo a rigorous ERM data review. This review will be performed in accordance with the most current Region III modifications to the "Laboratory Data Validation Functional Guidelines for the Evaluation of Organic (and Inorganic) Analysis" (US EPA Data Review Work Group, 6/91 for Organics and 7/88 for Inorganics). The remaining sample data will only be evaluated based on the results of associated blanks. Based upon the quality assurance review, qualifier codes will be placed next to specific sample results on the sample data tables. These qualifier codes will serve as an indication of the qualitative and quantitative reliability of the data.

9. Section 4.15.1.1. Please give more information of how previous data will be incorporated with the new, for example what will happen if two different analytical methods are used? Are you going to exclude any data based on its age?

Response: Data from previous investigations will be incorporated into the nature and extent of contamination evaluation and the risk assessment. Data will only be used if it is felt that, as a result of physical characteristics of either the constituent or the media, concentrations have not varied over time. For instance, polyaromatic hydrocarbons (PAHs) are resistant to leaching and volatilizing in soils; therefore, data for these constituents would be considered in this report.

10. Section 4.15.1.1. Please state what exposure scenarios will be considered when calculating the health-based screening levels. For example, there are some areas of the site that contain sensitive populations, it would not be reasonable to assume only a worker scenario here for screening purposes. Please include to calculations that will be used to derive health-based screening values.

AR302714

Response: Health based screening levels will be calculated in a manner that is consistent with USEPA guidance (EPA/903/R-93-001, January 1993); thus, exposure scenarios used to derive screening levels will match those outlined in this document. It is expected that the majority of the onsite soils will be compared to industrial worker screening levels and some areas may be screened against residential screening levels. Similarly, following USEPA guidance, surface water that could be used as a drinking water source will be screened against drinking water screening levels. Although the guidance document will be attached as an appendix, the equations used to derive the screening levels, and the assumptions regarding exposure, will be included in the text.

11. Section 4.15.1.1. The streams sampled will have a potential for human consumption from incidental ingestion by wading recreators, consider this in your screen the surface water.

Response: Screening will proceed per USEPA Region III's guidance. If surface water exceeds the screening levels, then an exposure scenario such as children recreating in the creek will be considered.

12. Section 4.15.1.2. Please include the exposure scenarios that will be evaluated, and in the following section include in detail how they will be evaluated. This site is rather diverse, we have an industrial situation plus in the northern region of the site a residential area with sensitive populations. The sooner we nail down how these are going to be treated the better.

Response: The risk assessment work plan does not provide exposure scenarios for each portion of the site to allow for flexibility in the development of the risk assessment. Potential exposure scenarios that are envisioned for the entire site (although each scenario may not be applied to all portions of the site) include: residential, industrial, recreational (playing in the creek and ATV riding), trespassing onto the restricted areas, and fishing in the creeks and river. Each of these scenarios may be best developed once the description of each area and the constituents of concern in each area are known. Therefore, we request that this information be omitted from the risk assessment work plan.

13. Section 4.15.1.2.1. Please identify the preliminary exposure pathways that you anticipate will be evaluated.

Response: The risk assessment work plan does not provide exposure scenarios for each portion of the site to allow for flexibility in the development of the risk assessment. Potential exposure scenarios that are envisioned for the entire site (although each scenario may not be applied to all portions of the site) include: residential, industrial, recreational (playing in the creek and ATV riding), trespassing onto

the restricted areas, and fishing in the creeks and river. Each of these scenarios may be best developed once the description of each area and the constituents of concern in each area are known. Therefore, we request that this information be omitted from the risk assessment work plan.

14. Section 4.15.1.4. I would like to see an uncertainties discussion for each area of the site.

Response: An uncertainties section following the discussion of each area would strengthen the RI. This comment will be incorporated into the work plan.

15. Section 4.19.3 Do not use methanol for decontamination, you will be generating a RCRA F003 listed waste.

Response: Methanol will be used as a decontamination solution, but will be collected, containerized, and stored at the site pending proper disposal as I.D.W. ERM acknowledges the regulations in 40 CFR300 Tables 302.4 and 40 CFR261.5.

AR302716

Response to
Comments of USACE
JIM WOOLCOTT, CEMRO-ED-EH
Draft Middletown Airfield Supplimental StudiesWork Plan
Site Safety and Health Plan
Dated 3 March 1994

1. Table 3-1, Pg. 2 - If lead is a known site contaminant (as listed in this table), than your medical monitoring section should include employees receiving pre- and post-work blood lead tests, per 1926.62, along with initial employee sampling, presence on-site of the standard, and initial work in level C (HEPA) respiratory protection. If lead is not anticipated to be encountered, delete reference(s).

Response: The lead levels detected onsite during the Remedial Investigation are representative of background conditions and are not indicative of a lead contamination problem at the Site. In addition, the soils are moist due to a high water table (5 to 8 feet deep), therefore dust would be minimal. Proper engineering controls will be used to control any dust created. Areas will be misted with water once the soil has been contacted by any sampling method. The soil levels of lead at Middletown generally range from 7 to 30 ppm in the soil with several exceedances. The highest concentration recorded was 335 ppm. This level is still considered to be low by EPA Risk Assessment Models for ingestion of lead. In addition, this level is below the EPA required cleanup level of 500 ppm. Although the possibility of lead exposure exists at Middletown, ERM feels that there is an extremely low chance that individuals will be exposed in excess of the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) or the Action Limit at $30\mu g/m^3$.

ERM still feels that it is important to list lead as a possible contaminant in Table 3.1 because proper personal hygiene methods should still be followed including limiting smoking, drinking, and eating in the work place, which would limit employee exposure.

2. Figure 4-1, Section 4.0 (Pg. 3), & Section 10.0 (Pg. 1) - Name of USACE IH/Safety Officer is incorrect. Should be spelled "Anita Meyer".

Response: Figure 4-1, Section 4.0, and Section 10.0 will be revised to read Martha Boss instead of Anita Meyer.

3. Table 8-1, Pg. 2 - a) - Cadmium ACGIH TLV should be 0.01 mg/m3; b) - Under Arsenic - column headed "Characteristics", type - change "odar with with" to Odor vary with".

AR302717

Response: The ACGIH TLV for Cadmium will be revised to read 0.01 mg/m and the "Characteristics" column for Arsenic will be revised to read "odor vary with".

4. Table 8-1, Pg. 3 - Toluene ACGIH TLV (1993-94) should be 50 ppm, not 100 as stated.

Response: The ACGIH TLV for Toluene will be revised to read 50 ppm.

5. Environmental monitoring to assure compliance with OSHA, following the ACGIH guidelines, is only applicable for permeable pro-clothing. The Corps has determined that Level D and mod-D is permeable; Level C, B & A is impermeable, and these employees should be monitored by use of physiological protocol specified in the USGC/EPA/OSHA/NIOSH "4-Agency Manual". Some of this information you have included in this section. Please address this distinction between monitoring (environmental vs. physiological) methods.

Response: As per discussion with Martha Boss, IH and S for the COE, ERM's approach to heat stress is adequate.

6. General - a) I did not notice any information concerning your HazCom written program (existence, availability on-site) or see any MSDSs included in the SSHP. Although MSDS on site contaminants are not technically required by 1910.120 to be included, .120 does required specific hazard information on site contaminants. The easiest way to meet this requirement is to include MSDS on these chemicals. Also, MSDS are required to be submitted for review on all chemical brought on-site (Decon solutions, gasoline, etc.). A copy of HazCom written program can be included as an Appendix. Make sure a list proceeds the MSDS X-referencing the MSDS location within the program (reference 1926.59 (e) (1) (i).

Response: Material Safety Data Sheets (MSDSs) for all chemical compounds encountered onsite as well as MSDSs for chemicals brought onsite will be located in a binder in the ERM field office. Each binder will include an index to cross-reference chemicals. In addition, Table 8-1 also makes reference to the potential contaminants that may be encountered onsite. Reference to ERM's Hazard Communication program will be added to Appendix A.

b) I also did not notice any statement describing the existence/availability of a written respiratory plan, as required by 1910.134(b)(1). Please address.

AR302718

Response: A reference will be made to ERM's respiratory plan in Appendix C of the SSHP and a copy will be made available at the ERM field office.

c) Please state in the SSHP that a copy of the OSHA Poster # 2203, Notice of Employee Rights, will be kept posted on-site at all times during this project.

Response: A reference to the posting of the OSHA Poster #2203, Notice of Employee Rights will be made in Appendix A of the SSHP.

d) The Corps S&H manual, EM-385-1-1, requires that a Certificate of Analysis be submitted to the Corps site representative verifying that any bottled air used in conjunction with Supplied Air Respirators meet minimum Grade D characteristics. See attached guidance document for further information.

Response: A "Certificate of Analysis" will be submitted to the onsite Corp's representative verifying that bottled air used for supplied air respirators meets at a minimum Grade D characteristics and a reference will be made in Appendix C of the SSHP.

e) Per the new lead (construction) standard, a quantitative fit test within the last 6 months for all employees wearing a FF APR is required. I have included a Corps memo on this subject. Either address or delete lead as a contaminant, if it is not anticipated to be encountered.

Response: As mentioned in Comment 1, ERM feels as though the potential to exceed the Action Level at 30 $\mu g/m^3$ of lead in air is extremely low, therefore, a quantitative fit test would not be required. ERM conducts qualitative fit tests for employees on a yearly basis to assure proper respirator fit.

AR302719

MIDDLETOWN AIRFIELD SITE
Middletown, Pennsylvania

DRAFT WORK PLAN (Prepared 28 FEB 1994 by ERM)
Supplemental Studies Investigation

Comments by: Jerry Trease, CEMRO-ED-EG (Chemistry)
U.S. Army Corps of Engineers, Omaha District
Dated 19 April 1994

VOLUME I - WORK PLAN

Section 1:

1. TOC/4 Page reference (4-17) for section 4.8.1. should be flush rate.

   Response: The format will be corrected.

2. 1.0/1 1st para. A sentence break is suggested after the word "Pennsylvania." Then reword the remainder of the original sentence as follows: "These studies are required by..."

   Response: The suggested edit will be made.

3. 1.0/1 2nd para. According to the RI Report (section 1.1), the RI/FS Work Plan was dated August (not September) 1988 and amended November 1988.

   Response: The text will be changed to indicate the correct data for the RI/FS Work Plan.

4. 1.1/2 Previous reports use the acronym "MAAMA," instead of "MA/MA." A global search and replace is suggested.

   Response: The suggested edit will be made.

5. 1.2.1/4 4th para. Add a comma after the word "Borough."

   Response: The suggested edit will be made.

6. 1.2.1/4 Last para. If the park that is referenced in the first sentence is Hoffer Park, its location description in that sentence may be inaccurate.

   Response: This information was taken from the RI Report. However, it is not significant to the Supplemental Studies Investigation, and the first sentence will be deleted.

AR302720

7. 1.2.3/5 1st line. The acronym SCS should be defined the first time it is used in the document.

Response: The acronym SCS is defined on p. 1-4, fifth paragraph.

8. 1.3/12 2nd para. In the sentence "Four 24-hour pumping tests were performed . . ." it should be clarified that one pump test was stopped after 11 hours due to a torrential rain shower. (Ref. pg. 3-45, 1990 RI Report).

Response: The suggested clarification will be made.

9. 1.4/12-19 Section 1.4 looks incomplete w/o a separate bullet and subsection to summarize the surface water and sediment data from the Susquehanna River.

Response: This comment is acknowledged. A summary of the RI surface water and sediment data from the Susquehanna River will be added as Section 1.4.7.

10. 1.4.2.3/16 1st para., last line. Suggest the words "are present" be replaced by the words "were detected."

Response: The suggested edit will be made.

11. 1.4.2.3/16 2nd para., 3rd sentence. The word "anymore" is redundant with the word "currently," and could be construed as suggestive.

Response: This statement was taken from page 4-35 of the RI Report. The word "anymore" will be deleted from the sentence.

12. 1.4.3/17 It is probably premature to determine whether the Fire Training Pit has been adequately characterized. Combining the first two sentences is suggested by deleting the phrase "has been adequately characterized in the RI. Therefore, it". Then, the addition of a clarifying sentence should be considered, similar to the following: "The current Supplemental Studies Investigation of adjoining areas was designed to provide information which, when evaluated in conjunction with previous RI data, will determine whether additional study is needed in the Fire Training Pit Area." Any rewording should be coordinated with the USACE TM to assure USACE compliance with requirements of the ESD.

AR302721

Response: This comment was discussed with Mr. Daniel Gillespie, the USACE TM, on 27 April 1994. Subsequent discussions between USACE and EPA revealed the presence of a low permeability layer at the Fire Training Pit Area. EPA recommended that no additional borings be conducted in order to prevent penetrating the low permeability layer.

13. 1.4.4.1/17 1st para. If known, the origin of the slag should be stated. It is of interest to know whether the slag at the North Base Landfill was of the same description and origin as the slag used as fill under the runway.

Response: Comment acknowledged. This information was taken from the RI Report, and no additional information concerning the slag at the North Base Landfill is available at the present time.

14. 1.4.5.3/17 Last para. The information in the last paragraph discusses Swatara Creek and is out of place under the *Chemical Data Summary* section for Meade Heights. Moving it to section 1.4.6, if not redundant with information already given in section 1.4.6, is recommended.

Response: Comment acknowledged. The information in this paragraph is already summarized in Section 1.4.5; therefore, the last paragraph of Section 1.4.5.3 will be deleted.

Section 2:

15. 2.0/1 1st para., 9th line. Soil vapor should be added to the list of media to be sampled.

Response: The suggested addition will be made.

AR302722

16. 2.0/1 2nd para. (1) The example given in this paragraph needs to be clarified to emphasize the comprehensiveness (with the exception of the camera survey) and flexibility of the Industrial Area field program to encompass not only the pipeline between Bldg. 142 and the lagoons but also the pipeline system which connects numerous buildings (both demolished and existing) to the Former Industrial Waste Sump House (Bldg. No. 267). Ref. section 3.1 (2) The project objectives for investigating ground water should be clarified to emphasize study of the hydrological (or hydrogeological ??) interconnection of the entire ground water regime extending from the North Base Landfill area to aquifer system under the Industrial and Runway Areas. (3) The quarterly monitoring programs for the Susquehanna River and the sentinels wells between the North Base Landfill and production well MID-04 should be identified as a project objective. (4) Conducting an aquatic survey in the stream at the Meade Heights should be identified as project objective.

Response: Comment acknowledged. Based on further discussion with Mr. Trease and Mr. Gillespie, the second paragraph of Section 2.0 will be amended to state the overall project objectives, as listed in Scopes PR001, PR002, PR003 and PR004.

Section 3:

17. 3.01 1st bullet. For consistency with the content of section 3.1, it is suggested that the following or similar phrase be added at the end of the 1st bullet: "/Building 267 Pipeline".

Response: The suggested edit will be made.

18. Table 3-1 Good effort! Table 3.1 provides a good reference for a comprehensive summary of entire investigation. The minor comments which follow are only suggestions and should be incorporated only to the extent that they contribute useful clarification that may facilitate quick reference to field personnel. Table 4-1 in the QAPP (Appendix A) is the source of a few of the suggested clarifications.

a. Pg. 1, 2nd bullet under Investigation Action: add the words "and pipelines" after the word "House".

Response: The suggested clarification will be made.

b. Pg. 1, 4th bullet under Analysis: add CCl_4, 1,2-DCA to the list of compounds. Note: it is this reviewer's understanding that the mobile lab screening analysis for split spoon samples (five/boring) was to include these compounds. However, for the direct push work, these two compounds were eliminated so that a portable GC/PI, as opposed to the laboratory grade GC/PID/ELCD, could be used to avoid the high daily rental expense of the GC/PID/ELCD and GC/MS mobile lab.

The disposition of this comment should be coordinated with the author of the ERM-FAST® QAP (App. A, Attachment 2). The ERM-FAST® QAP includes CCl_4 and 1,2-DCA in the compound list for the screening analysis of all direct push samples (soil vapor, soil, and water) as well as for the screening analysis of all split spoon samples. PADER comment 1) should also be considered in addressing this comment.

This comment also applies additional bullets on the remaining pages of Table 3-1 as follows: all split spoon soil (S) samples for (F, Level II) analyses using the laboratory grade GC/PID/ELCD. Based on the assumptions that background borings will be needed and that they will be completed when the GC/PID/ELCD and the GC/MS mobile lab is on-site, this would include Background Soils given on pg. 7 of Table 3-1.

AR302724

Response: Based on discussions with Mr. Gillespie and Mr. Trease on 27 April 1994, it is the current plan to use the GC/PID/ELCD for all Level II field screening, including the screening during the SVE pilot testing. Therefore, CCl_4 and 1,2-DCA will be added to the list of compounds for Level II screening for the direct push soil vapor and soil samples as well as the split spoon samples and vapor samples from the SVE pilot test.

With regard to the background soil borings, the Work Plan states that these samples will be analyzed for TCL VOCs plus TICs by GC/MS, for Level III data. Therefore, this change is not applicable for the background soils.

c. Pg. 1, 7th and 9th bullets under Analysis: add TOC, CEC to the parameter list.

This comment also applies additional bullets on the remaining pages of Table 3-1 as follows: all split spoon soils (S) samples for laboratory (L) analyses. The Background Soils (given on pg. 7 of Table 3-1) is an exception where TOC and CEC was not scoped.

Response: TOC and CEC will be added to all bullets on Table 3-1 pertaining to the laboratory analysis of split spoon soil samples, with the exception of the background soils.

d. Pg. 1. Suggested reformat for last two bullets under Investigative Action:

•Based on GC screening, select 3 samples from each of 10 borings plus a surface scrape sample (0-2") from 2 borings along pipeline routes	•30(S)	•(F, Level III) TCL VOCs + TICs (exclude surface scrape samples)
	•32(S)	•(L) TCL SVOCs + TICs, TCL Pesticides (only). TAL total metals, CN (total and amenable). TOC, CEC
•Based on GC screening, select 3 samples from each of 2 borings plus a surface scrape sample (0-2") from the 2 borings at Lagoons	•6(S)	(F, Level III) TCL VOCs + TICs (exclude surface scrape samples)
	•8(S)	•(L) TCL SVOCs + TICs. TCL Pesticides/PCBs, TAL, total metals, CN (total and amenable), TOC, CEC

Response: The recommended format changes will be made.

AR302725

e. Pg. 2, 2nd bullet under Investigative Action: Unless a decision was made to the contrary during negotiations of Scope PR001, the phrase "sample shallow well for VOCs with 14-day turnaround time to locate intermediate well" should be added (after adding a semicolon) to the end of the second bullet. A following applicable entry should be made under the respective Number of Field Samples and Analyses columns: •1(GW)(shallow well); •(L)TCL VOCs plus TICs (14 day turnaround).

Response: Comment withdrawn by Mr. Trease during conference call on 27 April 1994.

f. Pg. 2. Suggested reformat for 4th bullet under Investigative Action:

•Based on GC screening, select 3 samples from each of 2 shallow well borings along Bldg. 142 pipeline	•6(S)	•(F, Level III) TCL VOCs + TICs
	•6(S)	•(L)TCL SVOCs + TICs, TCL Pesticides (only), TAL total metals, CN (total and amenable), TOC, CEC
•Based on GC screening, select 3 samples plus a surface scrape sample (0-2") from the 1 shallow well boring at Lagoons	•3(S)	•(F, Level III) TCL VOCs + TICs (exclude surface scrape sample)
	•4(S)	•(L) TCL SVOCs +TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), TOC, CEC

Response: The recommended format changes will be made.

g. Pg. 3. Suggested reformat for 2nd bullet under Investigative Action:

•Based on GC screening, select 3 samples from each boring plus 10 surface samples (0-2") for analysis	•90(S)	•(F, Level III) TCL VOCs + TICs (excludes the 10 surface samples)
	•100(S)	•(L)TCL SVOCs + TICs, TAL total metals, CN (total and amenable), TOC, CEC
	•78(S)	•TCL Pesticides (only)
	•22(S)	•TCL Pesticides/PCBs on 18 samples from borings and 4 surface samples

Response: The recommended format changes will be made.

h. Pg. 3. Suggested reformat for 6th bullet under Investigative Action:

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•Based on GC screening, select 3 samples from each shallow well boring plus 1 surface sample (0-2") for analysis	•9(S)	•(FLevel III)TCL VOCs + TICs (excludes the 1 surface samples)
	•10(S)	•(L)TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), TOC, CEC

Response: The recommended format changes will be made.

i. Pg. 4 & 5. The analysis "moisture content" should be added to the parameter list for the sediment sample for Meade Heights and the Susquehanna River.

Response: Moisture content will be added to the parameter lists for the Meade Heights and Susquehanna River sediment samples.

j. Pg. 7. Background Soil. Under the Number of Field Samples column change the number from 20 to 15 for the TCL VOCs + TICs analysis, then add the bullet "•20(S)" across from the remaining parameters. Then under the Analyses column change the work "except" to "excludes".

Response: The suggested edits will be made.

k. Pg. 7. Existing Monitoring Wells. Indicate that there are 32 shallow monitoring wells the for TCL Pesticides analysis.

Response: The suggested clarification will be made.

l. Pg. 8. SVE Pilot Testing. Under the Investigation Action column it is suggested that the 4" be moved to follow the first SVE acronym in the description.

Response: The suggested edit will be made.

AR302727

m. Pg. 8 & 9. Quarterly Monitoring Program. Susquehanna River: Based on the schedule for task number 63 on Figure 5-3 in Section 5 of Work Plan, only 4 quarterly monitoring rounds are possible (subsequent to the initial sampling) by the end of the third calendar quarter 1995, assuming the initial round occurs in July 1994. Sentinel Wells: Based on the schedule for task number 64 on Figure 5-3 in Section 5 of Work Plan, only 3 quarterly monitoring rounds are possible (subsequent to the initial sampling) by the end of the third calendar quarter 1995, assuming the initial round occurs in October 1994. This affects the Number of Field Samples given in Table 3-1.

Response: Based on discussions with Mr. Gillespie, the quarterly monitoring program described in this Work Plan will include sampling through the third quarter of 1995. The number of field samples given Table 3-1 for the Susquehanna River and the Sentinel Wells will be changed to reflect this data.

o. Pg. 8. Typo: "oOxygen" in the last bullet under the Analysis column.

Response: The text will be corrected.

p. Pg. 9, footnote (2). Typo: "cCompounds" in the definition of SVOCs.

Response: The text will be corrected.

q. Table 3-1. The SITE WIDE - WATER SOURCE analyses given on Table 1.0 of Scope PR001 and Table 1.0 of Scope PR002 are not included on Table 3-1 of the Work Plan. Please explain.

Response: The Site Wide Water Source sampling and analysis will be added to Table 3-1.

19. 3.0/2 2nd paragraph, 2nd sentence. Since Level III GC/MS data will be generated using a laboratory grade instrument, either the work "near", or the entire 2nd sentence should be deleted or reworded.

Response: This sentence will be deleted.

20. 3.0/2 3rd paragraph. Clarify for consistency with response to comment 18.b above.

AR302728

Response: The compounds CCl_4 and 1,2-DCA will be added to the list of parameters for field screening by GC.

21. 3.1/3.0 The title of section 3.1 doesn't match the content of that section. An alternative title might be: INDUSTRIAL AREA - BLDG. 142 & 267 PIPELINES/LAGOONS

Response: The title of Section 3.1 will be amended as suggested.

22. 3.1.4/6 Last para. At the end of the second sentence, add the phrase "(two along the pipelines and two in the lagoon area)".

Response: The suggested clarification will be made.

23. 3.1.4/6 Last. para. Delete the phrase "and Polychlorinated Biphenyls (PCBs)" from the 8th line. Then add the following sentence to the paragraph: "A total of six subsurface samples from the two borings and two surface scrape sample all from the wastewater lagoon area will be analyzed for TCL Polychlorinated Biphenyls (PCBs)."

Response: The paragraph will be amended as recommended.

24. 3.1.5/6 1st para., 1st sentence. To avoid a misconception of the number of wells being installed overall in the Industrial Area (section 3.1 and 3.2), the ending phrase "in the Industrial Area" should be deleted.

Response: The sentence will be edited as recommended.

25. 3.1.5/7 4th para., 1st sentence. Suggested rewording: "Ten soil samples (nine subsurface samples from borings and one surface scrape sample .....".

Response: The suggested clarification will be made.

26. 3.1.5/7 4th para., 2nd sentence. The phrase "plus TICs" should be added after the acronym VOCs.

Response: The suggested edit will be made.

27. 3.1.5/7 4th para., last sentence. Suggested rewording: ".....TCL SVOCs plus TICs, TCL Pesticides, TAL total metals, cyanide (total and amenable), TOC and CEC. Three subsurface samples and one surface scrape sample from the mid-lagoon area shallow monitoring well boring will also be analyzed for TCL PCBs."

Response: The sentence will be reworded as recommended.

28. 3.1.5/7 Last para. The word "cyanide" should be replaced with the phrase "cyanide (total and amenable)". A global search and replace for all of section 3.0 is recommended.

Response: The term "cyanide" will be replaced with "cyanide (total and amenable) throughout Section 3.0.

29. 3.1.5/8 1st paragraph. Suggested rewording: "The samples from the two shallow monitoring wells installed along the Building 142 pipeline will be analyzed for TCL Pesticides, and the sample from the shallow well installed in the mid-lagoon area will be analyzed for TCL Pesticides/PCBs.

Response: The sentence will be reworded as recommended.

30. 3.2.1/9 2nd para. The last sentence should clarify the percentage of samples or sample locations that will be collected for geotechnical samples.

Response: The Work Plan states that two samples per boring will be collected for geotechnical analysis. ERM feels that this provides a clearer understanding of the sampling requirements than a percentage.

31. 3.2.1/9 Last para. Suggested rewording for the 6th line: "for TCL SVOCs plus TICs, TCL Pesticides, TAL total metals, cyanide (total and amenable), TOC and CEC." Note: TOC AND CEC should be added to all lists of parameters in section 3.0 which involve soil samples to be submitted to an offsite laboratory for chemical analysis. Background soil samples is an exception where TOC and CEC where not scoped.

Response: TOC and CEC will be added to the list of parameters for off-site laboratory analysis of split spoon soil samples to all appropriate sections of Section 3.0, with the exception of the background soils.

32. 3.2.2/10 4th para., 1st sentence. Suggested rewording: "Ten soil samples (nine subsurface samples from borings and one surface scrape sample) .....".

Response: The suggested clarification will be made.

33. 3.2.2/10 4th para., last sentence. Suggested rewording: ".....TICs, TCL Pesticides/PCBs, TAL total metals, cyanide (total and amenable), TOC and CEC."

Response: The sentence will be reworded as recommended.

AR302730

34. 3.2.2/10 Last para. Suggested rewording: ".....TCL VOCs plus TICs, SVOCs plus TICs, TAL total metals (total and dissolved), cyanide (total and amenable). The three shallow .....".

Response: The sentence will be reworded as recommended; however, the word "total" following "TAL" will be deleted.

35. 3.4/13 1st para., last sentence. Typo: Fruehauf, not Freuhauf. Incidentally, Fruehauf Corporation was acquired by Terex Trailer Corporation, to whom the property was deeded on 6 July 1989.

Response: The spelling will be corrected, and the sentence will be changed to indicate the change in property ownership.

36. 3.4.1/15 At the end of section 3.4.1 and/or at other appropriate locations is the Work Plan, the locations for collecting duplicate confirmatory samples for offsite laboratory analysis for QA/QC purposes should be described. Scope PR002 paragraphs 2.2.3.4 and 2.2.3.6 provide pertinent background information, special PQLs, and recommended sampling locations. During preliminary scope development, upland crop fumigation was suggested as one possible source for the low estimated levels of bis(2-chloroethyl)ether which were reported for monitoring well RFW-1 in the 1990 RI Report.

NOTE: Based on discussions with Lancaster Laboratories and MRD personnel, the effect of adding HCL preservative to the confirmatory samples for off-site analysis will have an unknown effect on the selected B/N/A compounds; therefore, it was concluded that such samples should not be acid preserved. Consequently, the maximum holding time for analysis is reduced from 14 to 7 days. The following notations (or equivalent) should be clearly indicated on the Chain-of-Custody records of ERM Traffic Report which will accompany the samples inside the cooler used to ship the samples to the respective laboratories: BIS(2-CHLORO-)8260, NO ACID PRESERVATION, 7 DAY HOLDING TIME, TARGET POL = 5 µg/L FOR TCL VOCs, BIS(2-CHLOROETHYL)ETHER, AND 1,2-, 1-3, 1,4-DICHLOROBENZENES.

Response: Regarding the first part of this comment, a reference to the collection of duplicate confirmatory samples will be added to Section 3.4.1. Additional details concerning proposed duplicate sample locations will be provided in Section 4.6, which discusses the sampling methodologies.

The second part of this comment is acknowledged, and the direct push ground water samples will be collected in unpreserved vials. Appropriate instructions for the recommended notations to the laboratory will be added to Section 4.6 of the Work Plan and to the QAPP. These notations will be written on the Traffic Report and Chain of Custody forms, and the laboratory will also be notified verbally when this sampling event takes place.

37. 3.4.2/15 Last para. Scope PR002 paragraph 2.2.12.1 indicates 200 feet (not 100 feet) for the proposed intermediate depth sentinel wells. Please explain.

Response: The proposed well depths will be corrected.

38. 3.4.2/15 2nd para. Verify the appropriateness of the term "monitoring well" to describe piezometers.

Response: The term "monitoring well" will be replaced with "piezometer".

39. Figure 3-4 Existing monitoring well location GF-303 and boring locations BH-1 and BH-2 should be added to the figure. Also, different location symbols and separate legend descriptions should be provided on the figure for monitoring well versus soil boring locations. Also explain why the symbol used on the figure for the production well MID-04 is identified as a building under the legend.

Response: Figure 3-4 was prepared using Figure 4-7 of the RI Report. The locations of monitoring well GF-303 and borings BH-1 and BH-2 were not shown on that figure.

The figure will be revised to show a different symbol for monitoring well versus soil boring locations. Production well MID-04 is located inside the building shown on the figure. The legend will be changed to clarify this point.

40. 3.4.3/16 2nd para. The phrase "The shallow and intermediate piezometers will be install to the same depths as the sentinel wells" may need to be reworded depending on the disposition of comment 37 above.

Response: This sentence will be amended consistent with the change made in response to Comment 37.

41. 3.4.3/16 3rd para. Supply the missing period at the end of the first sentence.

Response: The suggested edit will be made.

42. 3.4.4/17 3rd, 4th, and 5th bullets. Scope PR002 paragraphs 2.2.12.4.1, 2.2.12.4.2 and 2.2.12.4.3 indicate 100 feet (not 50 feet) for the proposed intermediate depth monitoring wells. Please explain.

Response: The proposed well depths will be corrected.

43. 3.5/18 9th line from top of page. Clarify the phrase "did not contain no".

Response: The word "no" will be deleted from this sentence.

44. 3.6/19 2nd para. Clarify the difference in the year (1989) for completing the surface water and sediment sampling given in section 3.6, 2nd para. compared to section 3.6.1, 2nd para. (1990).

Response: According to Section 3.7 of the RI Report, the surface water and sediment sampling actually occurred in December 1988; therefore, the dates given in Sections 3.6 and 3.6.1 of the Work Plan are both incorrect and will be changed to 1988.

45. 3.9/22 In addition to the concern for the potential migration of contamination from the North Base Landfill, this paragraph should be reworded to acknowledge contamination present in the Industrial Area as part of the reason for capture zone analysis for HIA Wells.

Response: This paragraph will be reworded as recommended.

46. 3.12.1/26 1st bullet. It is suggested that the words "and Pipeline" be inserted after the number "267".

Response: The suggested clarification will be made.

47. 3.13/29-33 Global search and replace for section 3.13. For consistency with the format used in previous sections of the draft Work Plan, replace the phrase "TCL VOCs and SVOCs plus TICs" with the new phrase "TCL VOCs plus TICs, TCL SVOCs plus TICs." Also replace the word "cyanide" with the new phrase "cyanide (total and amenable)."

Response: Section 3.13 will be edited as recommended.

48. 3.13.1.3/30 The letter "s" should be deleted from the word "wells" in both bullets under the Mid-Lagoon Area heading. "TCL pesticides" is not a parameter for intermediate well, however, both "TCL pesticides and PCBs" is a parameter for the shallow well.

Response: The text will be edited as recommended.

49. 3.14/33 1st para., 3rd line. Suggest replacing the word "in" with the word "from".

Response: The suggested edit will be made.

50. 3.14/33 2nd para., 5th line. Suggest replacing the phrase "more appropriate remedial" with the new phrase "appropriate for the Site."

Response: The suggested edit will be made.

51. 3.14/34 2nd para., 6th line. Suggest replacing the phrase "TCL VOCs and SVOCs plus TICs" with the new phrase "TCI VOCs plus TICs," "TCL SVOCs plus TICs."

Response: The sentence will be reworded as recommended.

52. 3.16/35 Last para., 2nd line. Delete the comma after the word "health."

Response: The suggested edit will be made.

Section 4:

53. 4.1.1/1 The first sentence should be reworded to indicate which pipeline will be involved in the video camera survey. It is this reviewer understanding that the video camera survey will only involve the Bldg. No. 142 Pipeline, not the Waste Sump House (Bldg. No. 267) pipeline system.

Response: The recommended clarification will be made.

AR302734

54. 4.2.1/3 The *Objective* for the soil vapor survey needs be reworded to include the full list of objectives given in section 3.1.2 of the draft Work Plan.

Response: The section will be modified to refer the reader to Section 3.1.2 for a detailed discussion of the objectives of the soil vapor survey.

55. 4.2.2/3 Reference Figure 3-2 should be revised (or another figure provided) to show the Bldg. No. 267 pipeline system. The wording in section 4.2.2 needs to be supplemented to estimate the length of the Bldg. No. 267 pipeline runs and to estimate the anticipated number of soil vapor survey points to be collected along those runs.

Response: Figure 3-2 will be revised based on additional information which ERM has received concerning the pipelines to correct the location of Pipeline 142 and add the location of Pipeline 267. Section 4.2.2 will be revised to include reference to soil vapor sampling points along the Building 267 pipeline runs. However, the total exact length of pipeline is not clear at the present time. The 40 points will be distributed to provide adequate coverage along the pipeline and around the Waste Sump House area. Exact sampling locations will be determined in the field based on site conditions and consultation with the USACE.

56. 4.6.5/16 See the NOTE in comment 36 above for alerting the laboratories to special analytical requirements for the direct push water samples. Unless field screening results from the upcoming field investigation indicate otherwise, the recommended location for collecting the USACE downgradient split would be downgradient of monitoring well RFW-1.

Response: As indicated in the response to comment 36, details concerning proposed duplicate sample locations will be added to Section 4.6. The recommended instructions for notations on the Chain of Custody and Traffic Report forms submitted to the laboratory concerning analytical requirements will be added to this section.

57. 4.7/16 2nd para. The compound list for Level II GC screening by the mobile field unit for the different media (direct push soil vapor, direct push soil, direct push ground water, and split-spoon soil samples) needed to be clarified. See comment 18.b above to coordinate response for this comment.

Response: The compounds CCl_4 and 1,2-DCA will be added to the list of parameters for Level II field screening.

58. 4.8.2.1/17 Last paragraph. Since the fluorescent painted stakes will be used as the reference point for locating the sampling stations during subsequent quarterly monitoring events, the position of the stakes (if still present) should be verified (relative to measured positions documented in the field notes) immediately prior to each quarterly sampling round.

Response: This paragraph will be revised to indicate that sampling station locations will be verified as recommended. A sentence will also be added to the end of Section 4.16.1 indicating that surface water/sediment sampling locations will be verified prior to each quarterly sampling event.

59. 4.8.2.2/18 Last sentence. Figure 3-6 shows the direction of the Susquehanna River roughly east-southeast adjacent to the site. Consequently, it seems more appropriate to refer to sampling points along the "northern side," rather than along the "eastern side."

Response: The suggested clarification will be made.

60. 4.8.2.5/19 Both paragraphs. For consistency throughout the Work Plan, the word "cyanide" should be replaced by the phase "cyanide (total and amenable)."

Response: The suggested clarification will be made.

61. 4.8.2.5/19 2nd para. The second sentence states that "Sediment parameters such as pH and Eh will be measured at each sampling by mixing four parts distilled water to one part sediment." Please clarify whether these (presumable on-site) measurements will be a substitute for, or in addition to, the off-site laboratory analysis of pH as indicated in Table 3-1 for sediment (pg. 5 for Meade Heights; pg. 6 & 9 for Susquehanna River). Either pH should be added to the parameter list in the first sentence of this section, or appropriate corrections made on Table 3-1 in the Work Plan and in Table 4-1 & 4-3 in the QAPP. If field measurement is proposed in lieu of laboratory analysis, please discuss the rationale for the swap in the response to this comment.

Response: The statement that Eh will be measured on sediment samples is incorrect and will be deleted. The pH of the sediment samples will be measured in the field as indicated; however, sediment samples will also be analyzed for pH by the off-site laboratory, as required by the Scope of Services. The list of parameters in this section will be edited to include pH.

62. 4.11.2/31 In the event that a floating non-aqueous phase liquid (NAPL) layer is encountered in any new or existing monitoring well, a sample of the floating NAPL sample shall be collected and handled as described in section 2.4.8.4., pg. C-5, of the GENERAL CHEMISTRY REQUIREMENT (APPENDIX C) of the Scope of Services.

Response: A reference to the potential collection of a floating NAPL sample will be added to this section.

63. 4.11.2.1/32 1st para., 4th line. Please clarify the rationale for the use of the word "necessitating" in regard to placement of the pump intake during well evacuation.

Response: When a pump with a low flow rate is used to purge a high yielding well, the pump is initially placed near the top of the water column, and it is lowered further into the well as purging proceeds. This ensures that all of the stagnant water in the well is removed during purging. If a low flow rate pump were placed near the bottom of the well, the pump might not create sufficient drawdown to evacuate the water near the top of the water column.

AR302737

64. 4.11.2.3/34 Item 4. Please provide detailed description of the materials of composition and operation of the specialized sampling device.

Response: The depth specific sampler is a device developed by *welenco, inc.* for collection of water samples from discrete intervals in a borehole. The samplers are constructed of stainless steel and come in two sizes: 2.125-inch and 3.0-inch outside diameter, with volumes of 1 liter and 2 liters, respectively. The sampler is disassembled and decontaminated between each use.

Prior to placing the sampler into the borehole, the sample chamber is evacuated and sealed. The sampler is then lowered to the required depth using an electric logging cable which is powered from the logging truck at the surface. When the sample depth is reached, a motor-operated valve is opened and closed, allowing the water sample to replace the vacuum inside the sample chamber. The sampler is then brought back to the surface, and the sample is transferred to the sample containers.

65. 4.11.4/36 2nd line. The term "MID-04" should be "HIA". See section 3.9.2, 2nd paragraph in the draft Work Plan.

Response: The text will be edited as recommended.

66. 4.12.1/36 Regarding the rationale for conducting capture zone analysis, see comment 45 above.

Response: This section will be revised to be consistent with the changes recommended in Comment 45.

67. 4.16.2/50 Regarding the number of quarterly rounds of sampling, see comment 18.m above.

Response: This section will be edited after comment 18m. is addressed to be consistent with the number of quarterly sampling rounds indicated on Table 3-1.

AR302738

68. 4.16.2/51 Regarding the sentence, "If dedicated PVC bailers are used for the initial ground water sampling, the bailers will be stored on-site in plastic bags labeled with the well numbers," two potential sources of contamination may result from long term bailer storage in plastic bags. (1) If adequate temperature control is not employed for storing the bailers, either the plastic bag or the PVC bailer may contribute contaminants from off-gassing. (2) If the bailers are not completely dry before being wrapped in plastic, bacterial growth could contribute contaminants. Note: one possible alternative that may be less prone to contamination could be to securely suspend the dedicated bailers above the highest anticipated water level inside the respective monitoring wells.

Response: It is ERM's standard procedure to place dedicated bailers in plastic bags and store them in a secure location on-site (i.e. the field operations trailer), if available. If there is no permanent structure on-site, arrangements may be made to store the bailers at the ERM warehouse in West Chester, PA. A statement will be added to Section 4.16.2 indicating that the bailers will be allowed to air dry before being wrapped in plastic.

69. 4.16.4/51 Last two sentences. Regarding pH and Eh measurements in the field, coordinate any changes to this section with the response to comment 61 above.

Response: The statement that Eh will be measured on sediment samples is incorrect and will be deleted. pH will be added to the list of laboratory parameters for the sediment samples.

70. 4.17.2/52 1st bullet. Laboratory grade non-phosphate soap should be specified.

Response: The suggested clarification will be made.

AR302739

71. 4.17.2/52 3rd bullet. In general, the use of 10% nitric acid rinse is viewed by this reviewer as practical in a laboratory cleaning procedure for non-metal equipment and containers that come in contact with the sample, but of questionable value in a field decontamination procedure. In this reviewer's opinion, about the only application for a 10% nitric acid rinse would be for the decontamination of reusable non-metallic bailers (dedicated PVC bailers for purging and sampling monitoring wells as described in the last paragraph of section 4.17.2), and for the decontamination of the non-metal parts (if any) of the Millipore® Hazardous Waste Filtration System (section 4.18). It is assumed that the separate laboratory clean glass jar for each surface water sampling location (as described in section 4.8.2.2) will be clean by the laboratory. Please explain the rationale and provide references of which support the use of 10% nitric acid for decontamination of stainless steel sampling equipment in the field.

Response: ERM's standard operating procedure (SOP) for field decontamination of equipment used to collect samples for metals analysis includes a nitric acid rinse because the acid rinse provides a low pH media for removal of trace metals. ERM's SOPs were developed to concur with requirements of various regulatory agencies (i.e., USEPA, NJDEPE, PADER). It is ERM's understanding that the use of a 10% nitric acid solution is a USEPA requirement.

72. 4.18/53 1st para. The second sentence should read: Tables 4-1, 4-2 and 4-3 of the QAPP ...."

Response: The suggested clarification will be made.

AR302740

73. 4.18/53 2nd para. For collecting samples for dissolved metals, large capacity (750 cm^2 filtration area) disposable in-line filters may provide some advantages over the Millipore® Hazardous Waste Filtration System. For example: (1) In some parts of the country where the concentration of dissolved iron in high water which is bailed from deep monitoring wells may cause filtration problems if the iron begins to precipitate upon exposure to air. The advantage of using an in-line filter would probable only be realized if a slow flow rate pump is used to deliver the sample directly from the well to the sample bottle with the filter in-line. (2) In general, the potential for picking up foreign contamination from the filtration apparatus would be minimized provided a high quality in-line filter and connecting tubing are used.

Response: Based on discussions with USACE, it has been determined that the slow flow rate pump method will not be used for purging and sampling; therefore, the use of an in-line filter is not applicable. The Millipore® system will be used for field-filtration of the dissolved metals samples.

74. 4.18/54 3rd para., 2nd sentence. Based on USACE's experience and on recommendation from Lancaster Laboratories, double bagged conventional ice is preferred over ice bags (Blue Ice) for sample shipments to the laboratory because conventional ice is more effective for maintaining cooler contents at 4 degrees C.

Response: This sentence will be revised to indicate that double bagged conventional ice will be used to refrigerate samples for shipment.

75. 4.18/54. Last para. An additional form (titled Characterization of Environmental Samples for Disposal) should be included with the Chain-of-Custody records and ERM Traffic Report forms in each cooler shipped to the MRD Laboratory. Guidance for completing this sample disposal questionnaire is given in section 3.6, page C-11 and Attachment 2 of Appendix C to the Scope of Services. The sealed ziploc plastic bag containing these three documents should be tapped with masking tape to the under side of the cooler lid.

Response: This section will be amended to include reference to the additional form for transmittal to the MRD Laboratory.

76. 4.18/54 Last para. As described in section 2.2.2, page C-1 & C-2, of Appendix C to the Scope of Services, sample shipment to the MRD Laboratory should have a project specific LIMS number (either LIMS #2102, LIMS #2103, LIMS #2104, or other additional LIMS numbers as may be established by the USACE throughout the investigation) included on the Chain-of-Custody record and ERM Traffic Report form. Based on personal communication with MRD Laboratory personnel, recording the LIMS number on individual sample bottle labels is optional. Note: the Stage 1, Stage 2, and Stage 3 terminology described in section 2.2.2 in App. C of the Scope no longer applicable. In general, the sequential use of the LIMS numbers given above should correspond to logical progression of the field work and correlate to the timely submittal of Analytical Data Packages as described in section 3.4 of App. C of the Scope. It is important that a clear message be included on the Chain-of-Custody record indicating the final shipment of samples shipped to the MRD Laboratory under a given LIMS number. This message is the que for the MRD staff to close out that LIMS number and prepare a Chemical Quality Assurance Report.

Response: Reference to project specific LIMS numbers established by the USACE during the investigation will be included in this section.

77. 4.18/54 New para. Suggest a new paragraph be added to address laboratory notifications of initial, weekend, and final sample deliveries. Detail with respect to notifications to the MRD Laboratory are given in section 2.2.6 of App. C to the Scope of Services.

Response: A paragraph will be added at the end of Section 4.18 which provides a brief description of the communications between the Field Operations Manager, the ERM Laboratory Coordinator, and the analytical laboratories concerning sampling schedule and sample shipment and delivery. The government QA laboratory will be notified as required by Section 2.2.6 of App. C of the Scope of Services.

AR302742

78. 4.19.5/56 1st para., 1st sentence. Please explain the rationale for covering the drums of IDW with plastic?

Response: The drums of IDW are covered with plastic to: a) prevent the accumulation of rain water on the drum lids and in the staging area; b) protect the labels from exposure to the weather, which may result in fading over time; and c) keep the outside of the drums relatively clean. In the event that the drummed material requires off-site disposal, this will save the time and expense of preparing the drums for off-site shipment (i.e. re-labeling and cleaning the outsides of the drums).

VOLUME II - APPENDICES

APPENDIX A - QUALITY ASSURANCE PROJECT PLAN

79. Figure 2-1 According to section 2.4.3, page C-3, of the GENERAL CHEMISTRY REQUIREMENTS (Appendix C) to the Scope of Services, the Quality Assurance Officer shall report to a responsible senior officer of the company (i.e., QA management shall be separate from project management). The organization chart on Figure 2-1 inappropriately shows the QA manager reporting to the Project Manager. Please revise the org. chart accordingly.

Response: Figure 2-1 will be revised to reflect the reviewers comment.

80. 2.12/4 Based on the business card this reviewer received from Ms. Loewen during the lab inspection, her first name is Kathleen, rather than Katherine.

Response: Section 2.2 of the QAPP will be revised accordingly.

81. 3.1/1 2nd para., last sentence. Soil vapor should be added to the list of sample media.

Response: Section 3.1 of the QAPP will be revised accordingly.

82. Table 3-1/3 North Base Landfill Area. On the top line, the Type of Analysis should read "On-site GC Analysis" and the Data Quality Level should be II. On the bottom line, the Type of Analysis could read either "Off-site Analysis" or "Off-site GC/MS Analysis."

Response: The top line will be revised accordingly. The bottom line will remain unchanged.

AR302743

83. Table 3-1/3 Main Airport/Industrial Storm Sewer. The phrase "assess presence levels" under the Purpose column is unclear.

Response: The phrase will be changed to "assess the presence of constituents."

84. Table 3-1/3 Background. The Purpose statement should be read follows (or similar) for the On-Site GC Analysis: To aid in selecting grab samples for VOC's analysis.

Response: The phrase will be changed accordingly.

85. 3.2/2 3rd para. The 2nd sentence regarding trip blank is unclear. In this reviewer's experience, the purpose of trip blanks is to determine whether samples are being contaminated during transit or sample collection.

Response: Travel blanks also serve as a check on whether detected results are indicative of the sampling location(as do other blanks). In this sense, they serve as a check of the accuracy of the results relative to the sampling location.

86. Table 3-3 Under the Precision Objectives column, three clarification are suggested: (1) replace the acronym "TCL VOA" with "TCL VOC" to avoid possible confusion with the term "volatile organic aromatics" which is sometimes use to represent BTEX; (2) replace the term "TAL/PPL Inorganics" with "TAL Inorganics" since the priority pollutant list (PPL) is not specified for this project; and (3) delete the entire row for the parameter "Total Petroleum Hydrocarbons" since TPH is not a parameter for this investigation.

Response: Table 3-3 will be revised to reflect the reviewer's comment.

87. 3.2/4 1st para. after the bullets. Please clarify the title of the USACE Engineering Regulation as follows: "Engineering and Design - Chemical Data Quality Management for Hazardous Waste Remedial Activities."

Response: The first paragraph will be revised to reflect the reviewer's comment.

88. 3.2/4 Last para. A DQO for completeness of 100% is desirable, but probably not realistically achievable. A completeness goal of 95% is recommended for this project.

AR302744

Response: Although achieving a completeness goal of 100 % is difficult, it is ERM's feeling that every attempt should be made from a QAPP implementation standpoint, to ensure the 100% complete data.

89. 3.3/5 2nd para., last sentence. Complete data deliverables, as discussed in Section 8.0 of the QAPP, goes beyond Analytical Data Package requirements described in section 3.4 of Appendix C to the Scope of Services. Although complete data deliverables should be available upon request, only the cover letter (described section 3.4) and the "Minimum Data Reporting Requirements" (sections 3.4.2 through 3.4.2.4.4) should be submitted in the Analytical Data Packages. ERM will need to coordinate with the laboratory to prepare a QA/QC Sample ID Comparison Table (section 3.4.2.1), since the field duplicate samples that are submitted the A-E contract laboratories and the field splits that are submitted to the MRD Laboratory be blind to the A-E contract laboratories. Also see related comment 76 above.

Response: Although complete data deliverables will be generated by the laboratory for this project, the only deliverables which will be prepared solely for the purpose of delivery to the Technical Branch, are the Quality Control Summary packages, as specified in Section 8.0 of the QAPP. Complete data deliverables will be used for data validation.

ERM will submit a QA/QC Sample ID Comparison table, summarizing all samples collected as part of the investigation.

Section 3.3 will be revised to reflect this information.

90. Table 4-1 Good effort! This table does a nice job of providing a comprehensive reference the key analytical requirement of the entire project. A few minor comments follow.

a. Analytical methods column. To make the analytical method numbers consistent with the most current promulgated EPA methods in SW 846 Update I dated July 1992, the following method numbers should be used throughout Table 4-1 and the remainder of the QAPP. Section 9 of the LLI/MSAI Laboratory QAP already reflects the July 1992 Update I methods, with one minor exception (i.e., 6010 is specified instead of 6010A). Note: Since the Scope of Services was being developed before the Official Update I package was promulgated and distributed, Appendix C of the Scope of Services incorrectly references methods numbers which were contain in the "unintended distribution" of Update I dated November 1990.

From	To
8021A Modified	8021 Modified
8270	8270A
9012A	9012
9060A	9060
9045	9045A
8080A	8080

Response: Global changes will be performed to address the reviewer's comment.

b. Additional comments regarding the Analytical Methods Column: The second ASTM method for Grain Size should be D422-63 (90). Also for consistency with the method for the Hardness analysis as indicated in the LLI/MSAI Laboratory QAP, it is recommended that both (130.1 or 130.2) be listed.

Response: For the purpose of consistency, ERM will specify all analytical methods for the project. Both Lancaster Laboratories, Inc. and Mountain States Analytical, Inc. have the capabilities to perform methods specified in the QAPP. It is recommended that the laboratory QAPP be revised to present only those methods specified by ERM.

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c. For additional concerns regarding the analytical methods, see TAL Metals methods clarification (Table 7-1) in comment 103 below.

Response: The analytical methods specified in the QAPP will be changed globally to reflect the reviewer's comment.

d. Container and Preservation Column. The one 1-liter amber glass with Teflon®-lined enclosure container specification for Soil and Sediment differs from USACE Sample Handling Protocol given in Appendix F of ER 1110-1-263. Please explain why amber glass is specified. Also, depending on how the analyses will be divided within each laboratory or between the LLI and MSAI Laboratories, it is recommended that the size and number of containers be coordinated with the flow of samples at the respective laboratories to the extent practical.

To facilitate sample flow and to minimize to excess sample that may require special handling for disposal, the MRD Laboratory prefers the following sample container specifications and parameter distribution for soil and sediment samples. MRD Laboratory indicated their flexibility and requests to be notified if these container specifications or parameter distribution are difficult to implement in the field.

Container	Soil	Sediment
2 x 40 ml G Septa vial, or 2 x 125 ml G* Septa vial	TCL VOCs	TCL VOCs
1 x 8 oz G with Teflon®-lined seal	TCL B/N/As TOC CEC	TCL B/N/As TOC CEC
1 x 8 oz G with Teflon®-lined seal	TCL Pest's/PCBs TAL Metals Cyanide (____)	TCL Pest's/PCBs TAL Metals Cyanide (____) pH Moisture Content

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	1 x 4 oz G with Teflon®-lined seal	Grain Size

*The 125-ml Septa vial is preferred when soil has a high clay content and it hard get into the 40-ml Septa vial with loss of VOCs.

Response: These sample container specifications will add considerable difficulty to sample collection and tracking in the field and are not planned to be implemented. Regarding the recommendation to use the 125-ml Septa vial, USEPA policy requires the use of 40-ml Septa vials for samples collected for VOC analysis.

91. Table 4-1, 4-2, and 4-3 The minor comments which follow are only suggestions and should be incorporated only to the extent that they contribute useful clarification for the Number of Environmental Samples for the following analytical Parameters: TCL Pesticides versus TCL Pesticides/PCBs. This comment is based on the design of the Sampling Program such that TCL Pesticides would always be a parameter whenever TCL PCBs is specified; therefore, designating the combined parameter Pesticides/PCBs for samples being sampled for PCBs is recommended.

a. Table 4-1, pg. 1. Change the Number of Environmental Samples for TCL Pesticides from 40 to 32. Then replace the Parameter for the 8 samples for "TCL PCBs" with "TCL Pesticides/PCBs."

Response: Table 4-1 will be revised to reflect this comment.

b. Table 4-1, pg. 2. Change the Number of Environmental Samples for TCL Pesticides from 10 to 6. Then replace the Parameter for the 4 samples for "TCL PCBs" with "TCL Pesticides/PCBs."

Response: Table 4-1 will be revised to reflect this comment.

c. Table 4-1, pg. 3. Change the Number of Environmental Samples for TCL Pesticides from 100 to 78. Then replace the Parameter for the 22 samples for "TCL PCBs" with "TCL Pesticides/PCBs."

Response: Table 4-1 will be revised to reflect this comment.

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d. Table 4-1, pg. 4. Delete the row showing 10 samples for TCL Pesticides. Then replace the Parameter for the 10 samples for "TCL PCBs" with "TCL Pesticides/PCBs."

Response: Table 4-1 will be revised to reflect this comment.

e. Table 4-1, pg. 7. Replace the Parameter for the 20 samples for "TCL Pesticides/PCBs" with "TCL Pesticides," since PCBs was not scoped for Background soil.

Response: Table 4-1 will be revised to reflect this comment.

f. Table 4-2, pg. 1. Site-wide Existing Wells. Change the Number of Environmental Samples for TCL Pesticides from 40 to 37. Then replace the Parameter for the 3 samples for "TCL PCBs" with "TCL Pesticides/PCBs."

Response: Table 4-2 will be revised to reflect this comment.

g. Table 4-2, pg. 1. Site-wide New Wells. Replace the Parameter for the 19 samples for "TCL Pesticide PCBs" with "TCL Pesticides" and reduce the Number of Environmental Samples from 19 to 15. Then replace the Parameter for the 4 samples for "TCL PCBs" with "TCL Pesticides/PCBs."

Response: Table 4-2 will be revised to reflect this comment.

h. Table 4-2, pg. 2. Replace the Parameter for the 30 samples for "TCL Pesticides/PCBs" with "TCL Pesticides," since PCBs was not scoped for Depth Specific Sampling at the HIA Production Wells.

Response: Table 4-2 will be revised to reflect this comment.

i. Table 4-2, pg. 3 and 4; Table 4-3, pg. 1, 2, and 3. Add the letter "s" to the word "Pesticide."

Response: Tables 4-2 and 4-3 were revised to reflect this comment.

92. Table 4-1 Page 4. Storm Sewer Sediment. Please delete the extraneous "30" (third entry) under the Number of Environmental Samples column.

Response: Table 4-1 will be revised to reflect this comment.

93. Table 4-1 Page 7. Background Soil. Please change the Number of Environmental Samples for TCL Volatiles from 20 to 15, since the surface scrape sample were not scoped for that parameter.

Response: Table 4-1 will be revised to reflect this comment

94. Table 4-2 For the Site-wide New Wells, please change the Number of Environmental Samples for TCL Volatiles, TCL Semivolatiles, TAL Metals (total) TAL Metals (dissolved), and Cyanide (total and amenable) from 50 to 49, or how the number 50 was derived. Note: the 5 samples for TCL Volatiles (14-day turnaround) is correct because it was decided during negotiations that the intermediate depth well would be installed at the mid-Lagoon area regardless of the VOCs concentrations in the proposed new shallow well. Consequently, the scope requirement for a 14-day turnaround VOCs analysis was dropped for proposed new mid-Lagoon shallow well. Therefore, comment 18.e on the draft Work Plan is withdrawn.

Response: Table 4-2 will be revised to reflect this comment.

95. Tables 4-2 & 4-3 For completeness, it is suggested that the field screening measurements for pH, conductivity, temperature, dissolved oxygen be added to the Meade Heights Area and Susquehanna River surface water analyses.

Response: Requirements for field measurements are presented in Table 3-1 of the Work Plan.

96. Table 4-2 The Source Water analyses for drilling and equipment decontamination activities is not included on this Table. Please coordinate with the response to comment 18.p on the draft Work Plan for the incorporation of the Source Waters analyses.

Response: Table 4-2 will be revised to present requirements for source water testing.

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97. Table 4-4 The relationship the number of field QA/QC samples given in this table appears to be much lower than indicated on the tables in the Scope of Services (PR001 through PR004). The number of MS/MSD samples also appears low compared to ERM's backup for analytical that was provided during negotiation. Perhaps the multiple rounds of quarterly monitoring was not taken into account. The number of rinsate blanks for the Ground Water Sampling Program are not included on Table 4-4. Brainstorm idea for discussion: >Since the number of QA/QC shown in the Scope of Services was derived site specifically, it may be useful to develop a subcolumn breakdown for QC samples in Tables 4-1, 4-2, and 4-3 under the Number of Environmental Samples column. Then, Table 4-4 could serve as a summary table.

Response: Table 4-4 will be revised to reflect the number of quality control samples presented in the scope.

98. 5.0/1 4th para. See comment 74 above regarding conventional versus ice packs in cooler shipments to either the A-E contract laboratories or the MRD Laboratory. Also see comments 75 and 76, 89, 99 above regarding the Sample Disposal Questionnaire and LIMS numbers to be recorded on the Chain-of-Custody records and ERM Traffic Reports for sample shipments to the MRD Laboratory. USACE Sample Handling Protocol in Appendix F or ER 1110-1-263 also indicates that the liquid level for aqueous sample should be marked on the outside of the container with a grease pencil to provide a reference point for documenting leaking sample containers during sample cooler receipt inspection.

Response: A sentence will be added to Section 5.0 of the QAPP to require that for each aqueous sample collected, the level of liquid collected will be marked on the outside of the sample container so that leaking during shipment can be noted by the laboratory.

99. 5.0/2 3rd full para. Since the information that is to be recorded in Section 11.0 of the ERM Traffic Report and on the Sample Receipt Documentation Log (Figure 3 in Section 7, pg. 25, of the LLI/MSAI QAP) is essentially the same information, the use of the Cooler Receipt Form (Figure 5-5) is optional. It is anticipated that sample specific discrepancies that are observed upon sample cooler receipt inspection and sample log-in will keyed to specific sample ID in the Paperwork Discrepancy/Unpacking Problems section on the Sample Administration Receipt Documentation Log in the same manner as would be done if Cooler Receipt Form were to be used. A summary of the sample specific discrepancies information just described should be included in the case narrative for each "sample group" received by the laboratory. The case narrative, the Chain-or-Custody, and the ERM Traffic Report are to be included in the Analytical Data Package described in comment 76, 89, 99 above. The Sample Administration Receipt Documentation Log should not be included in the Analytical Data Package deliverables, however it should kept on file and made available upon request for verification of information in the case narrative.

Note 1: This comment negates the requirement to include the completed Cooler Receipt Forms in the Analytical Data Package as given in section 3.4.2.2, App. C, of the Scope of Services.

Note 2: If the MSAI Laboratory or the ERM-FAST® On-site Mobile Laboratory does not use the Sample Administration Receipt Documentation Log described in this comment, or use a comparable sample receipt documentation form, then the Cooler Receipt Form described above should be used.

Response: Sample receipt forms and traffic reports will be used to document the condition of the samples received by the laboratory.

100. 6.2/1 1st para., 2nd line. Suggested rewording: "taken and recorded for ground water samples and surface water samples collected during the field investigation. Dissolved oxygen (DO) is an additional field screening measurement that will be conducted during surface water sampling activities."

Response: Dissolved oxygen measurements will be performed for surface water samples.

101. 6.2/2 The superscript "1" given in the formula for calculating the conductivity probe cell constant should be keyed to the application information in the text or in Table 6-1.

Response: The superscript will be deleted.

102. 7.1/1 4th para. Table 4-1 does not indicate which samples will be analyzed for Geotechnical analysis. Please clarify.

Response: Table 4-1 presents samples for geotechnical testing.

103. Table 7-1 TAL Metals methods clarification for consideration:

Metal	From	To
ICP Metals	6010 (ICP)	6010A (ICP)
Arsenic	7061A (GH)*	7060 (GF)
Thallium	7840/7841 (FL/GF)*	7841 (GF)

*Note: The Inorganics Method Numbers table in section 9, pg. 5 of the LLI/MSAI QAP does list both Gaseous Hydride (GH) and Graphite Furnace (GF) methods for arsenic (and selenium) as well as both the Flame (FL) and Graphite (GF) methods for thallium; however, the second sentence in the footnote under the Inorganics Method Number table indicates: "For this project ICP, GFAA, and Cold Vapor methods will be used." <u>If the option of using the Gaseous Hydride method(s) for arsenic (and selenium) and the option of using the Flame method for thallium are important for meeting detection limit DQOs and PARCC DQOs, the rationale for specifying these methods should be described in response to this comment and the appropriate changes should be made in both the QAPP and LLI/MSAI QAP.</u>

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Response: Table 7-1 will be revised to reflect the reviewer's comment. With respect to the issue of using graphite furnace atomic absorption spectroscopy (GFAA) versus gaseous hydride, the QAPP specifies that GFAA will be used for the determination of arsenic, selenium, lead, and thallium. It will be recommended that LLI revise their document to reflect the project specific method (GFAA).

104. Table 7.2 Pg. 8. Under the column heading "Element," the caption "(PPL/Inorganics)" should be replaced by "(TAL Metals)." CLP quantitation limits versus SW 846 MDLs versus Risk Assessment requirements > discuss item for conference call.

Response: Table 7-2 will be revised to reflect the reviewer's comment.

105. Table 7.2 Pg. 9. The letter "t" at the end of the 2nd and 3rd column headings should be defined in a Table 7-2 footnote.

Response: Table 7-2 will be revised to reflect the reviewer's comment.

106. 7.4/11 An analytical method summary for TOC and CEC should be added to section 7.4. The analytical summary for the CEC method shall address the rationale (including soil/sediment types anticipated at the site) for selecting method 9080, rather than method 1981, for analyzing Middletown Airfield Site samples. The method 9080 Scope and Application section indicates that method 9080 is not applicable to soils containing appreciable amounts of vermiculite clay, kaolin, halloysite, or other 1:1-type clay minerals. Method 9081 is applicable to such soil type as is also generally the generally preferred method for very calcareous soils (consisting of or containing calcium carbonate).

Response: It is ERM's opinion that such a description is not necessary.

107. 8.0/1 4th para. The data packages described in this paragraph are assumed to be deliverables from ERM's contract laboratories to ERM for the purpose of data validation. The deliverable requirements presented in Table 8.1 go beyond the Analytical Data Package deliverables which are to be forwarded to the USACE TM and the MRD Laboratory as described in section 3.4 in Appendix C of the Scope of Services. See comment 76, 89, 99 (and related comments 76, 89, 99 and 76, 89, 99) for discussion of the contents and approximate schedule for submittal of the Analytical Data Package deliverables to the USACE TM and the MRD Laboratory.

Response: See response to comment #89.

108. 8.0/2 1st para. after bullets. Reference to "EPA" should be replaced by "USACE."

Response: Section 8.0 will be revised to reflect this comment.

109. 8.1/3 1st sentence. Reference to "EPA" should be replaced by "USACE."

Response: Section 8.0 will be revised to reflect this comment.

110. 9.2/1 Travel Blanks. 8th line. It is suggested that the word "aqueous" be inserted in front of the word "samples."

Response: Section 9.2 will be revised to reflect this comment.

AR302755

111. 9.2/1 Equipment Rinsate Blanks. Suggested rewording for the 2nd bullet is as follows: "Equipment rinsate blanks will be collected for the ground water sampling program.....(from the Hydros® system) over and through the device. Approximately one (1) equipment rinsate blank for every twenty (20) field samples will be collected for each sampling device associated with ground water samples. The equipment rinsate blanks which are collected for ground water sampling activities will be analyzed for identical parameters as the ground water. For filtered ground water samples, the equipment rinsate blanks will.....ultrapure deionized water through the Millipore® filtration apparatus. No equipment rinsate blanks will be collected for the surface water sampling program. The separate laboratory clean glass jar that will be used for collecting the surface water samples at each sampling station will essentially eliminates cross-contamination between locations. No equipment rinsate blanks will be collected for solid sampling equipment such as split spoon samplers, hand augers, spoons, etc. Worker training and field oversight of the equipment decontamination activities is considered more beneficial than collecting rinsate blanks for solids sampling equipment. Because of the much higher quantitation limits for most analytes in soil or sediment compared to the much lower quantitation for a rinsate sample, USACE concludes that analyzing rinsate blanks collected from the decontamination of soil or sediment has very little potential for contributing useful data."

Response: Section 9.0 will be revised to present the requirements for field quality control samples, as specified by the Scope of Services.

112. 9.2/2 Duplicates (Blind). 3rd line. The intended frequency for field duplicates for this investigation is 1.10, not 1:20.

Response: Section 9.2 will be revised to reflect the reviewer's comment.

113. 9.2/2 Quality Assurance (Split) Samples. 6th line. Substitute "to" for "of."

Response: Section 9.2 will be revised to reflect the reviewer's comment.

AR302756

114. 9.2/2 Matrix Spike Sample. A frequency higher than 1:20 (with respect to the number of field samples) for MS and MSD is recommended in the case of the sediment and surface water sampling program. The matrix interferences may be different for the Meade Heights stream compared to the Susquehanna River. The seasonal changes in the Susquehanna River could present different matrix interference problem each quarterly monitoring round. Note: The frequency of MS and MSD to the number of field sample that were negotiated for the project is greater than 1:20 because of the task breakout often included a MS and MSD for sample groups of less than 20 samples.

Response: MS/MSD samples will be submitted for each specific sampling area. This will be done so that interferences that are specific to a sampling area can be evaluated.

115. 9.2/2 Last para. Please clarify the last sentence in the document concerning whether it applies specifically to the preparation of MS/MSD in the laboratory for VOCs analysis, or to the collection of duplicate samples in the field for VOCs. Regarding field collection of samples for VOCs analysis, homogenizing should be avoided (not discouraged).

Response: Samples for VOC's analysis will not be homogenized. The last sentence of Section 9.0 will be deleted.

116. 10.0/3 Figure 10-1, 1st pg., 4th item from bottom. USACE guidance only requires a travel blank for aqueous media.

Response: The ERM Quality Assurance Audit form is a generic form. If a travel blank is not required for the project, the field person will enter "N/A" for Not Applicable.

117. 12.0/2 2nd para under 12.4.1. This reviewer is not familiar with "chain-of-custodians." Should this be "Chain-of-Custody records" instead?

Response: Section 12.4.1, second paragraph, will be revised to reflect the reviewer's comment.

AR302757

118. 14.0/1 14.2, 1st line. Please discuss the merits of preparing a single versus multiple QCSRs. Based on this reviewers understanding, the discussion on this topic during negotiations followed the logic that a separate QCSRs would be prepared to correspond to each Preliminary OU#2 Report. Then the last QCSR would cover the analyses and QC activities that occur after the last Preliminary OU#2 and the Final OU#2 Report.

Response: ERM wishes to discuss this issue with the USACE Technical Manager and Chemist.

119. 14.0/2 Next to last bullet. Including the "Results of USACE Evaluation of QA Samples" in the QCSR may require some discussion regarding logistic (timeless) as well TM/PM input.

Response: ERM wishes to discuss this issue with the USACE Technical Manager and Chemist.

120. Table 7-2/5 See comment 129 below for coordination of lower quantitation limits than listed in the method for 8270 analysis of ground water samples collected from monitoring wells at the North Base Landfill Area.

Response: ERM will indicate on the traffic reports for the North Base Landfill area ground water samples that a detection limit of 5 µg/L will be required for bis(2-chloroethyl)ether, and dichlorobenzene). Table 7-2 will be revised to add a footnote which indicates the required quantitation limit for these compounds for ground water samples collected from the North Base Landfill area.

APPENDIX A - ATTACHMENTS

ATTACH. 1 - LABORATORY QUALITY ASSURANCE PLAN (QAP)

121. 3/1 2nd Ref. Suggest inserting the phrase "(revised March 1983)" after the reference no. "600/4-79-020."

Response: Section 3.0 will be revised to reflect this comment.

122. 6/1 2nd para. According to section 5.0, pg. 1 of the draft QAPP, ERM will use laboratory-supplied I-Chem 300 Series bottles appropriate for each media as sample containers.

Response: ERM wishes to discuss the use of IChem 300 series containers with the USACE Chemist.

AR302758

123. 6-1 Special handling (no acid preservation, and a 7-day holding time) in planned for an estimated 23 samples for GC/MS 8260 analysis with a target PQL of 5 µg/L for all TCL VOCs + TICs (plus the following selected semi-volatiles: bis(2-chloroethyl)ether, 1,2-, 1,3-, and 1,4-dichlorobenzenes). The reason for requesting analysis of the selected semi-volatiles by the 8260 methods derives from the limited sample volume (too little for the typical 8270 analysis for semi-volatiles) anticipated from the direct push sampling technology that will be used to collect the environmental ground water samples. Based on discussions with Lancaster Laboratories and MRD personnel, the effect of adding HCL preservative to the confirmatory samples for off-site analysis will have an unknown effect on the selected semi-volatile compounds; therefore, it was concluded that such samples should not be acid preserved. Consequently, the maximum holding time for analysis is reduced from 14 to 7 days. The following notations (or equivalent) have been recommended as annotations on the Chain-of-Custody records or ERM Traffic Report which will accompany the samples inside the cooler used to ship the samples to the respective laboratories: BIS(2-CHLORO-)8260, NO ACID PRESERVATION, 7-DAY HOLDING TIME, TARGET POL = 5 µg/L FOR TCL VOCS, BIS(2-CHLOROETHYL)ETHER, AND 1,2-, 1,3, 1,4-DICHLOROBENZENES.

Response: LLI will add a footnote to Table 6-1 presenting requirements.

124. Table 6-1 Consistent with Tables 4-1 through 4-3 of the QAPP, the USACE recommends a maximum holding time of 28 days for the metal mercury (Hg) for both water and soil in either glass (G) or plastic (P) containers. In this instance, USACE follows the suggested maximum holding time (28 days, G or P) as given in method 7470A (Rev. 1, November 1992) of proposed Update II to the SW-846 (Third Edition), rather than follow the suggested maximum holding time (38 days, G; 15 days, P) given in method 7470 (Rev. 0, September 1986).

Response: Table 6-1 will be revised to reflect the reviewer's comment.

AR302759

125. 7/1 — 2nd para., 7th line. Please indicate what documentation record will be used for documenting the pH.

Response: ERM, LLI, MSAI will discuss the procedure for recording sample pH measurement.

126. 7/25 (Figure 3) — It is anticipated that Lancaster Laboratories, Inc., including Mountain States Analytical, Incorporated (MSAI), of Salt Lake City, Utah) will use the Sample Administration Receipt Documentation Log (or comparable log at MSAI) in conjunction with the ERM Traffic Report Form (Figure 5-3 in the QAPP) as an option to the Cooler Receipt Form (Figure 5-5 in the QAPP). See comment 76, 89, 99 above for related information.

Response: See response to comment #99.

127. 9/2 — Inductively Coupled Plasma (ICP). Two items of concern: (1) Method number 6010 should be changed to 6010A for consistency with SW846 (3rd Edition, Update I, July 1992); (2) Per discussion between the USACE Project Chemist and personnel at ERM, USACE MRD Laboratory/MCX, and Lancaster Laboratories, Inc., it has been agreed that all aqueous samples (unfiltered or filtered) submitted from the field for ICP analysis will be digested by method 3005A (rather than 3010A prior to analysis).

Response: Section 9 will be revised to reflect the reviewer's comment.

128. 9/(6 through 15) — "J" - Value reporting as described at the end of each tables on pg. 6 through 15 has been requested by the USACE Project Chemist for this project.

Response: Section 9 will be revised to reflect the reviewer's comment.

129. 9/(8 & 9) — For all ground water samples collected for this project from all new and existing monitoring wells at the North Base Landfill Area, a quantitation limit (LOQ) of 5 µg/L is requested for the following selected semi-volatile compounds: bis(2-chloroethyl)ether, 1,2-, 1,3-, and 1,4-dichlorobenzenes).

Response: Section 9 will be revised to reflect the reviewer's comment.

130. 10/3 — Soil and sediment sample results for this project requires reporting on a dry weight basis with the % moisture also reported.

AR302760

Response: Section 10 specifies that results for solid samples will be reported on a "dry weight" basis.

ATTACH. 2 - ERM-FAST® QUALITY ASSURANCE PROJECT PLAN

ERM FAST® QAP Comments - (5/03/94)

131. TOC — The Table Of Contents in the draft ERM-FAST® QAP is currently comprised to 3 pages, rather than 4 pages as indicated.

Response: The Table of Contents header will be revised to reflect a total of 3 pages.

132. General — Add a section, or expand an existing section, to **describe** the field facility **"safeguards" against data loss** in the event of power loss, system failure, or catastrophic event (such as fire, unauthorized access, sabotage, etc.).

Response: The following paragraph will be added to the end of Section 7: "The Field Chemist will perform daily electronic archiving to 150 Megabyte Bernoulli disks. When full the Bernoulli disks shall be removed from the field facility and stored at the field operations trailer for safekeeping."

133. 1.1/1 — The 2nd paragraph should also address organic vapor control. Please discuss whether background **organic vapor** levels from airport operations or from sample handling activities within the cube-style truck are anticipated to be a problem and how such vapors will be controlled.

Response: Section 1.1, paragraph 2 shall have the following inserted after the first sentence: " no significant effects of ambient air are anticipated do to local airport activities. The GC/MS analyses to be performed shall be carried out in a closed system with an internal helium environment. Additionally, the facility requires only reagents necessary for the analysis of volatile organics, and therefore no reagents that can potentially interfere with volatiles analyses shall be present within the field facility."

134. 2.0/1 — A section describing the **Technical Director's responsibilities** should be added for completeness.

Response: A description of the Technical Director starting as the new Section 2.1 shall be included.

AR302761

135. 2.2/1 Please clarify whether the **Facility Task Manager (FTM)** position described in section 2.2 corresponds to the **Facility Schedule Coordinator** position identified in section 2.0. Also identify the **Project Manager** so it is clear that the PM referred to in this section is the same as PM identified in section 2.3 of the QAPP.

Response:

1) The heading for Section 2.2 should properly read Facility Task Coordinator (or FTC).

2) Section 2.0 shall be amended to include a reference to the "PM as described in Section 2.6 of the QAPP", as well as revisions to both the TM and FTC position descriptions.

136. 3.1/1 2nd para., 2nd line. Soil vapor should also be listed as a sample media.

Response: Section 3.1, paragraph 2, first sentence shall include "soil vapor" as a sample medium.

137. 3.2 and 3.3 Since **internal standards** and **surrogate compounds** are not listed among the items that provide a check on accuracy in the 3rd paragraph of section 3.2, it appears that section 3.2 primarily applies to GC analyses. Conversely, since **internal standards** and **surrogate compounds** are listed in the 1st paragraph of section 3.3, it appears that section 3.3 primarily applies to GC/MS analyses. Please clarify either the content or title of sections 3.2 and 3.3 as appropriate.

Response: Both Sections 3.2 and 3.3 are titled correctly. Section 3.2 is intended to focus on the overall DQO of the investigation, while Section 3.3 is intended to focus on the DQO for the specific methodology. These sections shall be altered to include specifics regarding internal standards as well as surrogate compounds.

138. Table 3-3 Table 3-3 appears to be lacking in pertinent criteria objectives for GC/MS Analytical Data, such as accuracy and precision for **surrogate standards** (section 8.8 of method 8260). Please clarify. Also, the subtitle of the table **"Field Facility Objectives for Selected Volatile/Semivolatile Fractions"** is inappropriate since the GC/MS analysis applies to the **TCL VOCs + TICs.**

AR302762

Response: Table 3-3 shall be altered to include precision and accuracy objectives for surrogates as well as internal standards. Also Table 3.3 shall be subtitled as "Field Facility Objectives for Volatile Organic Compounds".

139. 3.3/4 1st para., last line. The promulgated method 8260, Rev. 0, July 1992, from Update I of SW846, third edition, should be specified rather than proposed method 8260A, Rev. 1, November 1992, from Proposed Update II of SW846, third edition.

Response: The Rev. 0 of Method 8260 can and will be specified and included in this QAP. However, ERM shall use only aqueous calibration standards as agreed to previously.

140. 4.1/1 2nd para. Completing the Cooler Receipt Form (Figure 5.5 in the QAPP) is recommended. See comment 76, 89, 99, 107 for related discussion on other approaches for documenting sample receipt and log-in information as well as the final disposition of such information.

Response: Section 4.1, paragraph 2 shall include the requirement for completing the "Cooler Receipt Form". Additionally, the time and date of sample receipt, as well as the person's name who receives the samples shall be logged at the field facility.

141. 4.2/1 1st line. Double bagged conventional ice is preferred over ice packs (Blue Ice) because of its better efficiency for maintaining 4 degrees C for a longer period of time. This is a mutual conclusion from Lancaster Laboratories, Inc. and the MRD Laboratory.

Response: Section 4.2 shall state the requirement to use "double bagged conventional ice" as a refrigerant.

142. 5.2.1 & 5.2.2 1st para. in both sections. Same as comment 139 above, i.e., 8260, not 8260A.

Response: Please note ERM's agreement and exception as indicated in response 139.

143. 5.2.1/2 Last sentence. The first word should be "If," not It.

Response: Correction shall be made.

AR302763

144. 5.2.2/3 1st line. Rather than aqueous method blanks, **clean soil that is free of Target analytes should be used for all method blanks.** .

Response: ERM agrees to use clean soil for method blanks as described in Sections 7.5.3.1 of method 8260. This shall also be described in Section 8 of the QAP.

145. 5.2.2/3 7th through 10th lines. Suggested rewording: **"A mid-range standard will be analyzed as a Continuing Calibration Check Standard (CCCS) containing all compounds of interest every 12 hour shift and repeated after the analysis of each 20 analyses within that 12 hour shift."**

Response: The MRO's **suggested** wording shall be incorporated.

146. 5.2.2/3 12th line. **After the** word **"performance"** the following phrase should **be inserted: "(by checking the SPCCs and CCCs as described in sections 7.4.3 and 7.4.4, respectively)."**

Response: The MRD's phrase shall be inserted.

147. 5.2.2/3 14th line. **Please summarize the criteria** for the CCC analysis above which a new initial calibration will be performed.

Response: Section 5.2 shall state a 25% difference criteria for CCCs.

148. 5.2.2/3 16th line. Section 5.10 of the method 8260 lists **1,4-difluorobenzene,** rather than "fluorobenzene," as one of the three recommended internal standards. Please clarify.

Response: Section 5.2.2 shall be corrected to include chlorobenzene-d5, 1,4-dichlorobenzene (d-4), 1,4-difluorobenzene and pentafluorobenzene as internal standards.

149. 5.2.2/3 Last sentence. The **criteria** regarding allowable changes in the **internal standard responses** as described in the last sentence in section 5.2.2 of this document **appears** to be **more stringent than to criteria given in section 7.4.5 of method 8260.** Although the more stringent criteria is acceptable, the criteria in the method is sufficient.

Response: ERM shall include the method criteria of -50% to +100% in Section 5.2.2.

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150. 5.2.2/3 The Chief of the Organics Analysis Section at the MRD Laboratory indicated that he would be **happy to discuss the section 5.2.2 comments by conference call** for any clarifications that may be necessary.

Response: ERM would like very much to have a discussion on these and other minor issues.

151. Table 6-1 The superscript [a] should be added after the word **"Limits"** in the column heading: Estimated Reporting Limits.

Response: The "a" superscript shall be included.

152. 6.3.1/4 Recommended rewording for the title of section 6.3.1: ***Qualitative and Quantitative Procedures for Compound Identification and Quantification during Organic Analysis.***

Response: MRO's recommended title shall be included.

153. 6.3.1/4 1st para. The 1st and 3rd sentences appears appropriate for TICs, but not for TCL VOCs. It is this reviewer's understanding that the MS detector for GC/MS analysis affords definitive (not qualitative) identification TCL compounds. Please clarify the document as appropriate.

Response: The MRO is correct in the "definitive " nature of GC/MS. ERM feels this statement can (and will) be made in the second to last sentence of the first paragraph of Section 6.3.1. ERM feels that our "Qualitative identification" statement in the first statement is appropriate as only the "mass spectrum" is under discussion, and not in combination with GC retention time.

154. Table 6-3 Please indicate whether the expiration times for the Primary Custom Standard Mix is also applicable for the secondary dilution standards.

Response: Secondary standards mixes shall have an expiration of one month, and this shall be included in Table 6-3 on revision.

155. 7.0/1 2nd para. Please identify ERM's Quality Assurance Chemist by reference to section 2.8 of the QAPP.

Response: Reference shall be made.

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156. 7.0/1 3rd para. Field reporting on an "as received" basis is adequate for use in supporting field decisions for placement of additional direct push points and for locating soil boring locations. However, in the Preliminary and Final OU#2 Reports, the results for GC screening analysis on soils (and sediment, if any) and the GC/MS analysis of soils (and sediment, if any) should be reported on a **"dry weight basis,"** not "as received." Note: off-site laboratory determination of % solids (for use in "dry weight" calculations) should be considered to minimize the generation of organic fumes in the field facility. The rationale for reporting the GC soil screening results on a "dry weight basis" is for the purpose of using that data to supplement the GC/MS data is drawing concentration isopleths of soil contamination in the project reports.

Reporting on a **"dry weight basis"** is also the manner in which **GC/MS data package information** should be provided in the **Analytical Data Package** deliverables to the MRD Laboratory and the USACE TM. Submittal of these data packages should correspond to changes in the LIMS number assigned to the QA samples shipments to the MRD Laboratory. See comments 76, 89, 99, 107 above for additional discussion on the use of LIMS numbers for shipment of QA samples. Analytical Data Package deliverable information from the GC/MS soil analysis by the ERM-FAST® field facility should be coordinated with the data from LLI and MSAI for mailing to MRD Laboratory and the USACE TM. See related comments 76, 89, 99, 107.

Response: ERM shall dry weight correct field GC/MS results as the final deliverable using percent moisture determination derived by the commerical laboratory.

157. 8.1 Please provide a bullet for Surrogate Spikes, Internal Standards, and Laboratory Control Samples (LCS), or explain why they are not applicable to this section.

Response: Bullets for these QA/QC events shall be included.

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158. 9.0 ERM should have appropriate agreement(s) in place with at least one of the A-E's contract laboratories for providing 8260 GC/MS analysis for all TCL VOCs + TICs on a **96-hour turnaround in the event of a catastrophic failure** which would prevent 48-hour turnaround on that analysis by the field facility. [Example Scope of Services (SOS) section number which explains this requirement: section 2.2.6.1.2 (3) of SOS PR001.]

Response: Arrangements for 96 hour turnaround shall be addressed.

159. 10.3/2 Last para., 2nd sentence. Surrogate spike recoveries should be added to the "real time" review criteria listed in Table 3-3. See comment 138.

Response: Surrogate recoveries shall be added as a "real time" review item.

160. 10.3.4/3 Third sentence. See comment 157.

Response: Surrogates, Internal Standards, and Laboratory Control Samples will be addressed in Section 10.3.

161. 10.4/3 Although the post-analysis review described in section 10.4 will be adequate for Analytical Data Package deliverables to the MRD Laboratory and the USACE TM, ultimately **10% of the GC/MS data must be validated as described in section 12.4.1 in the QAPP.**

Response: Section 12.4.1 of the QAPP shall be referenced.

162. 10.4/4 Last para. The word "may" (on the 1st, 3rd, and 6th lines) should be replaced with the word "will." For consistency with the data reporting from ERM's contract laboratories (LLI and MSAI), **"J" value reporting** is requested for all detected values below the LOQ for the Level III data. The "J" value reporting is needed to support the Risk Assessment; thus allowing an estimated value, rather than 1/2 the LOQ, for detected values below the LOQ.

Response: The reporting forms for level III analyses shall append "J" qualifiers as a default below the LOQ.

163. Attach. 1 Please provide **resume** for the field facility Field Chemist, Mr. Michael Osterhaudt.

Response: Michael Osterhaudt's resume shall be attached on resubmission of the QAP.

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164.	Attach. 2 (SOP - GC)	Section 9.2. Those QA/QC analyses which do not apply to the **headspace screen** for site specific volatile and semivolatile organic compounds **by GC** (see comment **157**) should be indicated as an exception either in section 9.2 of this SOP, or in section 8.0 of the ERM-FAST® QAP.
	Response:	These exceptions shall be added to Section 8.0 of the QAP.
165.	Attach. 2 (SOP - GCMS)	The copy of Method 8260A (Rev. 1, November 1992) which is included as the SOP for TCL VOCs analysis should be replaced by a copy of Method 8260 (Rev. 0, July 1992). See comment 139. **Note: The TCL compound "Ethylbenzene" appears to have been inadvertently omitted from the list of compounds originally given on page 2 of method 8260A.**
	Response:	Ethylbenzene shall be added to the list as well as dichlorobenzenes. ERM shall also incorporate Rev.O of the method.

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C	*Site Safety and Health Plan*

Section 1

1.0 INTRODUCTION

ERM Program Management Company (ERM) has been retained by the U.S. Army Corps of Engineers (USACE), Omaha District to conduct Supplemental Studies at the Middletown Airfield NPL Site, Pennsylvania. These studies are required by the December 1990 Record of Decision as clarified by April 1992 Explanation of Significant Differences. This work is being conducted under Contract Number DACW 45-93-D-0017, Delivery Order Numbers 005, 006, 007, and 008.

The scope of work for this Supplemental Studies Work Plan is described in detail in this document. Background information is summarized from previous site investigations. More detailed discussions of previous environmental investigations are presented in the Remedial Investigation/Feasibility Study (RI/FS) Work Plan and Report dated August 1988 (amended November 1988) and July 1990 respectively; prepared by Gannett Fleming, Inc.

1.1 SITE BACKGROUND AND HISTORY

The Middletown Airfield Site is located in Dauphin County, Pennsylvania, about 8 miles southeast of Harrisburg. It is situated between the boroughs of Highspire and Middletown (Figure 1-1 and Figure 1-2) along Pennsylvania Route 230, with the southern border on the Susquehanna River. The property was initially established by the Army as a basic training camp in 1898. In May 1917, the Army Signal Corps established a storage depot on 47 acres of this area, which was known as the Aviation General Depot. Warehouses, open sheds, and garages were constructed on the site beginning in 1918 for materiel storage. The depot was renamed in 1921 to the Middletown Air Intermediate Depot. Flying activities at the base began in 1918. The airfield was named the Olmsted Field for Lt. Robert S. Olmsted in 1923.

From 1931 to 1939, the Middletown Air Intermediate Depot operations remained stable, and the main functions were supply and maintenance of Army Air Corps materiel. During World War II, facilities were expanded. In 1943, the facility was assigned to the Middletown Air Depot Control Area Command. The Command was redesignated the Middletown Air Technical Service Command in 1944 and was changed again in 1946 to

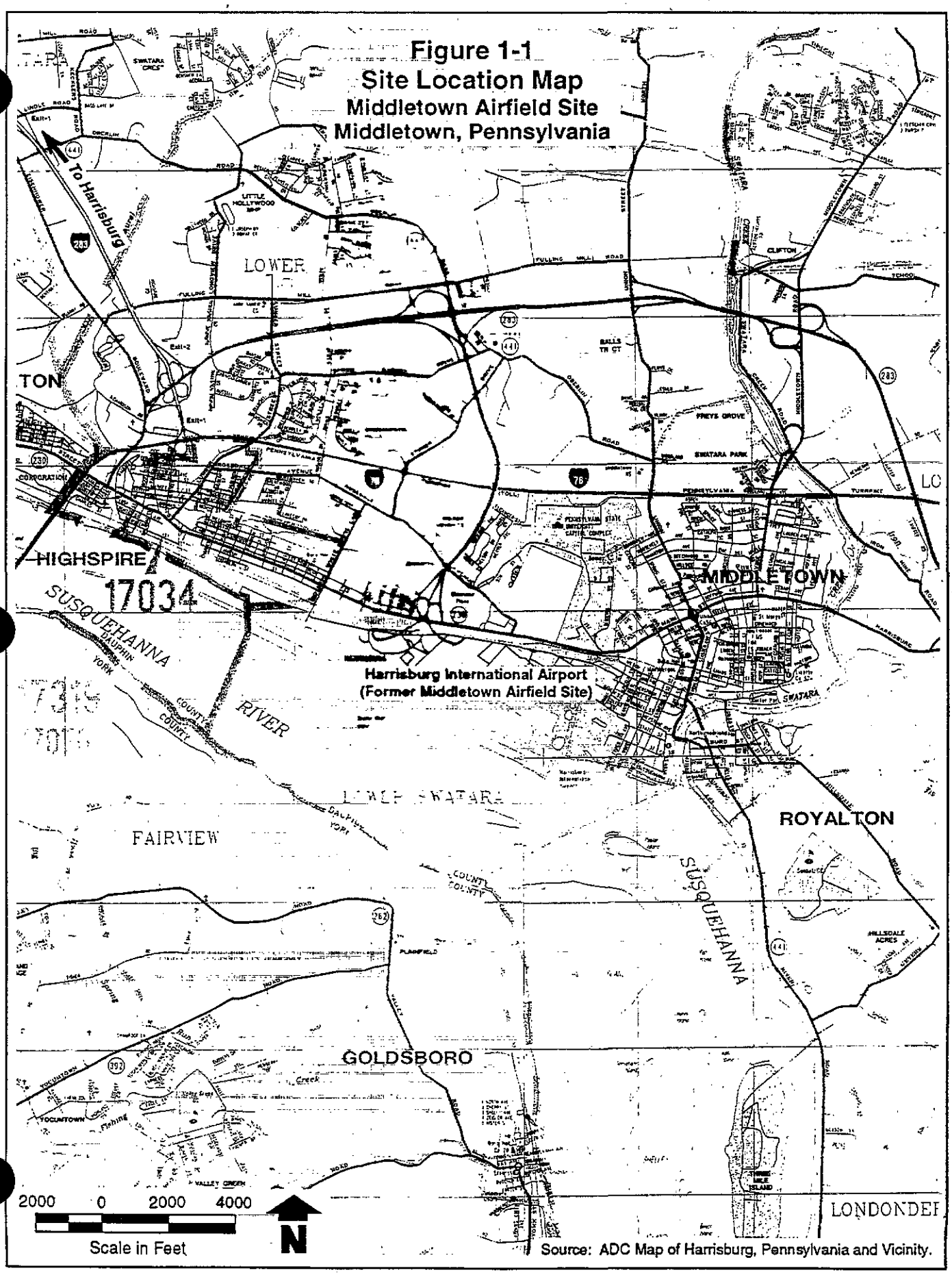
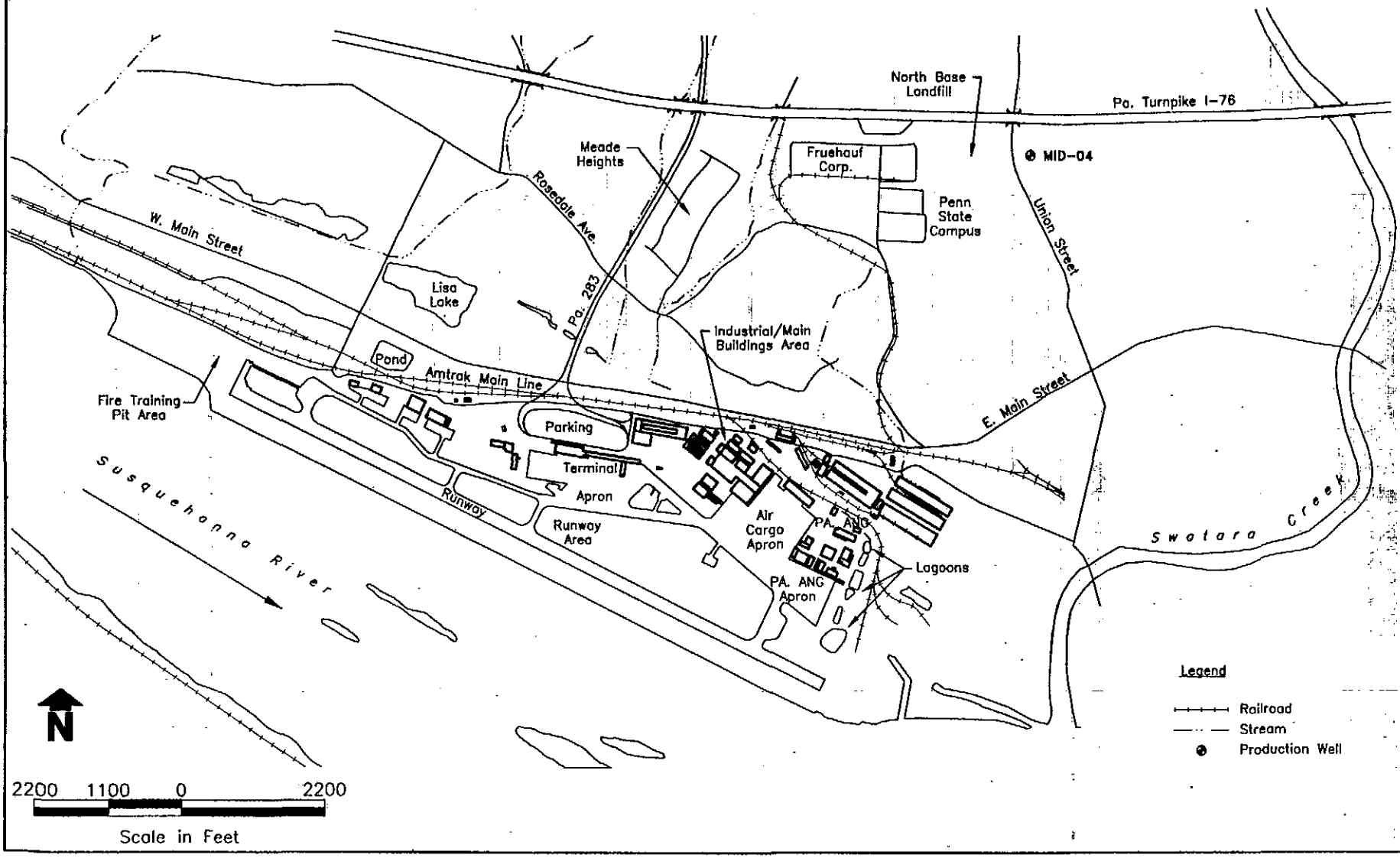


Figure 1-1
Site Location Map
Middletown Airfield Site
Middletown, Pennsylvania

Source: ADC Map of Harrisburg, Pennsylvania and Vicinity.

Figure 1-2
Generalized Base Map
Middletown Airfield Site
Middletown, Pennsylvania



THE ERM GROUP

PM005.02.01/02.23.94-DST/02.24.94-DST/A101-1

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Middletown Air Materiel Area (MAAMA). Activities during World War II included the overhaul of P-40, P-38, and B-25 type aircraft. In September 1947, Olmsted Field was renamed Olmsted Air Force Base to coincide with the designation of the Air Force as a separate Department of Defense establishment. Activities at Olmsted throughout its history included:

- Warehousing and supply of parts, equipment, general supplies, petroleum, oil and lubricants for the northeast procurement district;
- Complete aircraft overhaul, including stripping, repainting, engine overhaul, re-assembly, and equipment replacement;
- Engine and aircraft testing; and
- General base support maintenance and operation.

In 1948, four engine test cells were converted for the overhaul of jet engines, marking the introduction of jet aircraft to the base. In 1956, a major expansion of the existing runways to handle jet aircraft was undertaken. Additional property was purchased in 1956 to accommodate facility expansion, including property for military housing (Meade Heights), property west of the facility for runway expansion, and property north of Pennsylvania Route 230 for additional bulk warehousing (North Base).

By the early 1960s, Air Force operations at Olmsted began to decrease. The industrial portion of the installation was declared excess to the Air Force in November 1964, and all Air Force operations were ceased by 1966. The Air Force field and many of the Air Force buildings are now owned by the Pennsylvania Department of Transportation (Penn DOT) and operated by the Harrisburg International Airport (HIA), several small private manufacturing companies, and the Air National Guard.

For the purposes of this document, the former Olmstead Air Force Base, now the HIA, is referred to as the Middletown Airfield Site ("Site").

In March 1983, the volatile organic compound (VOC) trichloroethylene (TCE) was discovered in the HIA production wells triggering subsequent environmental investigations and studies, and the installation of the water treatment system that is currently in use. The Site was later listed on the National Priorities List (NPL). In 1988, the Department of Defense initiated a CERCLA RI/FS to determine the extent of contamination and

possible remedial measures. The RI was conducted by Gannett Fleming, Inc. (GF) in 1988 for EPA.

The RI focused on five distinct areas of the Site selected based on a review of Site operations:

- the Runway Area,
- the Industrial Area,
- the Fire Training Pit Area,
- the North Base Landfill Area, and
- the Meade Heights Area.

Approximately 30 acres of previously landfilled material exist within the Runway Area. This consists of about 10 percent of the total runway and taxiway areas. The Industrial Area of the Site included numerous buildings on an approximately 150-acre tract of land. The Fire Training Pit Area, located at the northwestern end of the airport runway, is approximately 1 acre in size. The approximate land area of the North Base Landfill, which is located three-fourths of a mile north of the airport, is 7 acres. The Meade Heights Area investigated by GF consists of a hillside area of about 2 acres and a ravine traversed by a small stream.

The results of the RI/FS were presented to the United States Environmental Protection Agency (USEPA) in the GF RI/FS report dated July 1990. The report provided the basis for EPA's December 1990 Record of Decision (ROD) for Operable Unit 2. The Pennsylvania Department of Environmental Resources (PADER) asserted that the ROD did not fully investigate the relationship between soil and ground water contamination, nor did it consider active soil cleanup technologies. USEPA incorporated PADER concerns into an Explanation of Significant Differences (ESD) document which required additional studies to address PADER concerns. This Supplemental Studies Work Plan is intended to satisfy the requirements of the ESD and ROD.

1.2 PHYSICAL SETTING

1.2.1 Demographics and Surrounding Land Use

The Site lies within the Triassic Lowland of the Piedmont Physiographic Province. The Triassic Lowland is characterized by a gently undulating topography, which slopes generally to the south and is traversed by long low ridges and a few round hills. Elevations on the site range from 280 feet above mean sea level (MSL) at the Susquehanna River to approximately 420 feet MSL at the northern boundary.

Portions of the Site are located on the floodplain of the Susquehanna River. However, the majority of this area has already been developed into the HIA and an industrial area. Very little of the area is an undisturbed natural area because of the industrial/commercial land uses. No federal or state threatened or endangered species are located in the vicinity. The diversity of aquatic life in Swatara Creek and the Susquehanna River is above average. Some wetlands on the site are potentially exposed to site contaminants. These include the forested area west of the Fire Training Pit, and an area adjacent to the Susquehanna River at the eastern edge of the Site. Wetlands are also located near the North Base Landfill and Meade Heights areas.

Land use at the Site is commercial/industrial; whereas, adjacent properties include commercial and residential land uses.

Approximately 14,320 people reside in the boroughs of Highspire, Middletown and Royalton, according to 1986 Bureau of Census data. The 1990 population was estimated to be 14,811, based on a linear projection of data for 1980, 1983, and 1986.

Potentially sensitive populations located within 1 mile of the Site boundaries include the Odd Fellows Home, schools in Middletown Borough, the Pennsylvania State University Capitol Campus, HIA tenants and HIA passengers.

The majority of the soils north of the Site are designated by the U.S. Department of Agriculture Soil Conservation Service (SCS) as prime farmland soils of Pennsylvania (GF, 1990). The only prime farmland soils present on the Site are located in the Meade Heights Area. None of the prime farmland soils on or in the vicinity of the Site are currently being farmed.

No federal or state parks are located within 5 miles of the Site, and there are no national wildlife refuges, Audubon refuges or Pennsylvania Game Commission state gamelands within 5 miles of the Site. Neither the Susquehanna River nor the Swatara Creek are listed as wild and scenic rivers.

1.2.2 *Climatology*

General climatic conditions at the Site are characterized by a humid continental climate. The average annual precipitation in the vicinity of the site ranges from 38.83 inches at York Haven, Pennsylvania, to 42.97 inches at Ephrata, Pennsylvania. Mean annual precipitation in the site vicinity is approximately 41 inches. Precipitation is generally well distributed throughout the year, although average summer rainfall is slightly higher than other seasons. Monthly extremes range from 0.43 to 8.43 inches. Dry spells can occur at any time, but extended periods of drought are rare. Approximately 60 percent of the annual total precipitation occurs from April to October, and about one-tenth of the total annual precipitation is snow (GF, 1990).

1.2.3 *Soils*

Fourteen soil units have been mapped at the Site by the SCS (1972). More than 75 percent of the soils on Site have been classified as urban land by the SCS. The SCS considers urban land to be soils whose original soil profile has been destroyed or covered by earth-moving equipment. Blast-furnace slag was used for fill when the runway was extended during the period from 1958 to 1961 and covers a large portion of the main airfield area. Soil borings completed in the area reveal a deep subsoil composed of a mixture of alluvial terrace and flood plain deposits. Although no attempts have been made to estimate the physical properties of urban land, it is reasonable to assume that they impose the same constraints on Site construction as the surrounding natural soils, that is, the occurrence of a high water table and periodic flooding.

1.2.4 *Geology*

In general, the geology of the Site is dominated by unconsolidated deposits underlain by sedimentary bedrock of the Triassic Gettysburg Formation. Although variations of lithology, weathering and fracturing exist in the bedrock at the Site, the major geologic differences are found in the unconsolidated deposits that overlie the bedrock.

Generally, the unconsolidated deposits at the Site can be divided into two categories: fill materials and naturally occurring deposits. In many instances, these two categories of material share the same composition and are not discernible from each other. However, in other cases, the fill material contains anthropogenic constituents which readily identify it as fill.

1.2.4.1 *Geologic Setting*

The following discussion has been summarized from GF, 1990 which referenced published geologic reports pertaining to the Middletown area.

The Site and the surrounding area are underlain by a complex sequence of interbedded sedimentary rock formations that form the Newark Group of Triassic Age. In the general area of the airfield, the Newark Group is divided into the New Oxford Formation and the overlying Gettysburg Formation.

The Gettysburg Formation consists of red shale; red, brown, and gray medium to fine-grained sandstone; quartz conglomerate; and limestone conglomerate, all of which are interbedded to some extent. Near its type locality, the Gettysburg Formation is estimated to be 15,000 feet thick.

The New Oxford Formation consists of arkose, conglomerate, and red sandstone; siltstone; and shale that unconformably overlie lower Paleozoic and Precambrian rocks. The estimated thickness of this formation is 4,800 to 6,900 feet.

The structure of the rocks in the Newark Group is a broadly north-northwestward dipping homocline that is modified by local folds plunging northward and reverse dips adjacent to the north border of the basin (where high faults form the northern boundary). It is also cut by a few faults at large angles to the strike of bedding. The dip of bedding throughout most of the area is north to northwestward, ranging commonly from 20° to 40°.

The sedimentary rocks of the Newark Group have been intruded by large sills and cross-cutting bodies of diabase and by many long narrow dikes. Many of these bodies have risen along fractures associated with faults, implying that the faults existed before the diabase was emplaced. The diabase is resistant to erosion and forms numerous ridges in the area.

The uppermost bedrock unit beneath the Site is part of the Gettysburg Formation. Aerial photographs reveal the strike of bedding in the Gettysburg Formation at the airfield and in the streambeds of Swatara Creek and the Susquehanna River. It has been reported that the strike of the beds ranges from N5°E to N65°E, with an average strike of N43°E. The dip of bedding is to the northwest at angles ranging from 19° to 38°. The average of nine dip measurements taken by previous investigators near the Fruehauf trailer manufacturing plant in the North Base Area was approximately 26°NW. Faults have not been mapped in the Gettysburg Formation in the immediate vicinity of the Site; this unit may be extensively fractured and jointed locally.

Throughout most of the Site, the Gettysburg Formation is covered by alluvial terrace deposits of Quaternary Age. These deposits occur at three levels, marking the three glacial events of the Illinoisan to late Wisconsin ages. The terrace deposits contain "pebbles and cobbles of granite and other igneous rocks, metamorphic rocks, various quartzites, cherts, and boulders of 5 to 10 feet in dimension". The lowest terrace deposit, upon which the main portion of the airfield is situated, occurs at approximately 300 feet MSL and consists of gravel and sand that are approximately 30 feet thick. The alluvium of higher terraces, which occur at approximately 340 to 380 feet MSL, is described as consisting of thin, discontinuous deposits as much as 20 feet thick. However, in the general area, they may be less than 10 feet thick. The upper portion of the underlying Gettysburg Formation has been described as deeply weathered and broken to a depth of approximately 10 feet prior to the deposition of the gravel. Consequently, cracks between blocks in the uppermost portion of the Gettysburg Formation are filled with alluvial material.

1.2.5 *Hydrogeology*

The following discussion has been summarized from GF, 1990 which referenced published hydrogeologic reports pertaining to the Middletown area.

Ground water at the Site occurs under both confined and unconfined (water table) conditions within the bedrock aquifer. The water table aquifer at the Site is present within terrace alluvium and the weathered upper zones of the Gettysburg Formation. The alluvium and weathered substrate do not yield significant quantities of water, but provide a permeable receptor for precipitation, which infiltrates rapidly, and provides recharge to the underlying bedrock aquifer system.

The unconfined aquifer extends to a depth of approximately 40 feet at the HIA and to a depth of approximately 20 feet in the North Base Landfill Area, and at both locations grades gradually into the underlying confined bedrock aquifers. Records of wells located in the area indicate that this aquifer is not extensively used. Because of the complex heterogeneous nature of bedding in the Gettysburg Formation, the exact location, extent, and hydraulic characteristics of individual aquifers at the Site are not well defined. Individual beds are laterally extensive, but range in thickness from a few inches to a few feet.

Because some beds contain more openings than others, the confined ground water system in the Gettysburg Formation consists of a series of tabular-shaped aquifers that generally dip 26° to the northwest. The network of water-bearing fractures in each aquifer is reportedly more or less continuous along strike. Thus, the greatest movement of water in response to pumping is parallel to the strike of bedding. The continuity of individual beds is limited by faulting and pinching out. Aquifers in the Gettysburg Formation are reported to extend downdip from a few hundred feet to as much as 3,000 feet below land surface. The hydraulic connection between individual aquifers in the Gettysburg Formation is reported to be generally poor, and wells deeper than 200 feet generally tap water from more than one aquifer.

1.2.5.1 *Summary of Site Hydrogeology*

The general ground water flow direction throughout the study area is southward toward the Susquehanna River. The hydrogeology of the Site is primarily controlled by overburden and bedrock stratigraphy and structure. It is also controlled by the Susquehanna River, local topography, and ground water withdrawals. Other influences on hydrogeology at the Site include local precipitation, land uses, and operation of the HIA well fields.

Site topography provides a significant portion of the driving force behind ground water movement at the Site. The difference in elevation between the Susquehanna River and the North Base Landfill is approximately 100 feet, over a distance of approximately 10,000 feet. This translates to an average potentiometric surface gradient of 10 feet per 1,000 feet. This topographic effect on ground water results in a higher hydraulic gradient beneath the hill in the North Base Landfill area.

Overburden stratigraphy is variable, often containing man-made materials. Large areas of the Site are underlain by river terrace deposits, which are generally highly conductive (sands and gravels) with regard to ground water flow. The overburden at this Site underlies large areas of impermeable surfaces, such as runways, taxiways, and buildings. Surface water runoff is greatly enhanced, and ground water recharge is reduced in these paved areas.

The lithology of the underlying Gettysburg Formation is predominately a sandy-shale or siltstone. The northeast striking and north dipping bedrock forms the basic framework for ground water movement. The bedding plane-controlled fracture system is preferentially interconnected in discrete zones, which are generally parallel to the strike direction of the Gettysburg Formation. Thus, ground water is transmitted primarily along various strike oriented fracture systems in preference to other directions. Lithologic variations probably do not influence Site hydrogeology as strongly as geologic structure.

The Susquehanna River strongly influences hydrogeologic conditions at the HIA. The Susquehanna River drains a significant portion of north central and northeastern Pennsylvania and New York State, and consequently incorporates precipitation, surface water runoff, and ground water discharge from its large drainage basin. The Susquehanna is the major receptor of Site runoff, and is also likely to be a major ground water discharge point.

Ground water withdrawals from several pumping centers also strongly influence ground water flow at the Site. Currently, wells HIA 1, 2, 3, 4, 5, 6, 9, 11, 12, and 13 provide drinking water after treatment at the on-site water treatment facility. Well HIA 14 is used exclusively for heating and cooling water. Water withdrawals from production wells at the Site accentuate ground water movement along tabular bedding plane aquifers and can significantly increase flow from the overlying unconfined aquifer through open fractures that are interconnected with the water table aquifer. Exposures of distinct bedding plane fracture systems at the bedrock surface constitute the updip portion of the various tabular-shaped aquifers within the Gettysburg Formation. Downdip extensions of such zones reportedly continue to depths of 1,000 feet, even though compressive loads tend to reduce the openings.

On the basis of usage, subsurface geology at the Site can be divided into three broad categories: overburden, shallow bedrock, and deep bedrock.

Use of ground water from the deep bedrock is extensive. Use of ground water from the shallow bedrock is less extensive, and the overburden is not used as a direct water supply source. HIA and adjacent communities are dependent on deep bedrock ground water supplies. Since economical alternatives are not available, HIA treats its water supplies to remove VOCs. Although the shallow bedrock aquifer is not directly used at the HIA, it is the vehicle of recharge from the overburden to the deep bedrock. Most airport production wells are cased to depths of 75 to 200 feet and are open from that depth to the total well depths of 450 to 800 feet.

The RI revealed that ground water recharge to the shallow bedrock aquifer carries contaminants from the overburden and that ground water movement through the bedrock occurs in isolated fracture zones. Once ground water enters the bedrock from the overburden, it travels toward the Susquehanna River along bedding plane fractures. Also, the overburden aquifer generally displays higher and more uniform hydraulic conductivity, compared to the bedrock aquifers where significant hydraulic conductivity differences exist throughout the bedrock mass. Preferential fluid movement occurs in the unit with higher conductivity, which in this case is the overburden. However, there does not appear to be a consistent confining layer between the overburden and the bedrock, except at some portion of the North Base Landfill. As a result, communication between the two layers has provided a means for contamination to enter the bedrock aquifer.

1.3 *SUMMARY OF PREVIOUS INVESTIGATIONS*

Several investigations of the Site have been performed. Since 1983, the PADER has been sampling the potable water production wells at HIA on a frequent basis. JRB Associates, Inc., performed a Phase I--Problem Identification Records Search of the Site under the Department of Defense's Installation Restoration Program (IRP). R.E. Wright Associates, Inc., investigated the former landfill located beneath the main HIA runways to determine if it is contributing to the contamination of production wells located in the Industrial Area. Based on ground water flow patterns and the types of contaminants, R.E. Wright Associates, Inc., concluded that the Runway Area landfill was most likely not the source of contamination to the production wells.

Roy F. Weston, Inc., conducted ground penetrating radar and magnetometer surveys at the Runway, Industrial, and North Base Landfill

Areas. As a result of the surveys, nine partially exposed 55-gallon drums were removed from a fill area located along a stream bank northeast of the Meade Heights housing complex. The drums were empty except for water and coatings of a hard black tarry substance. These contents were sampled and found to be nonhazardous under the USEPA characteristic of EP toxicity.

Remedial actions for the HIA production wells were addressed in the U.S. Air Force and Penn DOT's Focused Feasibility Study (FS), and Buchart-Horn, Inc.'s Phase IV--Corrective Action Study. An air stripping tower was installed at the wellhead of production well HIA-11 to lower the VOC to within drinking water standards. A water treatment system is currently in use at the Site that is capable of treating discharge from all HIA production wells. The treatment system includes an ion exchange unit for water softening and an air stripper for reducing the VOCs in the HIA well water. The water is chlorinated before distribution.

A train spill occurred to the north of the Runway Area at the HIA on June 4, 1988, approximately 500 feet west of Production Well HIA-12. The contaminants diethylene glycol and mineral oil were released into the subsurface environment. Remediation at the Site was initiated which included pumping ground water into settling tanks where skimming of the mineral oil occurred, biotreatment of the diethylene glycol, and reinjection of the treated water into the subsurface. Remediation was completed in spring of 1989.

In 1989, GF conducted an RI at the Site, including investigation of the following areas:

- Runway Area,
- Industrial Area,
- Fire Training Pit,
- North Base Landfill,
- Meade Heights, and
- Swatara Creek.

Each of the initial five areas of the Site was investigated in terms of evaluating the geology, and determining the concentrations of contaminants in specific media including soils, ground water, surface water and sediments. A total of 21 overburden monitoring wells, 14

bedrock monitoring wells, and 39 subsurface soil borings were drilled during the investigation. Two rounds of ground water samples were collected at each of the new wells installed by GF, as well as from 17 existing monitoring and production wells. One round of samples was collected from five residential wells and a nearby production well. Soil samples were collected generally at three depths for each soil boring, and three soil samples were collected at each monitoring well. In addition, one round of surface water and sediment samples were collected from 24 separate locations on the Site. Over 100 ground water samples, 200 soil samples, 24 surface water samples and 24 sediment samples were collected and analyzed over the course of the project.

The ground water portion of the investigation at the Site consisted of two major tasks, ground water sampling and aquifer testing. Slug testing was performed at newly installed wells, where applicable. Packer testing was performed at six bedrock wells. Three 24-hour pumping tests were performed after short-term step-drawdown testing. A fourth pump test was stopped after 11 hours due to torrential rain showers. Well hydrograph stations were used to record well water levels to determine pumping, recharge and river influences.

For a more detailed discussion of the RI Scope of Work and results/conclusions, refer to the August 1988 Work Plan, as amended, and the July 1990 RI/FS report.

1.4 *CURRENT CONDITIONS*

The following sections provide a summary of the significant findings of the RI. The information presented below represents what is currently known about the following areas and was used in scoping additional investigative activities in the Supplemental Studies Work Plan:

- Runway Area,
- Industrial Area,
- Fire Training Pit,
- North Base Landfill,
- Meade Heights,
- Swatara Creek, and

- Susquehanna River.

1.4.1 *Runway Area*

1.4.1.1 *Geology*

The unconsolidated deposits of the Runway Area are present in thicknesses up to 28 feet and can be broadly characterized by the horizontal and vertical extent of three major sediment groups. From north to south across the Runway Area, these groups are: mixed sands and gravels in the northernmost infield area; sands and gravels, underlain by fine-grained sediments, immediately north of the main runway; and slag-dominated fill, overlying bedrock, south of the runway.

Much of this area was built up on a thick section of steel mill slag generated at Bethlehem Steel's Steelton Plant and deposited in the 1950's. In addition, several exploratory borings encountered ash, ash-like material and trash fill. This trash fill material is presumed to have been deposited during operation of the Runway Area landfill and an incinerator at this Site prior to construction of the runway.

The bedrock geology of the Runway Area is consistent with that of the rest of the Site. The dominant lithologies, as observed during drilling, are red-brown shale, fine-grained sandstone, and siltstone. Also included are some conglomeratic strata. The upper bedrock section is generally more weathered than sections at depth; however, little coring of the upper bedrock sections was completed during GF's investigation.

1.4.1.2 *Hydrogeology*

The ground water potentiometric surface of the Runway Area indicates that ground water flow is toward the Susquehanna River with a horizontal hydraulic gradient of approximately 5×10^{-3} ft./ft.

Ground water occurs in two aquifer units which are both influenced by the Susquehanna River. These aquifer units are the unconsolidated overburden and part of the Gettysburg Formation. Although no confining unit was detected during the investigation, the bedrock aquifer probably behaves as a confined unit, particularly at increasing depth (GF, 1990).

Some limited reversal of the water table gradient away from the Susquehanna River may occur during periods of high river stage (GF,

1990). However, bedrock-confined aquifer response to relatively short-term, high river stages appears to be smaller in magnitude and significantly delayed because of lower hydraulic conductivity in the bedrock than in the overburden.

The RI (GF, 1990) indicates that hydraulic communication was measured between the Susquehanna River and the thick slag deposits common to the Fire Training Area. Thick slag deposits also underlie the Runway Area; therefore, it is reasonable to assume that hydraulic interconnection exists between the Susquehanna River and the slag deposits in the Runway Area.

1.4.1.3 *Chemical Data Summary*

Soil borings along the Susquehanna River (BHH-2, BHH-4, and BHH-8) showed the highest concentrations of volatiles (vinyl chloride, DCE, TCE, and chlorobenzene), semivolatiles (PAHs and dichlorobenzenes), and lead. The monitoring wells sampled showed elevated concentrations of the volatile organics TCE, DCE, vinyl chloride, carbon tetrachloride, benzene, chlorobenzene, and PCE. The metals detected at high concentrations in the monitoring wells were arsenic, barium, cadmium, chromium, lead, and nickel. Surface water and sediment samples were collected from the Susquehanna River adjacent to the runway. The surface water samples contained low concentrations of DCE, TCE, and 4,4'-DDT. Aluminum, iron, and zinc levels detected upgradient of the site exceeded the EPA's Ambient Water Quality Criteria (AWQC). The presence of potential Site-related contaminants (volatiles, PAHs, a phthalate, and a PCB) in the sediment was detected.

1.4.2 *Industrial Area*

1.4.2.1 *Geology*

The thickness of unconsolidated deposits in the Industrial Area ranges from 10.5 feet to 28.6 feet and consists of three recognizable units: an upper layer consisting of surficial soil, demolition debris, mixed sands, gravels, silts, and clays; a middle unit consisting of sandy silty coarse gravels; and a lower unit consisting of silty sands of weathered Gettysburg Formation bedrock. The overburden of the Industrial Area is distinctly different from the stratigraphy of the Runway Area, where the thick section of coarse gravels is absent.

Because of the historically urban land uses of the Industrial Area, the upper layer described above is often found underlying concrete or paving.

Underlying the middle unit (coarse gravel) is a silty sand that in many locations resembles the color of the Gettysburg Formation. Occasionally this unit is entirely absent, in which case the contact between the gravel unit and competent bedrock is sharp. In other locations the middle unit consists of olive green to red-brown and brown, fine silty sand and silty clay with gravel.

The Gettysburg Formation bedrock that underlies the Industrial Area consists of red-brown shale, siltstone, fine-grained sandstone and conglomerate. Fracturing is predominantly along dipping bedding planes, but some near vertical fracturing was also noted. Calcite filled bedding plane fractures are a common feature, and vugs were noted in cores from one well. Weathering ranged from slight to severe, but most of the bedrock was noted to be firm to hard with moderate weathering, except in the top of bedrock where weathering was more severe.

1.4.2.2 *Hydrogeology*

The potentiometric surface of the water table generally sloped from the northern edge of the Industrial Area toward the Susquehanna River, with an overall gradient of approximately 6.7×10^{-3} (ft./ft.). This gently sloping surface is interrupted by a strong change in gradient north of the Air National Guard Area at the eastern end of the Industrial Area. The water table at this location mimics the topography, with a water table gradient of approximately 1.2×10^{-2} (ft./ft.), and ground water flow was south toward the river. Ground water flow in the eastern end of the Industrial Area was generally toward the Susquehanna River, with an approximate gradient of 3×10^{-3} (ft./ft.).

Continuous pumping of production wells HIA-13 and HIA-14 does not completely dewater the overburden aquifer and is thought to enhance the capability of overburden to recharge bedrock. Such pumping-induced flow is also likely to accentuate contaminant migration downward.

The bedrock aquifer of the Industrial Area is confined. The potentiometric surface mimics both topography and the unconfined water table surface. Gradients for this surface are similar to those reported previously for the

water table, and flow of ground water is generally toward the Susquehanna River.

The separation of the water table and the bedrock potentiometric surface indicates that some downward vertical gradients exist between the two aquifer units and is controlled to some degree by the presence or absence of silty weathered bedrock, by the thickness of the weathered bedrock unit, and by the openness of fractures at the bedrock surface.

Pump testing was conducted on wells GF-318 and GF-310. Well GF-210 was used as an observation well during the pumping test. Additionally, a well hydrograph station was set up during and after the test in Well GF-309.

Analysis of the recovery of Well GF-310 by Theis equilibrium methods resulted in calculation of a transmissivity of 3.5×10^{-2} ft^2/min. Well GF-210 is located approximately 13 feet from GF-310 and is a shallow well. Analysis of the drawdown observed in GF-210 was not conducted, but the observed drawdown appears to represent leakage across the confining unit from the unconfined overburden aquifer.

Maximum drawdown during pumping of GF-318 was approximately 12 feet after 670 minutes. Analysis of recovery data using the Theis recovery method indicates a transmissivity of 2×10^{-1} ft^2/min. No drawdown was observed in the adjacent overburden monitoring, well GF-218.

1.4.2.3 *Chemical Data Summary*

Ground water contamination in the Industrial Area is widespread from the area to the east of the Terminal Building parking lot to the eastern edge of the Site near the warehouse buildings. However, the area around the Stambaugh Aviation facility and the waste sump (sampling locations GF-218, 318, 217, 317, 222, 227) can be classified as "hot spots" due to the presence of relatively high concentrations of TCE, DCE, chlorobenzene, dichlorobenzenes, chromium, lead, barium, arsenic, cadmium, and nickel. Except for chlorobenzene and dichlorobenzenes, none of the contaminants in the ground water were detected at high concentrations in the soil.

The ground water in this area is in close proximity to water production wells HIA-13 and HIA-14. Water pumped from HIA-13 for industrial process purposes is currently being treated in the wastewater lagoons at

the eastern end of the Site after use. The soils in this area do not currently seem to be a source of VOCs to the ground water. However, relatively high concentrations of semivolatiles were present.

1.4.3 *Fire Training Pit*

1.4.3.1 *Geology*

The unconsolidated overburden deposits at the Fire Training Pit consist primarily of fill ranging in thickness from 16 feet to 31 feet. The composition of the fill is variable, and includes sand, clay, gravel, and man-made materials (primarily construction debris). Gray slag, similar to that found south of the runway, was found in one monitoring well boring (GF-205). The fill is underlain by a sand and gravel unit that ranges in thickness from two feet to nine feet.

The underlying Gettysburg Formation consists of red-brown, fine-to-very fine-grained sandstone and siltstone. The bedrock is generally massive and competent.

1.4.3.2 *Hydrogeology*

Ground water below the Fire Training Pit area occurs in an unconfined, water table aquifer and a confined bedrock aquifer. The two aquifers apparently share a common potentiometric surface, with a gradient of 4.0×10^{-3} (ft/ft) toward the Susquehanna River. Ground water monitoring suggests hydraulic communication between the overburden aquifer and the river, especially where the area is underlain by slag deposits.

Slug testing of the overburden wells indicated a range of hydraulic conductivity values from 2.7×10^{-2} ft/min to 3.5×10^{-5} ft/min. The higher value was indicative of the presence of the slag deposits.

A 24-hour pumping test was conducted at bedrock well GF-305. The well was pumped at a rate of 5 gallons per minute, and the maximum drawdown in the pumping well was approximately 43 feet. No drawdown was recorded in the three overburden wells monitored during the test. Analysis of recovery data using the Theis recovery method indicated a transmissivity of 7.8×10^{-3} ft^2/min.

1.4.3.3 *Chemical Data Summary*

The highest soil contamination in the Fire Training Pit area was found in the surface soils. PAHs, dichlorobenzenes, phthalates, chromium and lead were the predominant contaminants. Low concentrations of DCE, TCE, bis(2-ethylhexyl) phthalate, barium and chromium were detected in the ground water. PAHs and phthalates detected in nearby sediment samples collected from the Susquehanna River are potentially site-related.

1.4.4 ***North Base Landfill***

1.4.4.1 *Geology*

Unconsolidated landfill deposits at this site range from 0 feet to approximately 20 feet, and overlie a very irregular bedrock surface. The trash fill sampled consisted of construction rubble, insulation materials, and paper. The remaining portions of the fill, which constitute the overburden, are composed of red-brown silty sands, gravel, slag, sandstone, clayey silt and wood.

The underlying Gettysburg Formation bedrock is composed primarily of red-brown, fine- to medium-grained sandstone, but also contains beds of conglomerate, siltstone and shale. This bedrock is occasionally cross-bedded, and vuggy in some locations. Weathering is generally moderate.

1.4.4.2 *Hydrogeology*

The bedrock aquifer potentiometric surface at the North Base Landfill slopes gently toward the Susquehanna River at a rate of approximately 2.0×10^{-2} (ft./ft.), and is strongly influenced by surficial topography. The bedrock aquifer is confined at the North Base Landfill.

No significant water table aquifer exists throughout the North Base Landfill Area; however, a wet area exists just to the west of Route 441. This area probably results from surface drainage onto poorly drained soils resulting from the weathering of the Gettysburg Formation.

One 24-hour pumping test in well RFW-1 was undertaken at the North Base Landfill. The maximum drawdown produced during the 24-hour pumping test was approximately 52 feet in the pumping well (RFW-1). The transmissivity and storativity values for confined aquifer testing

solutions ranged from 2.4×10^{-4} ft^2/min. to 4.6×10^{-6} ft^2/min. and 1.6×10^{-5} to 9.0×10^{-6}, respectively.

1.4.4.3 Chemical Data Summary

Well RFW-01 indicated the presence of TCE and DCE contamination in the bedrock ground water aquifer and raises a concern regarding the potential of contamination reaching the Middletown drinking water supply well (MID-04). The soils sampled to the north of RFW-01 in the Fruehauf parking lot contained minimal contamination except for some pesticides.

Surface water and sediment samples were collected from a small stream at the North Base Landfill. Some PAHs, phthalates, and a pesticide were detected in the sediments. Iron and lead exceeded EPA's AWQC for surface waters.

1.4.5 Meade Heights

1.4.5.1 Geology

The unconsolidated overburden of Meade Heights is similar to other study areas at the Site, where fill materials, consisting of man-made components, mixed with naturally occurring residuum, constitute a significant portion of the section. Fill extends to a depth of approximately eight feet. This fill is underlain by a red silty clay, which grades into red sandstone bedrock of the Gettysburg Formation. The upper portion of this rock is sufficiently weathered to allow auger penetration with ease to approximately 5 feet beyond the bedrock-soil interface.

1.4.5.2 Hydrogeology

Insufficient data prevented the development of a ground water table contour map for the Meade Heights Area, and no conclusions regarding ground water flow direction can be drawn. Slug testing of overburden well GF-250 resulted in a calculated hydraulic conductivity value of 8.9×10^{-5} ft/min.

1.4.5.3 Chemical Data Summary

The primary contaminants in the one soil boring conducted in this area were PAHs. Since these compounds are strongly adsorbed onto soils, they

should not pose a threat to ground water resources in the area. Barium, chromium, zinc and nickel were detected at elevated concentrations in the ground water. No known drinking water supplies exist in the area.

Sediment samples collected from the Meade Heights stream contained bis(2-ethylhexyl)phthalate and methylene chloride. Zinc exceeded the USEPA AWQC for surface waters.

1.4.6 *Swatara Creek*

1.4.6.1 *Surface Water*

Five surface water samples were collected along various locations of Swatara Creek. The only organics detected at various locations consisted of six pesticides at low concentrations. No inorganics were detected at concentrations of concern.

1.4.6.2 *Sediment*

Five sediment samples were collected at different locations along Swatara Creek. The primary organic contaminants found at several locations were PAHs, three phthalates, and 4-methylphenol. Other contaminants detected were three VOCs (6-55 µg/kg), and four pesticides. No inorganics were detected at concentrations of concern. Swatara Creek is not included in the scope of work for the Supplemental Studies Investigation.

1.4.7 *Susquehanna River*

1.4.7.1 *Surface Water*

Surface water samples were collected at eight locations along the storm drain outfalls to the Susquehanna River. Low concentrations of three organic compounds (DCE, TCE, and 4,4-DDT) were detected. Each compound was present at only one of the three locations where organics were detected. Concentrations of aluminum, iron, and zinc reportedly exceeded federal AWQCs.

1.4.7.2 *Sediment*

Eight sediment samples were collected along the Susquehanna River. The primary organic contaminants detected at several locations were 16 PAHs,

bis (2-ethylhexyl)phthalate, and 4-methylphenol. Seven VOCs (7-1,900 µg/kg) and PCB Arochlor 1242 were also detected. No inorganics were detected at concentrations of concern.

Section 2

Section 2

2.0 OBJECTIVES

2.1 PROJECT OBJECTIVES

The overall project objective is to perform the supplemental study requirements described in the 17 December 1990 ROD, as clarified by the 30 December 1992 ESD for the site. Specific objectives of the investigation activities are to:

- assess the potential impact of contaminated soil on ground water in and around the Industrial Area, North Base Landfill, and Runway;
- repeat previous EPA sampling of the Susquehanna River to verify that concentrations of site-related contaminants are below Ambient Water Quality Criteria (AWQC) levels;
- evaluate water quality and organisms in the stream flowing through the Meade Heights Area;
- install monitoring/sentinel wells between the North Base Landfill and Middletown production well MID-04 to provide warning of plume impacts on MID-04;
- perform a hydrogeologic investigation of shallow and deep ground water to determine extent of contamination and a capture zone, including evaluation of existing wells and new wells, as necessary to characterize the hydrogeologic regime at the site, and assist in development of a ground water restoration timetable;
- conduct a soil vapor extraction (SVE) pilot study to evaluate SVE as a potential soil cleanup method to enhance ground water cleanup within a reasonable timeframe;
- evaluate the best configuration for production wells and their pump rates to maximize containment of identified plumes;
- perform quarterly monitoring of the Susquehanna River and the Sentinel wells at the North Base Landfill; and
- develop a timetable for ground water restoration.

2.2 *DATA QUALITY OBJECTIVES*

Data Quality Objectives (DQOs) are quantitative and qualitative statements that are specified to ensure that data of known and appropriate quality are obtained to support their intended use, i.e., the risk assessment and evaluation of remedial alternatives for the site. Media that will be sampled to gather the necessary data to meet the project objectives will include ground water, surface water, sediment, soil vapor, and surface and subsurface soils.

The investigation approach is based on the use of field screening techniques (soil vapor surveys, borehole geophysics, television surveys), the operation of an on-site mobile laboratory to generate data in the field, and a step-wise approach to the installation of borings and wells to characterize and delineate the extent of contamination. For example, the investigation of the pipeline from Building 142 to the lagoons will be initiated with a camera survey of the line to identify potential leaks. A soil gas survey will then be performed, followed by direct push soil sampling, and soil borings and collection of split spoon samples. Each task will rely on data generated by the proceeding tasks in an effort to focus the sampling efforts to pinpoint the source and extent of soil contamination. With respect to ground water contamination, selected HIA production wells will be television surveyed, geophysically logged, and sampled at five depth specific intervals to identify the depth at which contamination is transported within the bedrock aquifer system.

Section 3.0 of the Quality Assurance Project Plan (QAPP) addresses the DQOs with respect to the laboratory analytical program. The objective is to maximize the representativeness and usability of the data and to provide a data base that is complete and accurate. Section 3.0 of the QAPP provides more detail on this subject.

The data generated during the investigations will also be used to conduct a Baseline Risk Assessment consisting of both human health and ecological assessments. For each constituent identified in each medium, media-specific screening criteria will be developed which will incorporate background data, promulgated regulatory criteria (potential ARARs such as Maximum Contaminant Levels or Ambient Water Quality Criteria), guidance values, and calculated health-based screening levels. This process is discussed in detail in Section 4.15 of this Work Plan .

Section 3

Section 3

3.0 SUPPLEMENTAL STUDIES SITE INVESTIGATION TASKS

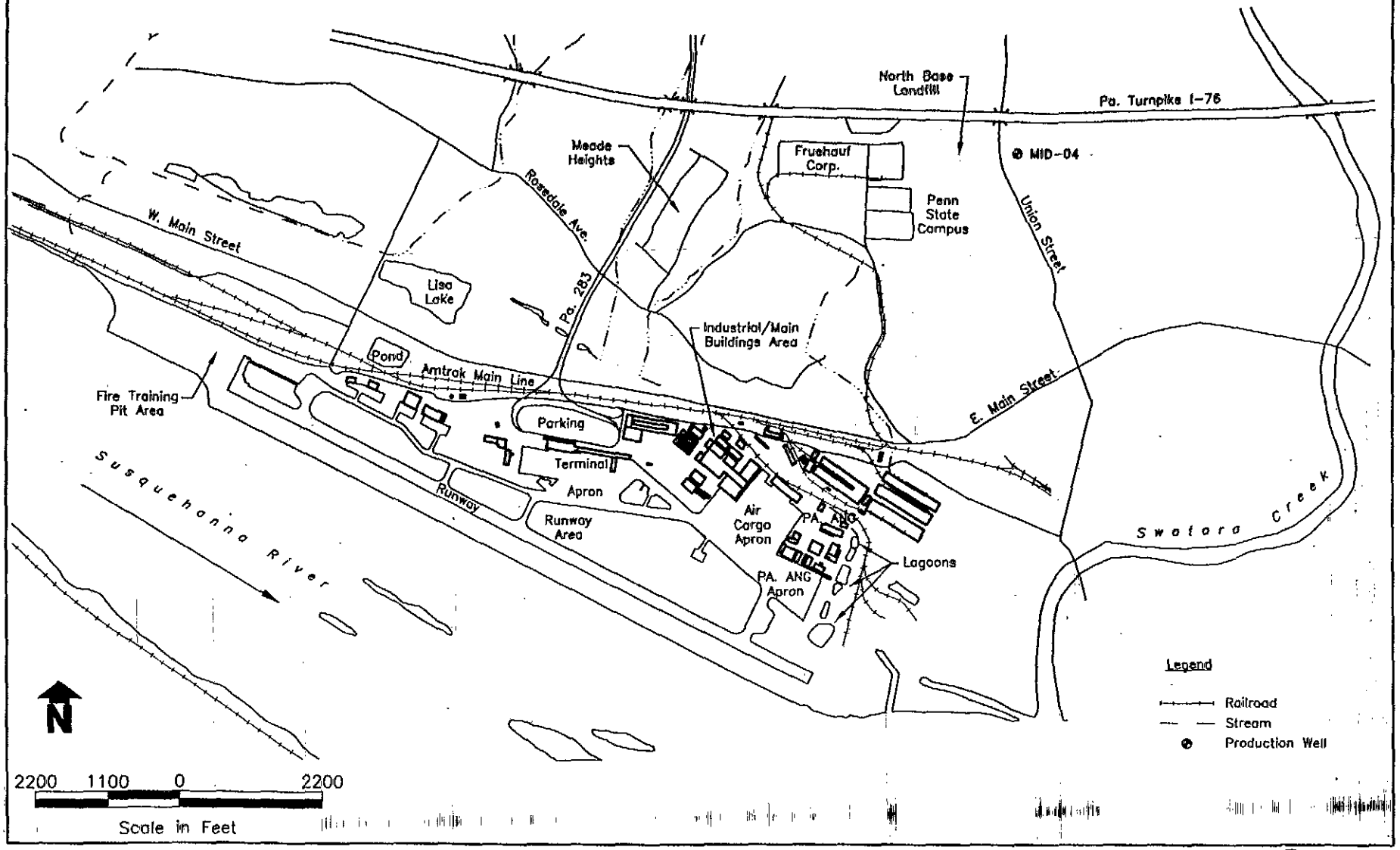
The Supplemental Studies Site Investigation includes completion of investigative tasks in the following seven areas of the Site:

- Industrial Area - Building 142 and Building 267 Pipelines,
- Industrial Area - Main Buildings Area,
- Main Airport/Industrial Area Storm Sewers,
- North Base Landfill,
- Meade Heights,
- Susquehanna River, and
- HIA Production Well Field.

Figure 3-1 shows the locations of these seven areas at the Site. The proposed investigative tasks and associated laboratory analyses are summarized in Table 3-1. In general, the following investigative tasks will be completed during the investigation to accomplish the project objectives described in Section 2:

- pipeline and storm sewer integrity surveying;
- direct push soil vapor sampling and analysis;
- direct push soil sampling and analysis;
- direct push ground water sampling and analysis;
- soil borings and soil sample analysis;
- installation of monitoring wells, ground water sampling and analysis;
- borehole geophysics;
- sediment and surface water sampling and analysis;
- aquatic survey of macroinvertebrates, insects, and fish;
- production well capture zone analysis including pumping tests;
- soil vapor extraction (SVE) pilot testing; and
- baseline risk assessment.

Figure 3-1
Areas of Investigation
Middletown Airfield Site
Middletown, Pennsylvania



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AR302806

Table *Summary of Field Investigations*
Middletown Airfield Site

Area of Concern	Investigation Action	Number of Field Samples (1)	Analyses (2)
Industrial Area - Building 142/267 Pipeline/Lagoons	•Pipeline integrity survey from Building 142 to Lagoons	•NA	•NA
	•Conduct direct push soil vapor sampling from 6 to 8 feet below grade at 60 locations along Bldg. 142 pipeline and 40 locations around Waste Sump House (Bldg. 267) and pipelines.	•100 (V)	•(F, Level II) PCE, TCE, 1,2-DCE, BTEX, CCl_4, 1,2-DCA, chlorobenzene, vinyl chloride, 1,2-, 1,3-, 1,4-dichlorobenzene
	•Collect 2 direct push soil samples from 20 locations along Bldg. 142 pipeline and Waste Sump House, and 5 locations around Lagoons	•50 (S)	•(F, Level II) PCE, TCE, 1,2-DCE, BTEX, CCl_4, 1,2-DCA, chlorobenzene, vinyl chloride, 1,2-, 1,3-, 1,4-dichlorobenzene
	•Collect 5 samples from each of 12 HSA soil borings: 10 borings along pipeline routes and 2 borings at Lagoons	•60 (S)	•(F, Level II) PCE, TCE, 1,2-DCE, BTEX, CCl_4, 1,2-DCA, chlorobenzene, vinyl chloride, 1,2-, 1,3-, 1,4-dichlorobenzene
	•Collect 2 samples per boring for geotechnical analysis	•24 (S)	•(L) Grain size distribution, Atterberg limits, moisture content
	•Based on GC screening, select 3 samples from each of 10 borings plus a surface scrape sample (0-2") from 2 borings along pipeline routes	•30 (S) •32 (S)	•(F, Level III) TCL VOCs + TICs (excludes surface scrape samples) •(L) TCL SVOCs + TICs, TCL Pesticides (only), TAL total metals, CN (total and amenable), TOC, CEC
	•Based on GC screening, select 3 samples from each of 2 borings plus a surface scrape sample (0-2") from the borings at Lagoons	•6 (S)	•(F, Level III) TCL VOCs + TICs •(L) TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL Total Metals, CN (total and amenable), TOC, CEC

AR302807

Table 3-1 *Summary of Field Investigations*
Middletown Airfield Site

Area of Concern	Investigation Action	Number of Field Samples [1]	Analyses [2]
Industrial Area - Building 142/167 Pipeline/Lagoons (continued)	•Install and sample 2 shallow and 2 intermediate depth monitoring wells along Bldg. 142 pipeline; sample shallow wells for VOCs with 14 day turnaround to locate intermediate wells	•2 (GW) (shallow wells) •4 (GW)	•(L) TCL VOCs plus TICs (14 day turnaround) •(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable) •(L) TCL Pesticides for shallow wells only
	•Install and sample 1 shallow and 1 intermediate depth monitoring well at Lagoons	•2 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable) •(L) TCL Pesticides/PCBs for shallow well only
	•Collect 5 samples from each of 3 shallow monitoring well borings	•15 (S)	•(F, Level III) PCE, TCE, 1,2-DCE, BTEX, chlorobenzene, vinyl chloride, 1,2-, 1,3-, 1,4-dichlorobenzene
	•Based on GC screening, select 3 samples from each of 2 shallow well borings along Bldg. 142 pipeline	•6 (S) •6 (S)	•(F, Level III) TCL VOCs + TICs •(L) TCL SVOCs + TICs, TCL Pesticides (only), TAL total metals, CN (total and amenable), TOC, CEC
	• Based on GC screening, select 3 samples plus a surface scrape sample (0-2") from the 1 shallow well boring at Lagoons	•3 (S) •4 (S)	• (F, Level III) TCL VOCs + TICs (excludes surface scrape sample) • (L) TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), TOC, CEC
	•Collect 2 samples from each of 3 shallow well borings for geotechnical analysis	•6 (S)	•(L) Grain size distribution, Atterberg limits, moisture content

AR302808

Table ***Summary of Field Investigations***
Middletown Airfield Site

Area of Concern	Investigation Action	Number of Field Samples (1)	Analyses (2)
Industrial Area - Main Buildings Area	•Collect 5 samples from each of 30 HSA borings	•150 (S)	•(F, Level II) PCE, TCE, 1,2-DCE, BTEX, CCl_4, 1,2-DCA, chlorobenzene, vinyl chloride, 1,2-, 1,3-, 1,4-dichlorobenzene
	•Based on GC screening, select 3 samples from each boring plus 10 surface scrape samples (0-2")	•90 (S) •100 (S)	•(F, Level III) TCL VOCs + TICs (excludes 10 surface samples) •(L) TCL SVOCs + TICs, TAL total metals, CN (total and amenable), TOC, CEC
		•78(S) •22(S)	• TCL Pesticides (only) •(L) TCL Pesticides/PCBs on 18 samples from borings and 4 surface samples
	•Select 10% of soil samples for geotechnical analysis	•15 (S)	•(L) Grain size distribution, Atterberg limits, moisture content
	•Install and sample 3 shallow, 3 intermediate depth, and 1 deep monitoring well; sample shallow wells for VOCs with 14 day turnaround to locate intermediate and deep wells	•3 (GW) (shallow wells) •7 (GW)	•(L) TCL VOCs plus TICs (14 day turnaround) •(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable), •(L) TCL Pesticides/PCBs for shallow wells only
	•Collect 5 samples from each of 3 shallow well borings	•15 (S)	•(F, Level II) PCE, TCE, 1,2-DCE, BTEX, CCl_4, 1,2-DCA, chlorobenzene, vinyl chloride, 1,2-, 1,3-, 1,4-dichlorobenzene
	•Based on GC screening, select 3 samples from each shallow well boring plus 1 surface scrape sample (0-2")	•9 (S) •10(S)	•(F, Level III) TCL VOCs + TICs (excludes surface sample) •(L) TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), TOC, CEC

AR302809

Table 3-1 Summary of Field Investigations
Middletown Airfield Site

Area of Concern	Investigation Action	Number of Field Samples [1]	Analyses [2]
Industrial Area - Main Buildings Area (continued)	•Collect 2 samples from each of 3 shallow well borings for geotechnical analysis	•6 (S)	•(L) Grain size distribution, Atterberg limits, moisture content
North Base Landfill	•Collect up to 75 direct push ground water samples at an average depth of 20 feet	•75 (GW)	•(F, Level II) PCE, TCE, 1,2-DCE, BTEX, CCl_4, 1,2-DCA, chlorobenzene, vinyl chloride, 1,2-, 1,3-, 1,4-dichlorobenzene
		•16 (GW)	•(L) TCL VOCs + TICs, plus bis(2-chloroethyl)ether, 1,2-, 1,3-, 1,4-dichlorobenzene
	•Install and sample 3 shallow and 3 intermediate Sentinel wells	•6 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable) •TCL Pesticides for shallow wells only
	•Install 2 shallow, 2 intermediate, and 2 deep piezometers	•NA	•NA
	•Install and sample 2 shallow and 7 intermediate monitoring wells	•9 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable) •(L) TCL Pesticides for shallow wells only
	•Collect 2 samples from each of 2 shallow well borings for geotechnical analysis	•4 (S)	•(L) Grain size distribution, Atterberg limits, moisture content

AR302810

Table *Summary of Field Investigations*
Middletown Airfield Site

Area of Concern	Investigation Action	Number of Field Samples [1]	Analyses [2]
Main Airport/Industrial Area Storm Sewers	•Collect 30 sediment samples from storm drains	•30 (S)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable)
Meade Heights	•Collect surface water and sediment samples from 4 locations in stream	•4 (SW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), hardness, alkalinity, TDS •(F) Conductivity, pH, temperature, dissolved oxygen
		•4 (SED)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), pH, TOC, CEC, grain size, moisture content
	•Perform aquatic survey of macroinvertebrates, aquatic insects, and fish at 4 locations	•NA	•NA
Susquehanna River	•Collect surface water samples from 4 locations in river	•4 (SW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), hardness, alkalinity, TDS •(F) Conductivity, pH, temperature, dissolved oxygen

AR302811

Table 3-1 Summary of Field Investigations
Middletown Airfield Site

Area of Concern	Investigation Action	Number of Field Samples (1)	Analyses (2)
Susquehanna River (continued)	•Collect sediment samples from 4 locations in river, coincident with surface water sampling	•4 (SED)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), pH, TOC, CEC, grain size, moisture content
HIA Production Wells	•Conduct borehole camera survey of 3 HIA wells	•NA	•NA
	•Conduct borehole geophysical logging at each of 3 HIA wells under static conditions. Based on logs, collect depth-specific samples from 5 intervals in each well	•15 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides, TAL total metals, CN (total and amenable)
	•Install test pump and begin pumping well. While pump is running, conduct borehole logging. Based on logs, collect depth-specific samples from 5 intervals in each well under flowing conditions	•15 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides, TAL total metals, CN (total and amenable)
Runway Area	•Install and sample 3 shallow and 2 intermediate depth monitoring wells	•5 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable) •(L) TCL Pesticides for shallow wells only
	•Collect 2 samples from each of 3 shallow well borings for geotechnical analysis	•6 (S)	•(L) Grain size distribution, Atterberg limits, moisture content

AR302812

Table

Summary of Field Investigations
Middletown Airfield Site

Area of Concern	Investigation Action	Number of Field Samples (1)	Analyses (2)
Industrial Area Capture Zone Tests	•Install and sample 6 shallow, 6 intermediate depth, and 6 deep monitoring wells	•18 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable) •(L) TCL Pesticides for shallow wells only
Deep Ground Water Flow Determination	Install and sample 3 deep (800') monitoring wells	•3 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable)
Background Soils	•Collect surface samples (0-2") and 3 subsurface samples from each of 5 borings in background locations (discrete samples for VOCs analysis and composite samples for other parameters)	•15 (S) •20 (S)	•(F, Level III) TCL VOCs + TICs (excludes surface samples) •(L) TCL SVOCs + TICs, TCL Pesticides, TAL total metals, CN (total and amenable)
Existing Monitoring Wells	•Sample 48 existing monitoring wells	•48 (GW) •32 (GW) •3 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable) •(L) TCL Pesticides for shallow wells only •(L) TCL PCBs for 3 wells (RFW-03, RFW-04, and GF-218)
Production Wells	•Sample MID-04 and 13 HIA production wells	•14 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total metals, CN (total and amenable)

AR302813

Table 3-1 Summary of Field Investigations
Middletown Airfield Site

Area of Concern	Investigation Action	Number of Field Samples [1]	Analyses [2]
Residential Wells	•Sample up to 8 residential wells, including Odd Fellows Home well	•8 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides, TAL total metals, CN (total and amenable)
SVE Pilot Testing	•Install 1 SVE 4" vacuum well and 3 SVE monitoring piezometers and perform OVA headspace screening on soil samples collected from ground surface to water table or bedrock	•NA	•NA
	•Based on OVA screening, select 3 samples from each boring for analysis	•12 (S)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TOC, and CEC
	•Collect vapor samples on a regular basis during 3-4 day pilot test	•25 (V)	•(F, Level II) PCE, TCE, 1,2-DCE, BTEX, CCl_4, 1,2-DCA, Chlorobenzene, vinyl chloride, 1,2-, 1,3-, 1,4-dichlorobenzene
Quarterly Monitoring Program	•Conduct quarterly sampling of the Susquehanna River and the Sentinel wells at the North Base Landfill, as described below, through the third calendar quarter of 1995		
•Susquehanna River (5 quarterly monitoring rounds subsequent to initial sampling)	•Collect surface water samples from 4 locations	•20 (SW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), hardness, alkalinity, TDS •(F) Conductivity, pH, temperature, Dissolved Oxygen

AR302814

Table ***Summary of Field Investigations***
Middletown Airfield Site

Area of Concern	Investigation Action	Number of Field Samples (1)	Analyses (2)
•Susquehanna River (quarterly monitoring, continued)	•Collect sediment samples from 4 locations, coincident with surface water sampling	•20 (SED)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable), pH, TOC, CEC, Grain Size
•North Base Landfill - Sentinel Wells (3 quarterly monitoring rounds subsequent to initial sampling)	•Sample 3 shallow and 3 intermediate Sentinel wells	•18 (GW)	•(L) TCL VOCs + TICs, TCL SVOCs + TICs, TAL total and dissolved metals, CN (total and amenable) •(L) TCL Pesticides for shallow wells only
Site Wide Water Source	• Sample potable water source to be used for drilling and decontamination during field investigation	• 1 (GW)	• (L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable)
	• Sample water from each water tank used by drillers (assume total of 3 drilling rigs, therefore 3 water trucks)	• 3 (GW)	• (L) TCL VOCs + TICs, TCL SVOCs + TICs, TCL Pesticides/PCBs, TAL total metals, CN (total and amenable)

Notes

(1) V = soil vapor sample
S = soil sample
GW = ground water sample
HSA = hollow stem auger

SW = surface water sample
SED = sediment sample
NA = Not applicable

AR302815

Table 3-1 Summary of Field Investigations
Middletown Airfield Site

(2) F = Analysis will be performed in the field by ERM-FAST®.
Level II = Field screening by Gas Chromatograph (GC)
PCE = tetrachloroethene
1,2-DCE = 1,2-dichloroethene
CCl4 = carbon tetrachloride
TCL = Target Compound List
VOCs = Volatile Organic Compounds
TAL = Target Analyte List
TOC = total organic carbon

L = Analysis will be performed by an off-site laboratory.
Level III = Field laboratory analysis by Gas Chromatograph/Mass Spectrometer (GC/MS)
TCE = trichloroethene
1,2-DCA = 1,2-dichloroethane
BTEX = benzene, toluene, ethylbenzene, and xylene
TICs = Tentatively Identified Compounds
SVOCs = Semivolatile Organic Compounds
CN = cyanide
CEC = cation exchange capacity

AR302816

Specific field investigation methods, techniques, numbers of samples (both field and quality assurance samples), and analytical requirements are discussed in Section 4 of this Work Plan, and in the QAPP found as Attachment 1 to this plan. A general discussion of the work to be performed at each of the seven areas is presented in Sections 3.1 through 3.15.

ERM-FAST® will provide field screening (Level II, by Gas Chromatograph (GC)) and/or analytical (Level III, by Gas Chromatograph/Mass Spectrometer (GC/MS)) services of various media (soil vapor, soil, and ground water) during the field investigation. Specific discussions of ERM-FAST® capabilities, DQOs, and field screening and analytical procedures are presented in the ERM-FAST® Quality Assurance Plan (QAP), which is Attachment 2 of the QAPP.

Unless otherwise indicated, samples submitted to ERM-FAST® for field "screening" will be analyzed by GC for the following selected VOCs and SVOCs: tetrachloroethene (PCE), trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE), 1,2-dichloroethane (1,2-DCA), carbon tetrachloride (CCl_4), vinyl chloride, benzene, toluene, ethylbenzene, xylene (BTEX), chlorobenzene, and 1,2-, 1,3-, and 1,4-dichlorobenzenes. Samples submitted for field "laboratory analysis" will be analyzed by GC/MS for the Target Compound List (TCL) VOCs plus up to ten Tentatively Identified Compounds (TICs) not on the TCL.

3.1 *INDUSTRIAL AREA - BUILDING 142 AND 267 PIPELINES/LAGOONS*

The Industrial Area is located in the central portion of the HIA as shown on Figure 3-1. Industrial operations have been conducted in shops in this area since the Air Force began operations in 1947. Industrial operations involved complete aircraft overhaul including stripping, metal finishing, painting, equipment assembly, and equipment testing. Currently, the Industrial Area is occupied by private manufacturing companies and the HIA.

Two pipelines are present in this area:

- Pipeline 142

  This pipeline carried contaminated ground water from production well HIA-13 to Building 142 for process water, and then transported

the water to the wastewater lagoons on the eastern side of the Site for treatment.

- Pipeline 267

  This pipeline, consisting of unused process lines, leads to Building 267 (the Waste Sump House) from several existing buildings and other demolished buildings and at one time carried industrial chemicals to the waste sump.

Previous investigations detected widespread ground water contamination in the Industrial Area. The constituents of concern included trichloroethene, dichloroethene, chlorobenzene, dichlorobenzene, chromium, lead, barium, arsenic, cadmium and nickel. However, these constituents were generally not detected in high concentrations in soil, with the exception of chlorobenzene and dichlorobenzene. This suggests that the source of the ground water contamination has not been identified. In addition, higher concentrations of VOCs were noted in surface water in the northern wastewater lagoon than are currently detected in the ground water from HIA-13. This suggests that the northern wastewater lagoon may be a source of ground water contamination. Suspected sources for the contaminants are current and/or past leaks from the two pipelines in the Industrial Area, and the northern wastewater lagoon.

The purpose of the investigation in this area is to evaluate the integrity of the pipelines and delineate the extent of soil and ground water contamination in these areas. This will be accomplished through the implementation of up to six tasks. Each task has been designed to be modified, if necessary, based upon the data collected in each preceding task. The exact placement of the data collection points in each task will be based on the information learned from the preceding tasks. The six tasks, presented in chronological order, are:

- pipeline integrity camera survey,
- direct push (Geoprobe®) vapor sampling,
- direct push (Geoprobe®) soil sampling,
- soil borings,
- shallow monitoring well installation and sampling, and
- intermediate depth monitoring well installation.

A review and detailed discussion of each task are presented in Sections 3.1.1 through 3.1.5.

3.1.1 *Pipeline Integrity Camera Survey*

A pipeline integrity survey will be completed along Pipeline 142 from Building 142 to the wastewater lagoons and several lines leading to Building 267. The purpose of the survey is to locate potential leaks along the pipelines. Figure 3-2 shows the approximate location of the pipelines. Pipeline 142 is approximately 4,200 feet long and the depth of the pipeline reportedly varies from 4 feet to 8 feet below grade. Evaluation of site drawings indicates a line west of Building 267 and a line from Building 133 located to the east as discharging to Building 267. A line carrying discharge from Building 267 to Post Run is also believed to have existed.

The pipeline integrity survey will be completed using a tractor-driven video camera survey evaluation. The catch basins and manholes that are encountered will also be surveyed. The survey will be monitored in real-time from a survey vehicle at the surface, and will be simultaneously recorded onto VHS format video tape. Potential leaks will be identified visually and could include cracks, breaks, holes or separations observed in the pipe, catch basin or manholes. In addition, possible leaks could be identified where water or material may be observed exiting or entering the pipeline based on changes in color, turbidity or flow characteristics of the water in the pipeline.

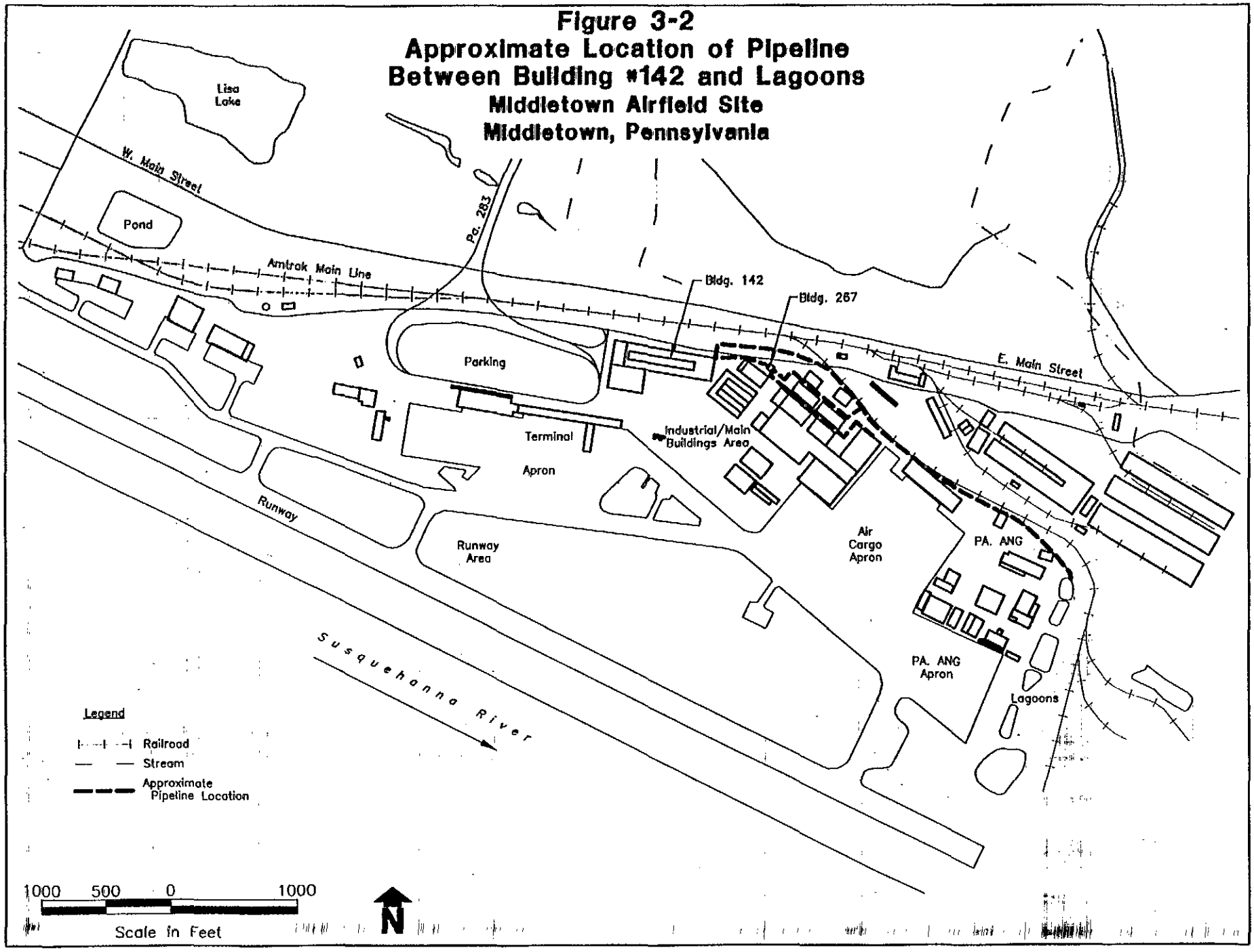
3.1.2 *Direct Push (Geoprobe®) Soil Vapor Sampling*

Direct push soil vapor sampling will be completed along the two pipelines using the Geoprobe System®. The objectives of the sampling are to:

- investigate contaminants that may have leaked from Pipeline 142, with emphasis placed on areas where potential leaks are identified in the video survey, and in the northern lagoon area where elevated VOCs were detected in the ground water;
- investigate contamination at the Waste Sump House along Pipeline 267, or spills and leaks to soil in the vicinity of the Waste Sump House; and
- determine whether contaminant vapors are migrating to or from the pipelines to adjacent buildings and paved areas.

Figure 3-2 shows the approximate locations of the pipelines. Up to 100 soil vapor samples will be collected. It is currently anticipated that 60 soil vapor samples will be collected along Pipeline 142, and 40 soil vapor

Figure 3-2
Approximate Location of Pipeline Between Building #142 and Lagoons
Middletown Airfield Site
Middletown, Pennsylvania



samples will be collected along Pipeline 267 and at the Waste Sump House to meet the objectives described above. At a minimum, samples will be located at intervals of 100 feet along the pipelines. Additional soil vapor points will be located based on the results of the video camera survey and the results of the field screening of the soil vapor samples.

Each sample will be field screened by ERM-FAST® for the select VOCs and SVOCs.

3.1.3 *Direct Push (Geoprobe®) Soil Sampling*

Upon completion of the soil vapor sampling, 20 locations will be sampled by direct push soil sampling to field verify the soil vapor results. The 20 locations will be along the pipelines and in the vicinity of the Waste Sump House. Direct push sampling will be accomplished using the Geoprobe System® equipped with soil sampling tools. Two samples will be collected at each location; one at the estimated pipe invert depth, and one just above the water table. The water table is expected to be encountered within 10 to 15 feet below grade. Five additional Geoprobe® sample locations will be completed around the first and second northernmost wastewater lagoons, and two samples will be collected per location. This overall strategy will result in the collection of a total of 50 samples.

The Geoprobe® sample locations will be selected after the soil vapor screening results are reviewed. Eighty percent of the locations in each area will be completed in areas where positive soil vapor results were recorded, with the objective of verifying and confirming the positive results. The remaining twenty percent will be completed where negative soil vapor results were recorded to verify and confirm the negative results. Samples will be field screened by ERM-FAST® for the select VOCs and SVOCs.

3.1.4 *Soil Borings*

Based upon results of the pipeline video survey, the direct push soil vapor sampling, and the direct push soil sampling, a total of 12 soil borings will be installed to further characterize and delineate the extent of soil contamination. Ten borings will be completed around the pipelines, and two borings will be completed in the wastewater lagoon area. Sample locations will be chosen after the direct push soil vapor and direct push soil sample screening results have been reviewed.

Soil samples will be obtained by the split spoon sampling method using a mobile drill rig. Split spoons will be collected from the ground surface to the water table according to the following criteria:

- at 2.5 foot intervals from the ground surface to 10 feet below grade, and
- at 5 foot intervals from 10 feet below grade and deeper.

It is estimated that borings will vary in depth between 5 and 20 feet below grade, with an average depth of 15 feet. It is also estimated that there will be five samples per boring for chemical analysis, for a total of 60 field samples. Two samples per boring will also be collected for geotechnical analysis.

Each of the soil samples will be field screened by ERM-FAST® for the selected VOCs and SVOCs. These field screening analyses will be completed within 24 hours to permit timely selection of samples for laboratory analysis and selection of shallow monitoring well locations.

Three out of five samples from each boring will be selected for laboratory analysis based upon the criteria described in Section 4.4.5. Approximately 36 split spoon soil samples will be sent for laboratory analysis, in addition to four surface scrape samples (two along the pipelines and two in the lagoon area). Surface scrape samples will be collected from the top two inches of exposed soil where concrete/macadam is not present. The samples will be analyzed by ERM-FAST® for TCL VOCs plus TICs and by an off-site laboratory for TCL SVOCs plus TICs, TCL Pesticides, Target Analyte List (TAL) total metals, cyanide (total and amenable), total organic carbon (TOC) and cation exchange capacity (CEC). The surface scrape samples will not be analyzed for VOCs. A total of six subsurface samples and two surface scrape samples, all from the wastewater lagoon area, will be analyzed for TCL Polychlorinated Biphenyls (PCBs).

3.1.5 *Shallow and Intermediate Monitoring Well Installation and Sampling*

A total of six monitoring wells will be installed. Two shallow monitoring wells and two intermediate depth monitoring wells will be installed along the Building 142 pipeline, and one shallow and one intermediate well will be installed in the vicinity of the middle wastewater lagoon.

The shallow monitoring well locations will be determined based on the results of the direct push soil vapor and soil sampling and the soil boring

results, and will be located in contaminated soil areas to determine the impacts of soil contamination on shallow ground water. The intermediate depth monitoring wells will be installed and sampled only after ground water analytical results from the shallow monitoring wells are available. The objective is to confirm shallow ground water contamination and to appropriately locate intermediate wells to define the vertical extent of contamination in ground water.

The shallow monitoring wells will be installed using the hollow stem auger (HSA) drilling method and will be completed in the overburden alluvium at a depth of approximately 25 feet. Monitoring well installation procedures are detailed in Section 4.9.3.

Five split spoon samples will be collected during the installation of each of the three shallow monitoring wells. The soil samples will be field screened by ERM-FAST® for the selected VOCs and SVOCs. These field screening analyses will be completed within 24 hours to permit timely selection of samples for laboratory analysis.

Ten soil samples from the shallow wells (nine subsurface samples from borings and one surface scrape sample) will be selected for laboratory analysis using the selection criteria outlined in Section 4.4.5. The samples will be analyzed for TCL VOCs plus TICs on-site by ERM-FAST® with a 48 hour turnaround time. Samples will be sent off-site for analysis of TCL SVOCs plus TICs, TCL pesticides, TAL total metals, cyanide (total and amenable), TOC and CEC. Three subsurface samples and one surface scrape sample from the mid-lagoon area shallow monitoring well boring will also be analyzed for TCL PCBs.

After development and two weeks of stabilization, ground water samples will be collected from the two shallow wells along the pipeline and analyzed by an off-site laboratory for TCL VOCs plus TICs. Fourteen-day turnaround time will be required and the VOC data will be reviewed to select the appropriate locations for the intermediate depth wells. Proposed well locations will be submitted for USACE review and approval prior to installation.

The intermediate depth monitoring wells will be installed into bedrock using the dual rotary drilling method. Surface casing will be installed to case off ground water from the overburden aquifer and the shallow portion of the bedrock aquifer. This procedure will prevent possible

vertical migration of contaminants from shallow zones to deeper zones during drilling.

After development and at least two weeks of stabilization, ground water samples will be collected from the six monitoring wells and analyzed by an off-site laboratory for TCL VOCs plus TICs, SVOCs plus TICs, TAL metals (total and dissolved) and cyanide (total and amenable).

The samples from the two shallow monitoring wells installed along hte Building 142 pipeline will be analyzed for TCL pesticides, and the sample from the shallow well installed in the mid-lagoon area will be analyzed for TCL pesticides/PCBs.

3.2 *INDUSTRIAL AREA - MAIN BUILDING AREA*

The main building area is located in the Industrial Area, in the central portion of the current airport facility as shown on Figure 3-1. This area includes the current and former paint racks, degreasing sumps and racks, Building 267, and the wash rack areas. These facilities were used by the U.S. Air Force in the past, as well as by current and past private owners and tenants. Past investigations in the industrial area detected widespread ground water contamination, and some soil contamination around the sumps, racks, wash areas, and the industrial waste sump.

The objectives of this investigation are to further characterize the soil contamination, hydrogeology, and ground water contamination in this area. This will be accomplished through the implementation of three tasks. Each task has been designed to be modified, if necessary, based upon the data collected in each preceding task. The exact placement of the data collection points in each task will be based on the information learned from the preceding tasks. The three tasks, presented in chronological order, are:

- soil borings,
- shallow monitoring well installation and sampling, and
- intermediate and deep monitoring well installation.

A review and detailed discussion of each task are found in Sections 3.2.1 and 3.2.2.

3.2.1 *Soil Borings*

A total of 30 soil borings will be installed to further characterize soil contamination near the current and past sumps, wash rack facilities, Building 267 (Waste Sump House), and the paint rack facilities. Fifteen borings will initially be installed around these facilities at the approximate locations shown on Figure 3-3. The remaining 15 borings will be completed after the results of the initial borings are evaluated.

Soil samples will be obtained by the split spoon sampling method using a HSA drill rig. Split spoons will be collected from the ground surface to the water table according to the following criteria:

- at 2.5 foot intervals from ground surface to 10 feet below grade, and
- at 5 foot intervals from 10 feet below grade and deeper.

It is estimated that the borings will vary in depth between 5 and 20 feet below grade, with an average depth of 15 feet. Approximately five samples will be collected per boring for chemical analysis, for a total of 150 soil samples. Two samples per boring will be collected for geotechnical analysis.

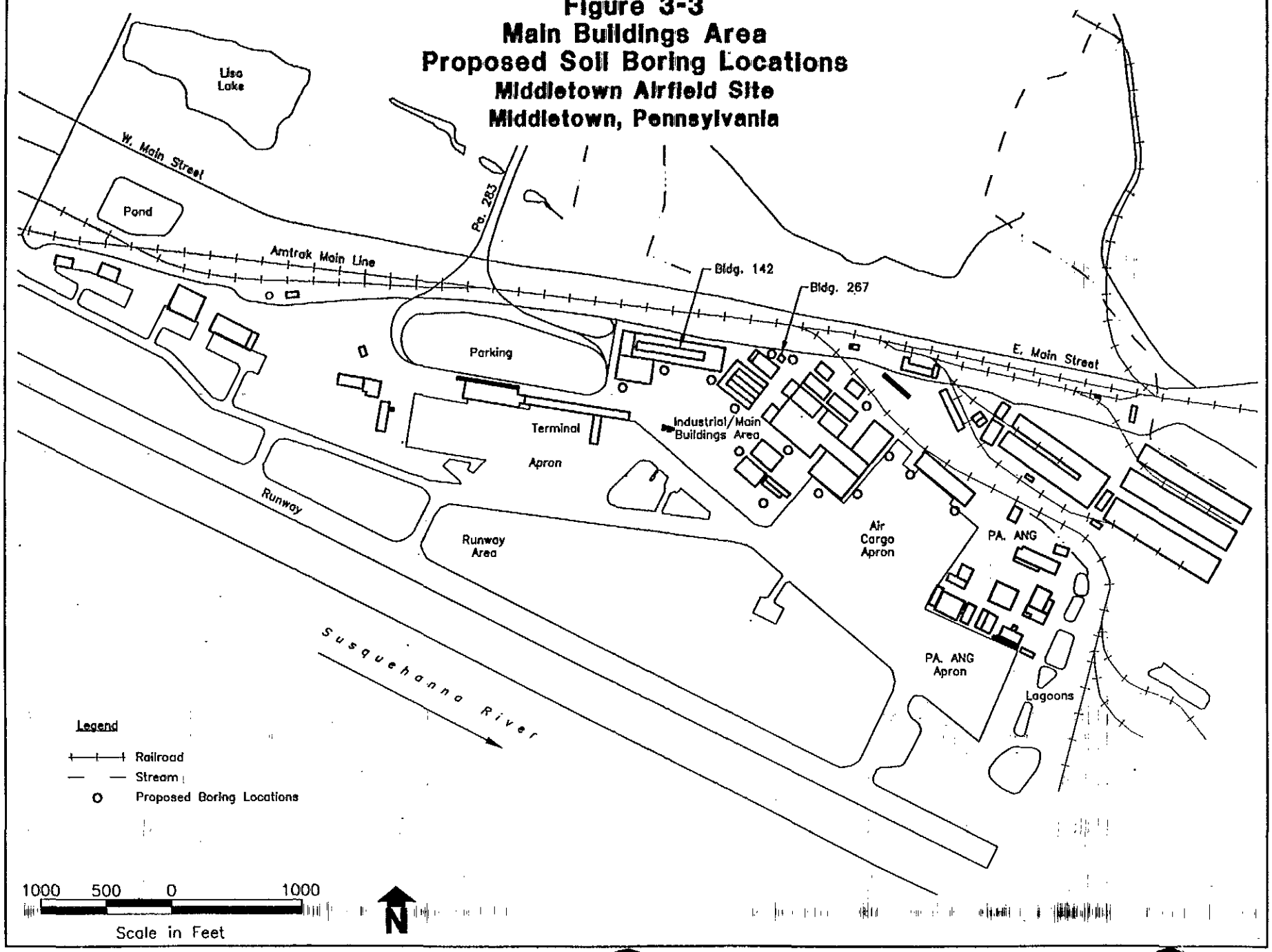
Each of the soil samples will be field screened by ERM-FAST® for selected VOCs and SVOCs. These field screening analyses will be completed within 24 hours to permit timely selection of samples for laboratory analysis, and for the selection of the remaining 15 boring locations and the monitoring well locations.

Three out of five samples from each boring will be selected for laboratory analysis based upon established criteria described in Section 4.4.5. Approximately 90 split spoon soil samples and 10 surface scrape samples will be submitted for laboratory analysis. The samples will be analyzed by ERM-FAST® for the TCL VOCs plus TICs and by an off-site laboratory for TCL SVOCs plus TICS, TCL pesticides, TAL total metals, cyanide (total and amenable), TOC and CEC. The surface samples will not be analyzed for TCL VOCs. Eighteen samples from selected borings plus four surface samples will be analyzed for TCL PCBs.

3.2.2 *Monitoring Well Installation and Sampling*

A total of seven monitoring wells will be installed in the Main Building Area, including three shallow, three intermediate depth, and one deep

Figure 3-3
Main Buildings Area
Proposed Soil Boring Locations
Middletown Airfield Site
Middletown, Pennsylvania



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monitoring well. The objectives of these wells are to investigate the ground water quality near the current and former paint racks, degreasing sumps/racks, and wash rack area.

The shallow monitoring wells will be located in areas containing elevated levels of chlorinated VOCs, as determined from the preceding soil boring task. The intermediate depth and deep monitoring wells will be installed after ground water analytical results from the shallow monitoring wells have been reviewed in order to choose appropriate well locations to define the nature and vertical extent of potential contamination in ground water.

The shallow monitoring wells will be installed using the HSA drilling method. The shallow monitoring wells will be in the overburden alluvium and will be approximately 25 feet deep. Monitoring well installation procedures are provided in Section 4.9.3.

Five split spoon soil samples will be collected during the installation of each of the three shallow monitoring wells. The soil samples will be field screened by ERM-FAST® for selected VOCs and SVOCs. These field screening analyses will be completed with 24 hours to permit timely selection of samples for laboratory analysis.

Ten soil samples (nine subsurface samples from borings plus one surface scrape sample) will be selected for laboratory analysis using the criteria detailed in Section 4.4.5. The samples will be analyzed for TCL VOCs plus TICs on-site by ERM-FAST® with a 48-hour turnaround time. Samples will be sent off-site for analysis of TCL SVOCs plus TICs, TCL pesticides/PCBs, TAL total metals, cyanide (total and amenable), TOC and CEC.

After development and two weeks of stabilization, ground water samples will be collected from the three shallow wells and analyzed by an off-site laboratory for TCL VOCs plus TICs. Fourteen day turnaround time will be specified and the VOC data will be reviewed to select the appropriate locations for the intermediate depth and deep wells. Proposed locations will be submitted to the USACE for review and approval prior to installation.

The intermediate depth and deep monitoring wells will be installed using the dual-rotary drilling method and will be completed in bedrock. The intermediate depth wells will be approximately 100 feet deep, and the deep well will be approximately 300 feet deep. The detailed drilling and

installation procedures for the bedrock monitoring wells are described in Section 4.9.3.

After development and at least two weeks of stabilization, ground water samples will be collected from the seven monitoring wells and analyzed by an off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (total and dissolved), cyanide (total and amenable). The three shallow well samples will also be analyzed for TCL pesticides/PCBs.

3.3 *MAIN AIRPORT/INDUSTRIAL AREA STORM SEWERS*

The Main Airport and Industrial Area are located in the central and southern portion of the facility (see Figure 3-1). These areas are drained by a system of storm sewers that convey stormwater run-off to the Susquehanna River. No previous storm sewer sampling has been conducted. This work is being conducted because surface water and sediment samples collected from the Susquehanna River contained VOCs, SVOCs, Pesticides, PCBs, and metals, which may be attributed to runoff from the Main Airport and Industrial Areas.

The objectives of this task are to determine whether contaminants exist in the storm sewer system, characterize the constituents and concentrations present, evaluate the storm sewer system integrity, and investigate the role of the system in potentially transporting contaminants from the Main Airport/Industrial Areas to the Susquehanna River.

This will be accomplished through the implementation of two tasks:

- storm sewer structural integrity survey, and
- storm sewer sediment sampling.

A detailed discussion of each task is provided in Sections 3.3.1 and 3.3.2.

3.3.1 *Storm Sewer Structural Integrity Survey*

Detailed mapping of the storm sewer system will be obtained from existing facility maps. These facility maps will be used to identify the locations of points of entry for stormwater into the sewer system, and the layout of the storm sewer network that transports the flow.

The structural integrity of the storm sewers will be visually evaluated in the immediate vicinity of manholes. This inspection will include identification of areas where stormwater may leak out and impact soil and ground water, and where potentially contaminated ground water may enter into the storm sewer system and discharge to the Susquehanna River. Potential leaks will be identified on a visual basis and could include cracks, breaks, holes and separations observed in the sewer, catch basins or manholes. In addition, possible leaks could be identified based upon the presence of water or material that may be exiting or entering the sewer, based on changes in color, turbidity or flow characteristics of the water in the sewer. Secondly, a Site walkover will be conducted to locate and inspect inlet locations identified on facility maps and possibly identify other inlets that are not identified on the maps. Thirdly, it will provide for observation of flow directions of any surface water in the storm sewer system. Flow directions will be mapped during the walkover and will aid in determining how contaminants are potentially transported through the sewers.

3.3.2 *Storm Sewer Sediment Sampling*

Upon completion of the integrity survey, sample locations will be selected to determine whether contaminants exist in the sewer system, and if so their relationship to potential leaks and inlets, and their distribution through the storm sewer system.

A maximum of 30 sediment samples will be collected. One sample will be collected at the end of each sewer outlet to the Susquehanna River to determine whether contaminants are being discharged to the river. The remaining samples will be located in the sewer system according to the following objectives:

- downstream of floor drains, leaks and other entry points where contaminants may be entering the storm sewers to allow for identification of sources; and
- throughout the storm sewer along lines and at line junctions to sufficiently evaluate the distribution and concentrations of contaminants in the entire system.

This sampling program will provide information on the overall contaminant distribution within the storm sewers and permit an evaluation of potential transport mechanisms.

To maximize the potential for intercepting potential VOCs in the sediment, samples will not be collected during or within 48 hours of a major rainfall event in order to minimize dilution and agitation effects from the rainfall run-off. The 30 samples will be collected within the shortest possible timeframe to provide a synoptic evaluation of the sediment quality under similar sampling conditions.

All samples will be analyzed by an off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TCL Pesticides/PCBs, TAL total metals, and cyanide (total and amenable).

3.4 *NORTH BASE LANDFILL*

The North Base Landfill is located north of the main airport area, and just south of the Pennsylvania Turnpike (Figure 3-1). This landfill was used for waste disposal during the runway expansion program from 1950 until 1956. Construction debris was the primary material disposed of at this location. However, it was also reported that some drums were deposited in the landfill. The property was owned by Freuehauf Corporation, a truck trailer company, until 6 July 1989 when it was acquired by Terex Trailer Corporation.

The primary contaminants of concern in ground water from the bedrock aquifer are TCE, dichloroethene (DCE), and phthalates (GF, 1990). A potential concern is that this contamination may reach Middletown Borough's water supply well (MID-04), which is located to the east of the landfill. VOCs (TCE and DCE) were detected in soil at low concentrations and do not suggest that a continuing source is present in soils at the North Base Landfill. Polycyclic Aromatic Hydrocarbons (PAHs) and phthalates were the predominant contaminants detected throughout soils. Pesticides and PCBs were present, but more localized.

To date, the extent of the contaminant plume in ground water has not been delineated. It is expected that the plume has extended southward toward the industrial area and the HIA. The objectives of the investigative tasks to be conducted during the Supplemental Studies are to delineate the extent of ground water contamination in the alluvium and bedrock aquifers.

The objectives will be met through the implementation of four tasks, including:

- direct push (Geoprobe®) ground water sampling,
- sentinel well installation,
- piezometer installation, and
- monitoring well installation.

A detailed discussion of each task is found in Sections 3.4.1 through 3.4.4.

3.4.1 *Direct Push (Geoprobe®) Ground Water Sampling*

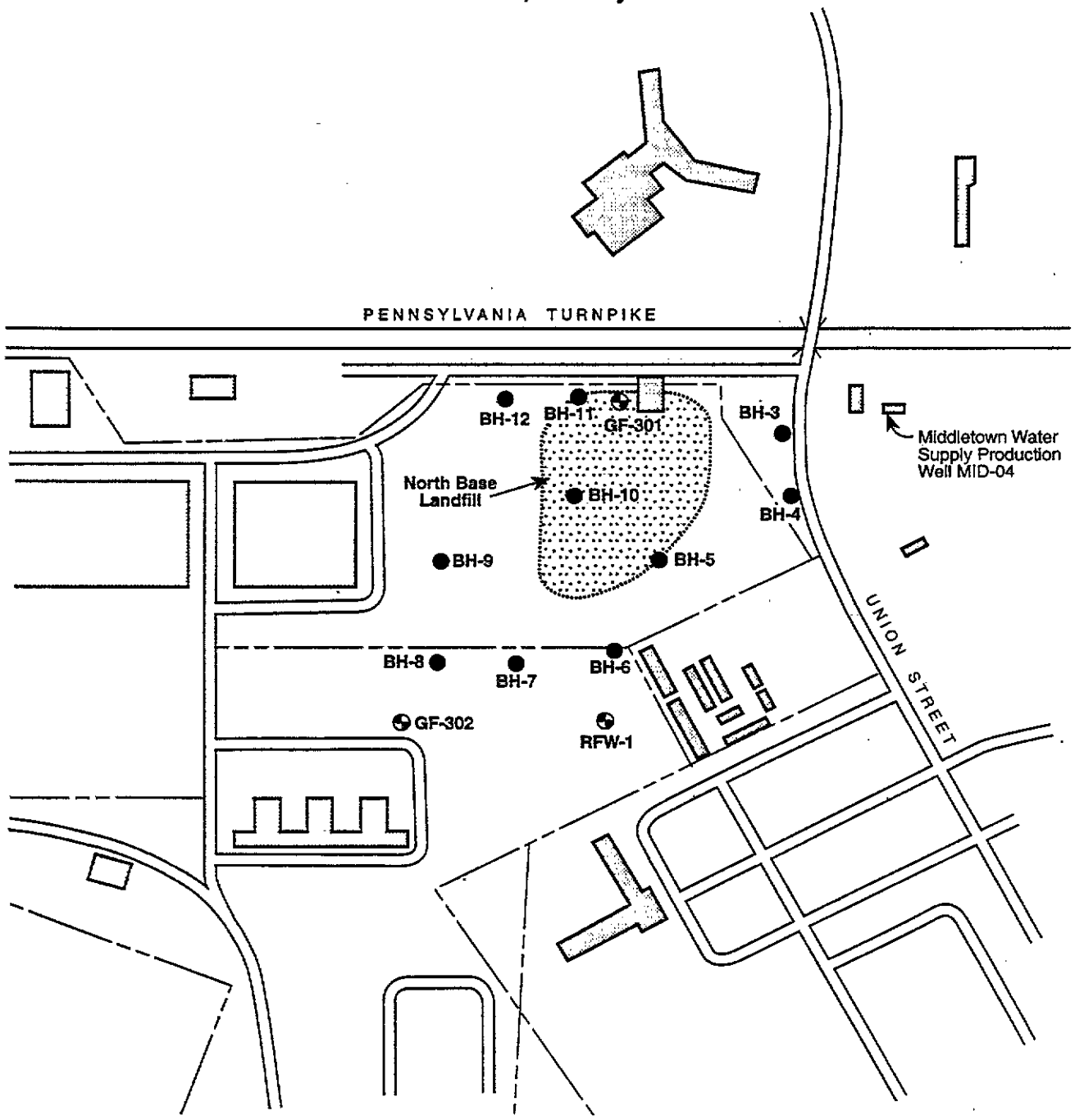
Seventy-five direct push ground water samples will be collected using the Geoprobe System®. The investigation will define the stratigraphy of the alluvium aquifer, estimate the horizontal extent of the contaminant plume in the alluvium, and aid in the placement of monitoring wells. Figure 3-4 shows the locations of the soil borings conducted during the RI (GF, 1990). The ground water samples will be located as discussed below.

- Sixty-five samples will be collected south of the landfill and outside the boundary of the previous soil boring investigation to delineate the southern extent of the VOC plume. The specific sample locations will be determined in the field based on site conditions and the results of the field screening.
- Five samples will be collected between the landfill and MID-04 to determine potential contaminant migration toward the production well.
- Five samples will be collected north of the landfill, Building 678/679, and the PA Turnpike to determine upgradient/background conditions.

Direct push ground water sampling methods are described in Section 4.6.3. Soil samples will be collected at selected intervals to characterize the alluvium and provide a stratigraphic log of the subsurface.

It is estimated that the ground water table will be encountered between 5 and 25 feet below grade, with an average depth of 20 feet. The Geoprobe will utilize a piezocone to detect the water table. Ground water samples will be collected from just below the water table according to the procedures described in Section 4.6.3. The 75 ground water samples will be field screened by ERM-FAST® for the select VOCs and SVOCs. These field screening analyses will be completed within 24 hours to permit timely selection of samples for laboratory analysis.

Figure 3-4
North Base Landfill
Middletown Airfield Site
Middletown, Pennsylvania



LEGEND

BH-4 ● Existing Soil Boring Location (GF, 1990)

GF-302 Existing Monitoring Well Location (GF, 1990)

Building

Property Line

Note: Production Well MID-04 is located inside the building shown.

N

200 0 200 400 600 800

Scale in Feet (Approx.)

Source: Gannett Fleming, 1990

Splits of 16 ground water samples will be submitted for laboratory analysis. Ten samples will be split from samples containing VOCs to confirm the presence of VOCs in ground water, and six samples will be split from samples that did not detect contaminants to verify delineation of the plume boundary. These samples will be analyzed by an off-site laboratory for TCL VOCs plus TICs and selected SVOCs (bis 2-chloroethyl ether and isomers of dichlorobenzene). In addition, duplicates of two of the samples submitted for off-site analysis will also be sent to the Government QA laboratory (MRD Laboratory). Additional details concerning duplicate sample locations and instructions for sample submittal to MRD Laboratory are provided in Section 4.6.

3.4.2 *Sentinel Well Installation*

The purpose of the sentinel wells is to provide early warning for potential contamination of Middletown Borough's water supply well (MID-04) from the North Base Landfill. The locations of the North Base Landfill and Well MID-04 are shown on Figure 3-4. This water supply well is located approximately 600 feet east of the North Base Landfill. Although MID-04 is hydraulically cross-gradient from the North Base Landfill, the potential exists for contaminants to be transported in that direction, since pumping of MID-04 may result in water being drawn eastward toward the well from the North Base Landfill.

Two sentinel well nests will be installed between the North Base Landfill and MID-04. Each well nest will include one shallow bedrock and one intermediate bedrock monitoring well. The sentinel well locations will be designed to provide a warning mechanism if contaminants move towards MID-04, and the wells will be designed to be converted to recovery wells to withdraw contaminated ground water, if present. The sentinel wells will be located based on the results of the direct push ground water sampling to ensure that they are outside the current shallow ground water plume. Furthermore, the piezometer nests described in Section 3.4.3 will also be installed prior to sentinel well installation to optimize placement of the sentinel wells.

Each shallow sentinel well will be approximately 50 feet deep. The intermediate depth sentinel wells will be approximately 200 feet deep. The drilling and well installation procedures are detailed in Section 4.9.3. The sentinel wells will be part of the quarterly monitoring program described in Section 3.15.

3.4.3 *Piezometer Installation*

The purpose of the piezometers is to provide ground water level information for capture zone analysis of well MID-04. The capture zone analysis is a desktop study to determine the effective radius of capture for ground water in the bedrock aquifer from pumping of MID-04. The piezometers will not be sampled for chemical analysis.

Three piezometer nests will be installed. Each nest will include a shallow bedrock (50 feet deep), intermediate bedrock (100 feet deep) and deep bedrock (300 feet deep) piezometer.

The locations of the two piezometer nests must optimize the site-specific hydrogeologic conditions and take into account two factors: the strike and dip of bedding, which will cause preferential ground water flow directions and drawdown from the pumping of MID-04, and the local direction of ground water flow. In general, the piezometers will be placed parallel and perpendicular to the bedding strike, and also on the upgradient side of the production well. Bedding strike averages N43°E at the Site, but varies significantly. Site-specific average strike and dip measurements in the North Base Area indicate that the strike is N43°E and the dip is 26°NW .

The shallow piezometers will be installed to the same depths as the shallow sentinel wells; however, the well construction will be different because the piezometers will be used only for water level monitoring. The intermediate piezometers will be installed to depths of 100 feet, and the deep piezometers will be installed to depths of 300 feet. The drilling and well construction details are described in Section 4.9.3.

The well screen for the deep piezometers will not be set across a zone of low permeability where there may be minimal or no hydraulic interconnection to MID-04 conducted. Therefore, a borehole camera survey and packer testing will be conducted in the two deep boreholes to avoid low permeability zones in bedrock at the base of the well. The borehole camera survey will be conducted from 100 to 300 feet below ground surface for the deep piezometers. The borehole camera will identify areas of hydraulic interconnection due to the relative presence and frequency of voids, fractures, and bedding plane partings in bedrock.

Based upon the observations of the borehole camera survey, the borehole will be separated into two types of zones; potential low interconnection

zones and potential high interconnection zones. To confirm the potential interconnection, straddle packer testing will be completed for each zone. The length of the packer zone will be varied based on the length of the zones identified in the borehole camera survey. The tests will involve pumping ground water from the packered zone to determine the horizontal hydraulic conductivity of the zone. Upon completion of the packer testing, the 20-foot well screen will be set across the zone with the highest hydraulic conductivity.

3.4.4 *Monitoring Well Installation*

The objectives of the monitoring wells are to:

- provide further delineation of the contaminant plume between the North Base Landfill and HIA; and
- provide information regarding the hydrogeologic framework to determine whether the HIA recovery wells will capture the contaminant plume.

A total of nine monitoring wells will be installed in the following three areas:

- Two shallow alluvium wells (25 feet deep) and two intermediate depth monitoring wells (100 feet deep) will be installed downgradient of the North Base Landfill toward the Industrial Area;
- Two intermediate depth wells (100 feet deep) will be installed on the western side of the North Base Landfill to determine the western edge of ground water contamination toward Buildings 678 and 679; and
- Three intermediate depth monitoring wells (100 feet deep) will be installed to identify contaminants migrating onto and off of the Building 678 and 679 property, and the extent of the transport of contaminants from those buildings toward the Industrial Area to the south. As such, one intermediate well will be located north/upgradient of the buildings, and two wells will be located south/downgradient of the buildings.

Monitoring locations will be proposed based upon the results from the direct push ground water sampling. Final well placement will be coordinated with and approved by USACE. The drilling and well construction details for these nine wells are described in Section 4.9.3.

The final borehole for the seven intermediate depth monitoring wells will be logged using borehole geophysics prior to setting the screen. The purpose of the logging is to collect information from each borehole to permit correlations between boreholes to further understand site-specific geology and hydrogeology. Each borehole will be logged using the following tools: natural gamma, sonic, neutron log, density, SP, temperature, three arm caliper and resistivity.

3.5 *MEADE HEIGHTS STREAM SURVEY*

Meade Heights is located to the north of the Main Airport and west of the North Base Landfill (Figure 3-1). This area was purchased by the Air Force as part of a major expansion in 1956 and was used for military housing. Aerial photographs indicate that this area was also used for waste disposal prior to 1963. A north-south oriented stream runs through Meade Heights to the northeast of a housing complex which currently houses students. Exposed drums were observed in a fill area along the stream bank and were removed. Surface water and sediment sampling in 1985 indicated the presence of toluene during an initial sampling event. Surface water and sediment samples collected in 1989 indicated that the surface water did not contain organic contaminants, and that zinc exceeded EPA's Ambient Water Quality Standards (AWQS). The sediments contained elevated levels of phthalates and methylene chloride.

The stream in the Meade Heights Area will be investigated to determine the presence and extent of contamination. This will be accomplished through the implementation of two tasks:

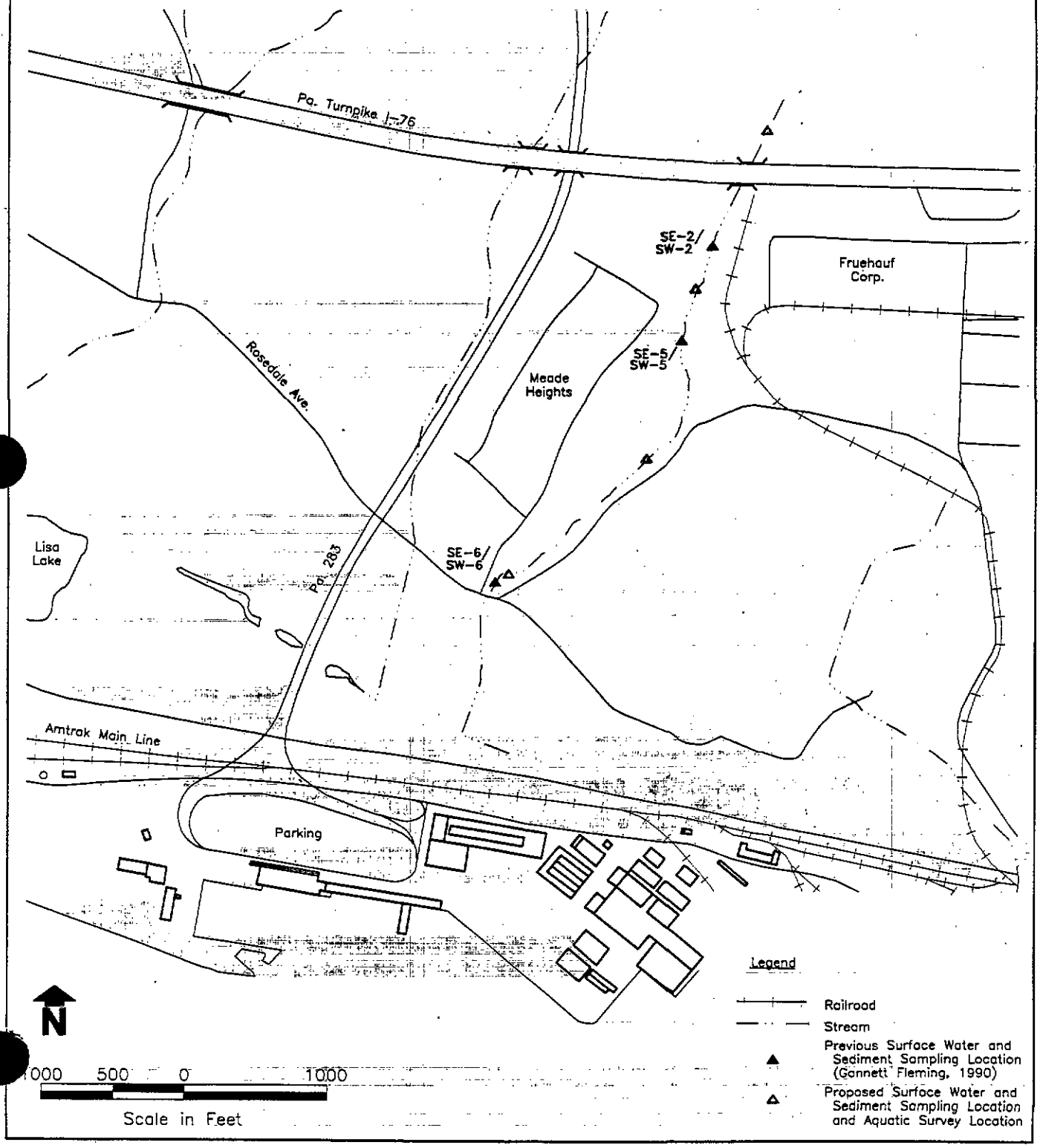
- surface water and sediment sampling, and
- an aquatic survey.

A detailed discussion of each task is found in Sections 3.5.1 and 3.5.2.

3.5.1 *Surface Water and Sediment Sampling*

The purpose of the sediment and surface water sampling is to determine the extent of contamination in the perennial stream portion at Meade Heights. The proposed sampling locations along the stream are shown on Figure 3-5. One set of samples will be collected upstream of the Pennsylvania Turnpike to establish background conditions. The remaining three sample sets will be located in the stream through Meade

Figure 3-5
Meade Heights
Proposed Surface Water and Sediment Sampling Locations
Middletown Airfield Site
Middletown, Pennsylvania



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Heights. These remaining three sample sets will be located so they do not duplicate locations sampled during the RI (GF, 1990), and as such will augment the data previously collected. The approximate RI sampling locations are also shown on Figure 3-5. These sample locations may be adjusted following a site visit to evaluate habitat variables and availability of stream sediments.

Surface water and sediment sampling will be completed during non-storm conditions to evaluate in-situ sediment quality and normal surface water run-off/baseflow to the stream. Surface water and sediment samples will both be analyzed for TCL VOCs plus TICs, TCL SVOCs plus TICs, TCL pesticides, TCL PCBs, TAL total metals and cyanide (total and amenable). In addition, surface water will be analyzed for water quality parameters including hardness, alkalinity, total dissolved solids (TDS), conductivity, pH, temperature and dissolved oxygen. Sediment will also be analyzed for geochemical parameters, including pH, total organic carbon (TOC), moisture content, cation exchange capacity (CEC), and grain size. The surface water and sediment sampling procedures are described in Section 4.8.2.

3.5.2 *Aquatic Survey*

An aquatic survey will be conducted in the stream at Meade Heights to determine the diversity and abundance of animal life. The survey will include evaluation of three major types of animal life: macroinvertebrates, aquatic insects, and fish.

The survey will be completed during the summer months at four locations along the stream. The first location will be upstream to determine the background diversity and abundance. The second location will be downstream of the fill area, the third location will be a stream in the center of Meade Heights, and the fourth location will be just downstream of Meade Heights. The upstream and downstream aquatic survey stations will be located in the vicinity of the surface water and sediment sample locations shown on Figure 3-5. A detailed description of the methodologies for the aquatic survey is included in Section 4.8.3.

3.6 *SUSQUEHANNA RIVER SAMPLING*

The Susquehanna River flows from northwest to southeast and is located along the southern boundary of the Site. The river's average discharge for

the 90 years prior to 1980 was approximately 34,500 cubic feet per second. The river is home to a diverse aquatic community, including macroinvertebrates, aquatic insects, game fish, and minnows. The species diversity is above average.

Surface water and sediment sampling was completed by NUS in December 1988. DCE, TCE, and DDT were detected at three of eight surface water sampling locations. Aluminum, iron and zinc exceeded AWQS. VOCs, SVOCs and PCBs were detected in the sediment samples. It was concluded that the Site could be the source of the detected organic compounds. However, the VOC levels detected were below MCLs. The RI report indicated that the metals that were detected were probably from upgradient sources.

3.6.1 *Surface Water and Sediment Sampling*

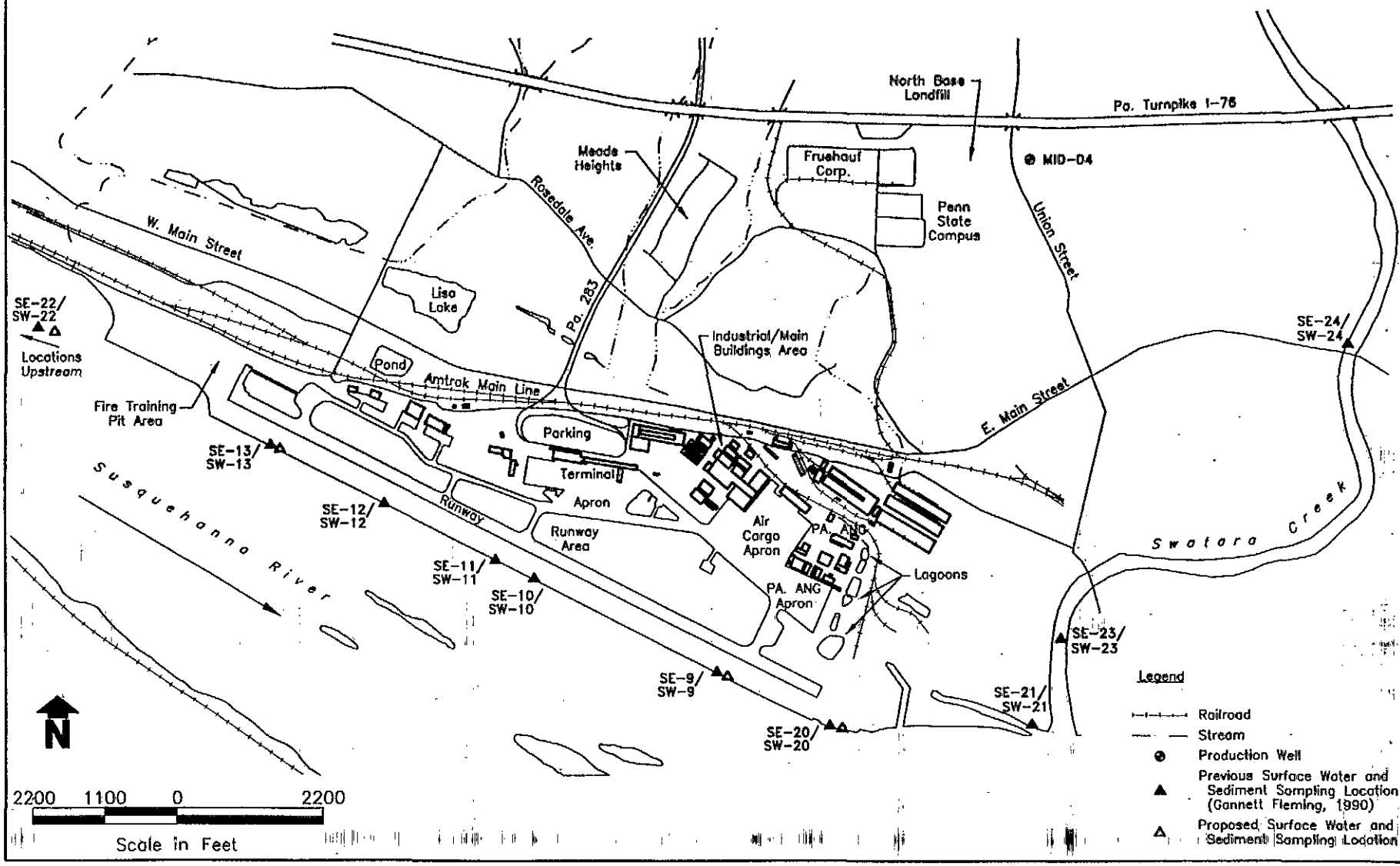
The purpose of the sediment and surface water sampling is to evaluate if surface water and sediment quality has been impacted. A total of four sediment and surface water samples will be collected to characterize chemical contaminants, water and sediment quality, and geochemical characteristics at the locations described below and shown in Figure 3-6:

- upstream of the Site to establish background conditions;
- downstream of the Fire Training Pit;
- downstream of the former landfill and incinerator area, now covered by the Runway Area; and
- downstream of the point of discharge from the wastewater lagoons.

Samples will be collected near the following locations previously sampled by NUS in 1988: SW-22/SE-22, SW-13/SE-13, SW-09/SE-09, and SW-20/SE-20. The surface water and sediment sampling procedures are described in Section 4.8.2.

Surface water and sediment sampling will be conducted during non-storm conditions to evaluate in-situ sediment quality and normal surface water run-off/baseflow to the river. Surface water and sediment samples will both be analyzed for TCL VOCs plus TICs, TCL SVOCs plus TICs, TCL pesticides, TCL PCBs, TAL total metals and cyanide (total and amenable). In addition, surface water will be analyzed for water quality parameters, including hardness, alkalinity, TDS, conductivity, pH, temperature and dissolved oxygen. Sediment will also be analyzed for geochemical

Figure 3-6
Susquehanna River Sampling Locations
Middletown Airfield Site
Middletown, Pennsylvania



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parameters which include pH, TOC, moisture content, CEC, and grain size. In the event results from surface water and sediment sampling identify the presence of site-related contaminants exceeding appropriate documented levels, an aquatic survey of the river will be performed in a subsequent work effort.

3.7 *DEPTH-SPECIFIC SAMPLING OF HIA WELLS*

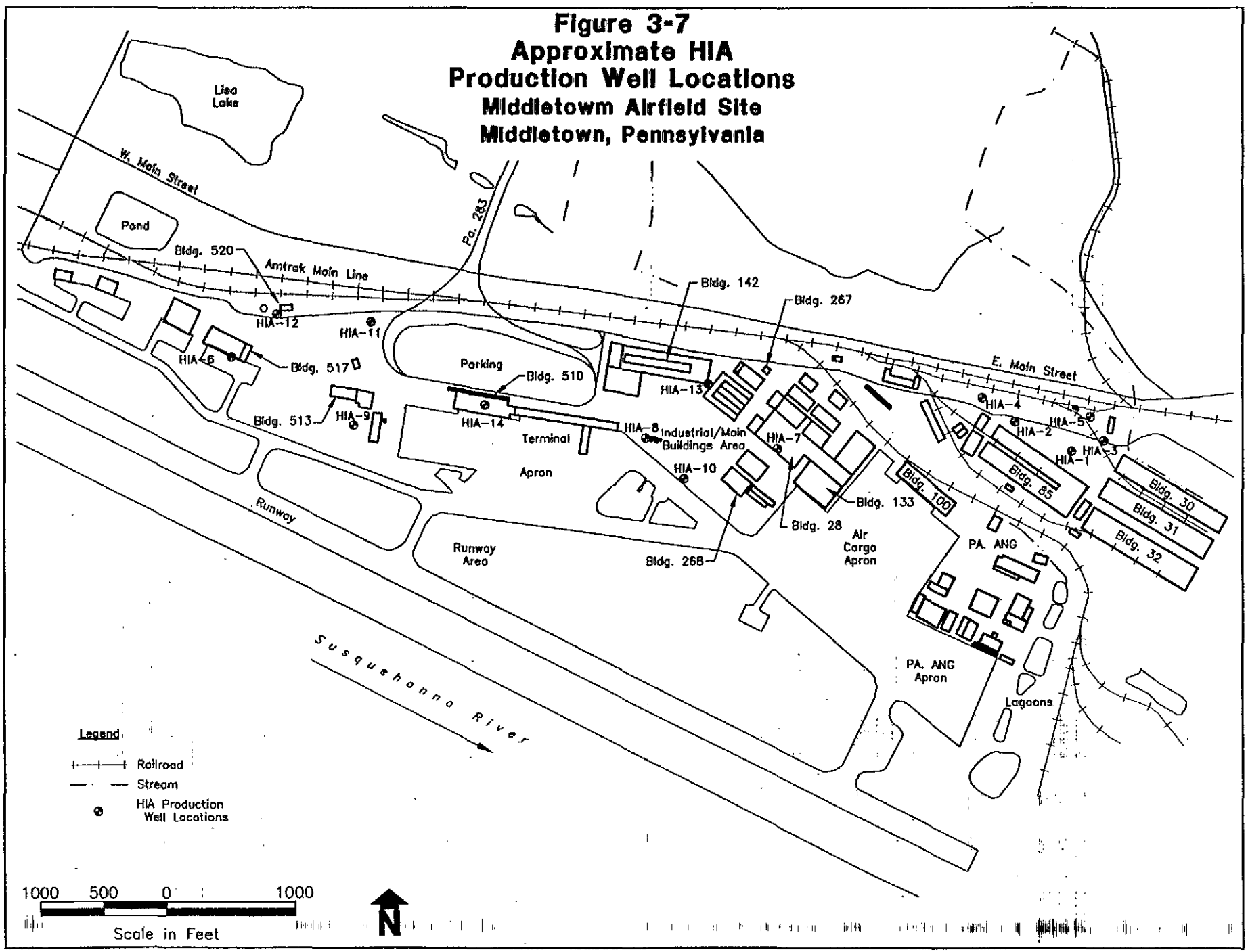
The objectives of the depth-specific sampling of the HIA wells are to determine the depth levels at which contaminants are being introduced into the wells, and to determine the water producing zones in the wells. This information will be collected through the use of geophysical borehole logging, borehole television surveying, and depth-specific sampling of water producing zones identified from the borehole logs, under flowing and non-flowing conditions. Three HIA wells will be sampled, including HIA-13, one of the eastern HIA wells (HIA-1 through HIA-5), and one of the western HIA wells (HIA-6 through HIA-14). The locations of the HIA production wells are shown on Figure 3-7.

The existing pump, if present, will be removed from each well, and a borehole television survey will be conducted of the casing and open borehole. Geophysical logging, using the following tools, will be conducted in the following order: temperature, fluid resistivity, caliper, spinner flow meter, neutron log and natural gamma log. Depth-specific sampling will then be conducted from up to five likely water producing zones identified from the geophysical logs.

Upon completion of sampling under static conditions, a test pump and access pipe will be installed in the well. The pump will be activated and allowed to purge the well. Geophysical logging, including spinner flow meter, temperature, and fluid resistivity will be conducted while the pump is running. Depth-specific sampling will then be conducted while the well is being pumped from the same five zones previously sampled. Upon completion of sampling, the well pump will be reinstalled.

All 30 ground water samples will be analyzed by an off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TCL pesticides, TAL total metals, and cyanide (total and amenable).

Figure 3-7
Approximate HIA Production Well Locations
Middletown Airfield Site
Middletown, Pennsylvania



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3.8 *RUNWAY AREA MONITORING WELLS*

The intent of installing and sampling Runway Area monitoring wells is to provide further definition regarding the nature and extent of the contaminant plume(s), and supplement existing data regarding the hydrogeologic framework where data are very sparse and separate plumes are suspected. The proposed monitoring well locations are described below and are shown on Figure 3-8.

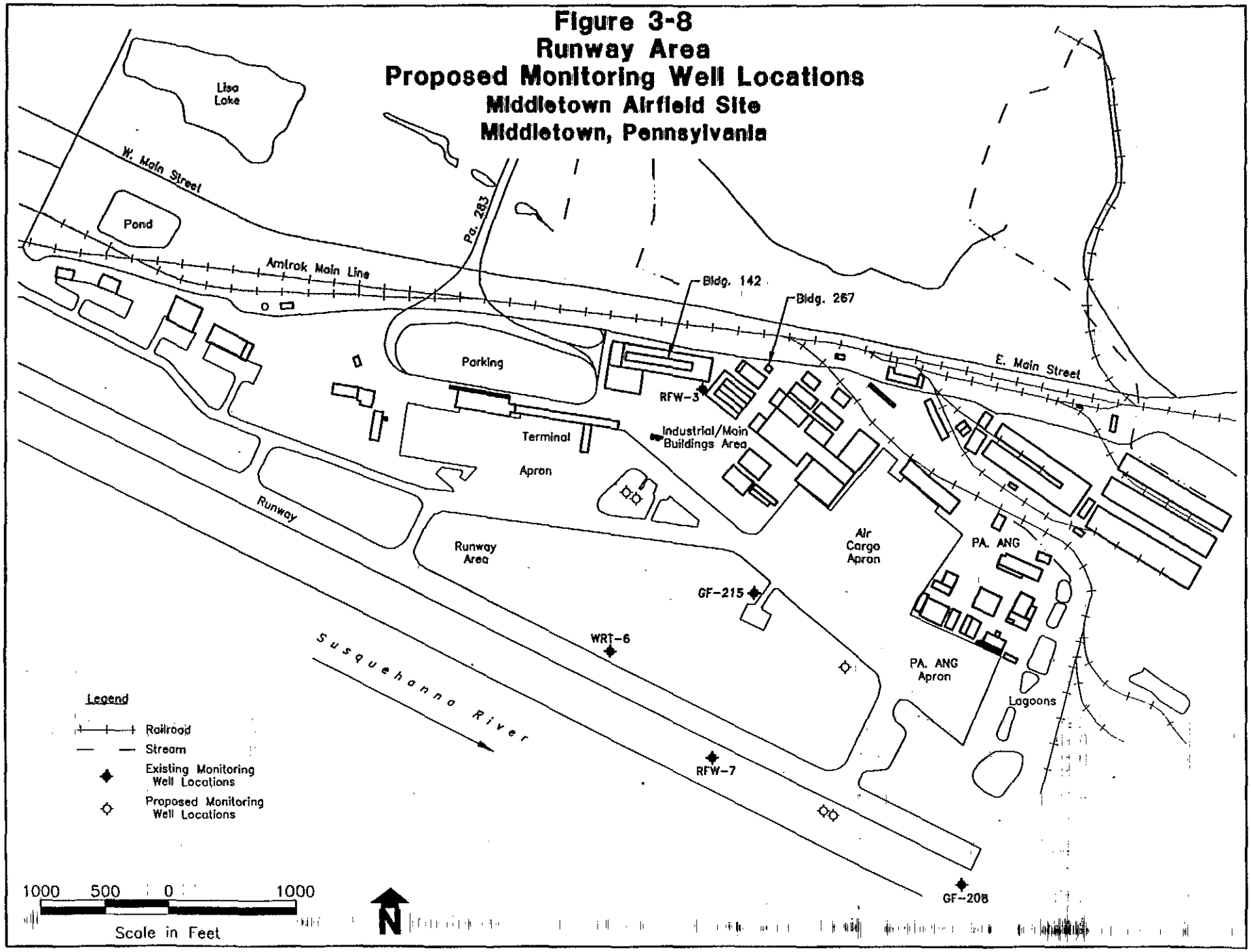
One shallow monitoring well and one intermediate depth monitoring well will be installed midway between monitoring wells RFW-7 and GF-208 by the runway. The shallow monitoring well will be installed in the alluvium with an estimated depth of 30 feet. The intermediate depth monitoring well will be installed in the bedrock at an estimated depth of 120 feet. The purpose of this monitoring well pair is to supplement existing data regarding contaminant concentrations along the Susquehanna River in the shallow and deeper aquifers.

One shallow monitoring well will be installed southeast of monitoring well GF-215 by the taxiway. The shallow monitoring well will be installed in the alluvium with an estimated depth of 30 feet. The purpose of this shallow monitoring well is to establish ground water quality in an area for which there is currently little information. Data from the well will provide information regarding the shallow aquifer, where there may be a divide in the contaminant plume coming from the Industrial Area and potentially from the lagoon area.

One shallow monitoring well and one intermediate depth monitoring well will be installed midway between monitoring wells WRT-6 and RFW-3 by the taxiway. The shallow monitoring well will be installed in the alluvium with an estimated depth of 30 feet. The intermediate depth monitoring well will be installed in the bedrock with an estimated depth of 120 feet. The purpose of the monitoring well pair is to establish ground water quality between the Runway Area and the Industrial Area where little information about plume migration in the alluvium and bedrock aquifers is available.

Drilling and monitoring well installation procedures are described in Section 4.9.3. Because these wells will be located along active runways, drilling will be limited to the hours of midnight through 6:00 a.m. to minimize interference with airport activities.

Figure 3-8
Runway Area
Proposed Monitoring Well Locations
Middletown Airfield Site
Middletown, Pennsylvania



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3.9 *CAPTURE ZONE PUMP TESTS, ANALYSIS, AND WELL INSTALLATION*

The potential for contamination to spread from the former North Base Landfill to Middletown Borough's production well (MID-04) and the HIA production wells, and the presence of contamination in the Industrial Area, are concerns. The Middletown production well is located near the North Base Landfill area (see Figure 3-1). The intent of the ESD was to protect the water supply from well MID-04 by installing sentinel wells to warn of contaminants moving toward MID-04. A wellhead protection study for several Middletown wells was performed in 1992, but did not include monitoring of local wells and/or piezometers. A capture zone analysis will be performed for MID-04 to take into account actual field measured results. Capture zone analysis of the HIA production wells (see Figure 3-7) is also a requirement of the ESD for the Site. The capture zone analyses will help to determine whether pumping at the production wells may result in contaminant migration from the North Base Landfill or the Industrial Area toward those wells.

Each capture zone test will require a 72 hour (nominal) pumping test, including drawdown monitoring of appropriate existing and newly installed wells and data analysis to determine the radius of influence of each well. The components of the Capture Zone Analysis are:

- work plan preparation,
- monitoring well installation, including borehole geophysics and ground water sampling,
- pretest and test data collection, and
- analysis and presentation of data.

A discussion of each component is presented in Sections 3.9.1 and 3.9.2.

3.9.1 *Middletown Production Well MID-04*

3.9.1.1 *Work Plan Preparation*

A work plan will be prepared for USACE approval that provides the details of the pump testing and analysis. Well specification, pumping rates, water disposition and measurement frequencies will be identified. Steps to minimize inconveniences to the Middletown Water Department and HIA, as well as contingency plans will be included. The preliminary

scope for the pumping tests is included in Section 4.12. Additional details will be provided after further information about the wells is obtained from the Middletown Water Department and the HIA.

3.9.1.2 Pretest and Test Data Collection

Water level data will be collected both prior to and during the tests to delineate the radius of influence of well MID-04. Antecedent water level fluctuation measurements will be collected in nearby wells or piezometers. Drawdown during the tests and recovery after the tests will be recorded using Hermit® data loggers fitted with down-well pressure transducers. Periodic manual checks of water levels shall be conducted throughout the test to ensure proper functioning of the automatic water level recording system. Additional details are provided in Section 4.12.

3.9.1.3 Analysis and Presentation of Data

Test data will be reviewed as it is collected to determine if the test is accomplishing the design goals. Presentation of graphical test data and raw data will be included with the capture zone analysis portion of the Operable Unit 2 Work report. Applicable standard analysis methods will be determined based on a preliminary review of the test data and used to define the capture zone of each well. Any limitations or restrictions on these conclusions will be discussed.

3.9.2 East Side and West Side HIA Production Wells

Two of the western HIA production wells (HIA-6 through HIA-14) and one of the eastern HIA production wells (HIA-1 through HIA-5) will be tested. The HIA production well locations are shown on Figure 3-7. Nearby monitoring wells will be used, as appropriate, for water level monitoring during these tests. The specific test wells will be selected after additional data concerning the wells are obtained from the HIA.

Implementation of the HIA capture zone tests will follow the same three steps used for MID-04. In addition, six monitoring well nests will be installed to monitor ground water levels during these three tests. Six shallow, six intermediate, and six deep monitoring wells will be installed in the Industrial Area to provide the best set of data for the east and west side HIA capture zone tests. The monitoring well nest locations will be proposed for USACE approval dependent upon selection of the specific HIA production wells for capture zone analysis. The wells will be

designed for the possibility of conversion to pumping/injection wells to intercept contaminants or reinject treated water, but the primary use will be for water level measurements. The six deep wells will be geophysically logged, and all 18 wells will be sampled as part of the ground water sampling program described in Section 3.13.

3.10 *DEEP GROUND WATER FLOW DETERMINATION*

Three deep (800 ft.) monitoring wells may be installed to determine regional deep ground water flow directions and contaminant levels outside of the capture zone of the HIA production wells. These wells may not be drilled if it is determined that contamination is not present at deeper intervals. This will be determined by the depth-specific sampling during the first stage of work; plus the capture zone analysis of the HIA production wells.

The wells will be designed for the possibility of conversion to pumping/injection wells to intercept contaminants or reinject treated water. The proposed well materials and design are described in Section 4.9.3. Data from previous investigations will be used to help locate the wells. A borehole television survey will be performed on the wells to locate appropriate intervals for packer testing. Packer testing will be performed on the wells to provide confirmation that the intervals to be screened are productive. Proposed changes in well design based on packer testing results will be submitted to the USACE for approval. An analysis of deep ground water flow direction will be performed and reported.

The three deep monitoring wells will be logged prior to setting the screen. Geophysical logging tools will include natural gamma, sonic, neutron, density, SP, temperature, caliper, and resistivity. Interpretation and correlation of the logs will be performed to help understand the hydrogeology.

Each of the new wells will be developed as described in Section 4.9, allowed to stabilize, purged, and then sampled as part of the ground water sampling program described in Section 3.13.

3.11 *BACKGROUND SOILS DATA REVIEW AND SOILS DATA COLLECTION*

Soil samples from the GF-212 monitoring well were previously used to define background conditions. However, the samples were ruled out for use as inorganic background samples because organics were present. The inorganic concentrations of concern in the GF-212 soils were within the range of Eastern U.S. background concentrations. Soils data in the RI and previous reports will be reviewed to determine if available local or Site specific data can be used for inorganic background data. Soil borings to obtain suitable background soils data will be conducted if existing data are determined inadequate by the USACE.

If required, up to five background soil borings will be drilled and sampled for chemical analysis. Boring locations to obtain representative samples of background soils will be approved by the USACE. Expected borehole depths of 15 feet are assumed for each boring.

Split spoon samples will be collected continuously from just below the surface to ground water or bedrock, whichever occurs first, and three composite samples plus one surface sample will be analyzed from each boring. The samples will be representative of the stratigraphy in the study areas for which background data are needed. The samples will be analyzed on-site by ERM-FAST® for TCL VOCs plus TICs. Samples will be analyzed by an off-site laboratory for TCL SVOCs plus TICs, TCL pesticides, TAL total metals, and cyanide (total and amenable).

3.12 *GROUND WATER RESTORATION TIMETABLE DEVELOPMENT*

The ESD requires a multiple step approach to developing a timetable for ground water restoration. The steps to complete this task include:

- determination of soil contamination leaching to ground water;
- reconfiguring the pumping rates/schedules at the HIA production wells;
- developing a timetable for ground water restoration using the above information and information regarding additional remedial activities; and
- development and analysis of a ground water model.

3.12.1 *Determination of Soil Contamination Effects on Ground Water*

Soil contamination varies across the Site and may be a continuing problem leading to ground water degradation. The investigation to further define soil contamination, especially in the Industrial Area, has been included in this work plan. An assessment of the potential for contaminated soils to leach contaminants to ground water will be performed. Remediation of contaminated soils may be required in the future to enhance ground water remediation and protection at this Site. Based on the ESD, areas of concern for soil contamination impacting ground water are in the vicinity of:

- Waste Sump House (Building 267) and Pipeline in the Industrial Area,
- Industrial Area and/or Pipeline 142 in the Industrial Area,
- Storm sewers in the Industrial Area,
- North Base Landfill,
- Runway Area, and
- Fire Training Pit.

To evaluate the potential impacts of soil leachate on ground water, the following tasks will be evaluated based on the results of the soil and ground water sampling activities.

- The release of soil contamination to ground water under current conditions will be evaluated based on the results of the soil and ground water sampling activities.
- The contaminant-specific minimum levels of soil contamination that will begin to cause risk-based health effects associated with the ingestion of ground water will be determined to help identify the options for, and the degree of remediation required for the contaminated soils.

To accomplish the above tasks, a vadose zone leaching model will be considered as well as other appropriate models which will be determined based on the data generated during this investigation.

3.12.2 *Reconfiguration of HIA Production Well Pumping Rates*

The ultimate goal of this task is to recommend how to reconfigure the current HIA well production schedule to maximize plume containment, or to develop a justification describing why reconfiguration is not necessary. Capture zone analysis and any other relevant analysis of data will be employed to make this determination. Standard numerical modeling will be used to evaluate the reconfiguration, considering both flow and contaminant transport. The model configuration is a three-dimensional model that represents the Site as a porous medium even though ground water movement by fracture flow is occurring.

The analysis to determine whether modification of HIA production well pumping rates is required will consider the following scenarios:

- current soil contamination effects on ground water and current HIA well configuration (pumping rates for each HIA well) with the operating air stripper;
- current soil contamination effects on ground water and reconfigured HIA wells (pumping rates for each HIA well);
- current soil contamination effects on ground water, current HIA well configuration (pumping rates for each HIA well) with the operating air stripper, plus soil vapor extraction (SVE) remediation; and
- reconfiguration of HIA wells coupled with SVE remediation.

Ground water and transport modeling will then be conducted as described below.

3.12.3 *Ground Water and Transport Modeling*

The future timing, location, quantity, rates and pathways of contaminant movement will be evaluated through the use of digital computer modeling, which will consist of the following tasks.

- *Review and Evaluation of Existing Data.* The complete data base will be studied to obtain an overall assessment of the Site and relevant processes occurring there, as well as the region surrounding the Site. Evaluations and reviews of data for modeling purposes will be done in conjunction with evaluations and reviews required by this Work Plan.

- *Conceptual Model Development*. Prior to the selection of a modeling code, ERM will develop a conceptual model of the region of interest consisting of the following:
  - the physical configuration of the system including definition of boundaries, sedimentary facies distribution, heterogeneities, aquifer thickness, hydrological conditions, and other geometric and geologic characteristics as applicable;
  - the identification of relevant physical and chemical processes involved in the system, including all active (i.e. pumping) and passive (i.e. natural recharge, evapo-transpiration, increases in water demand, etc.) controls on the system; and
  - the identification of the constant or time dependent conditions imposed on the boundaries of the model domain.
- *Model Construction*. Prior to constructing the model description and running the code on the modeling scenarios, a Modeling Work Plan will be prepared as an attachment to this Work Plan and reviewed by the USACE. The Work Plan will include:
  - Discussion of the model code ERM intends to use, as well as details on model construction (i.e. appropriate spatial grid spacing and aquifer parameters, temporal length of time steps scales for the system under consideration, boundary node assignments, etc.).
  - An existing validated model code; and
  - Documented experience of the modeler with the software that is chosen.

  ERM will justify any changes from that assumed in negotiations with regards to the model.
- *Model Calibration*. The model will be calibrated to the current Site conditions. A sensitivity analysis shall be performed by varying the model parameters and determining the impact on model results.
- *Modeling Scenarios*. ERM will model various scenarios as stated above, using Site data, historical information on contaminant concentrations, historical water levels, pumping rates, and configurations (i.e. number of pumping wells, location of wells, etc.). The chosen scenarios and the plans to accomplish will shall be presented in the Modeling Work Plan for the USACE's approval.

3.13 GROUND WATER SAMPLING

Ground water sampling and analysis will occur at several times during this investigation as listed below:

- sampling and analysis following shallow well installation, with an expedited sample analysis time to permit review of the data from the shallow wells to determine if proposed intermediate and deep wells are required;
- sampling and analysis of all new wells following installation of all intermediate and deep wells; and
- sampling and analysis of existing wells, including on-site monitoring wells, production wells and off-site residential wells.

Ground water sampling will also occur as part of the specialized investigative tasks and quarterly monitoring after the field activities have been completed. These tasks include the direct push ground water sampling discussed in Section 3.4.1, the depth-specific sampling of the HIA production wells discussed in Section 3.7 and a quarterly monitoring program for select wells discussed in Section 3.15.

3.13.1 *New Wells*

All new wells installed in the following areas or as part of the following tasks will be sampled upon completion of the well installation tasks. Those locations that require shallow well sampling and expedited analysis prior to selecting locations for the intermediate depth and deep wells are indicated below.

3.13.1.1 *Industrial Area - Main Building Area*

- Shallow wells 3
- Intermediate depth wells 3
- Deep wells 1

The shallow wells will be sampled first and analyzed by the off-site laboratory for TCL VOCs plus TICs as discussed in Section 3.2.2. Expedited VOC analysis will be required of the outside laboratory so that the data can be used to determine the locations for the intermediate depth and deep wells. All seven monitoring depth wells will be sampled and analyzed during a comprehensive sampling event for TCL VOCs plus

TICs, TCL SVOCs plus TICs, TAL metals (total and dissolved), and cyanide (total and amenable). The shallow wells will also be sampled for TCL pesticides/PCBs.

3.13.1.2 *Building 142 Pipeline*

- Shallow wells 2
- Intermediate depth wells 2

The shallow wells will be sampled first and analyzed by the off-site laboratory for TCL VOCs plus TICs as described in Section 3.1.5. Expedited VOC analysis will be required of the laboratory so that the data can be used to determine the intermediate depth well locations. All four wells will be sampled and analyzed during a comprehensive sampling event for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (total and dissolved), and cyanide (total and amenable). The shallow wells will also be analyzed for TCL pesticides.

3.13.1.3 *Mid-Lagoon Area*

- Shallow well 1
- Intermediate well 1

Both wells will be sampled and analyzed by the off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (total and dissolved), and cyanide (total and amenable). In addition, the shallow well sample will be analyzed for TCL pesticides/PCBs.

3.13.1.4 *Sentinel Wells*

- Shallow wells 2
- Intermediate wells 2

All wells will be sampled and analyzed by the off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (total and dissolved), and cyanide (total and amenable). In addition, the shallow well samples will be analyzed for TCL pesticides.

Following this initial sampling, the shallow and intermediate depth sentinel wells will be included in the quarterly monitoring described in Section 4.16.

3.13.1.5 *Piezometers*

- Shallow 3
- Intermediate 3
- Deep 3

These piezometers will be used for water level monitoring in the capture zone analysis for MID-04. No sampling is required.

3.13.1.6 *North Base Landfill Wells*

- Shallow wells 2
- Intermediate wells 7

All wells will be sampled and analyzed by the off-site laboratory for TCL VOCs and SVOCs plus TICs, TAL metals (total and dissolved), and cyanide (total and amenable). In addition, the shallow well samples will be analyzed for TCL pesticides.

3.13.1.7 *Runway Monitoring Wells*

- Shallow wells 3
- Intermediate wells 3

All wells will be sampled and analyzed by the off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (total and dissolved), and cyanide (total and amenable). In addition, the shallow well samples will be analyzed for TCL pesticides.

3.13.1.8 *HIA Capture Zone Wells*

- Shallow wells 3
- Intermediate wells 3
- Deep wells 3

All wells will be sampled and analyzed by the off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (total and dissolved), and cyanide (total and amenable). In addition, the shallow well samples will be analyzed for TCL pesticides.

3.13.1.9 *Deep Flow Zone Wells*

- Deep wells 3

All wells will be sampled for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (total and dissolved), and cyanide (total and amenable).

3.13.2 ***Existing Monitoring, Production and Residential Wells***

3.13.2.1 *Existing Monitoring Wells*

Existing monitoring wells in the following five areas will be sampled.

	Shallow	Intermediate	Deep
Industrial Area	17	7	-
Runway Area	11	4	-
Fire Training Pit	3	1	-
North Base Landfill	0	4	-
Meade Heights	1	-	-
Total	32	16	-

All 48 wells will be sampled and analyzed by the off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (total and dissolved), and cyanide (total and amenable). In addition, the 32 shallow well samples will be analyzed for TCL pesticides. The samples from three existing shallow wells (RFW-04, GF-218, and RFW-03) will be analyzed for TCL PCBs.

3.13.2.2 *Production Wells*

Fourteen production wells will be sampled, including the 13 HIA wells and the Middletown Borough Well MID-04. In addition, ERM will determine the status of wells HIA-7 and HIA-9 and, if available and appropriate, these two wells will be included in the sampling program.

All 14 wells will be sampled and analyzed by the off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TAL metals (total), and cyanide (total and amenable).

3.13.2.3 *Residential Wells*

Eight residential wells, including the Odd Fellows Home well, will be sampled. These wells include the five residential wells identified as RES-01 through RES-05 on Figure 2-4 of the GF RI Report, plus three additional wells which will be identified during the investigation.

All wells will be sampled and analyzed by the off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TCL pesticides, TAL metals (total), and cyanide (total and amenable).

3.14 *SVE PILOT RECOMMENDATION AND PILOT TEST*

A soil vapor extraction (SVE) system is proposed for pilot testing in the Industrial Area. The purpose of this pilot test is to determine if SVE is an appropriate remediation method to remove VOC contamination from the soils in this area.

Implementation of the SVE test will be based upon a recommendation from ERM and concurrence and authorization from the USACE, that based upon the data collected in this investigation, SVE is an appropriate technology. If the data indicate that SVE and/or another soil remediation technology would be appropriate for the site, ERM will recommend that the SVE test or other tests be run.

Likewise, if the data show that the Industrial Area is not the most appropriate location for the test, ERM will recommend an alternate location. A Treatability Study Work Plan will be prepared as an attachment to this Work Plan and submitted for USACE approval prior to implementation. The Work Plan will include definition of the test area, system design details, installation methods for the vacuum well and piezometers, sampling and analysis requirements, and other appropriate details.

The SVE pilot system will consist of one four-inch vacuum well and three monitoring piezometers within the defined test area. Soil samples will be collected for geotechnical and chemical analyses. The samples will be screened with an organic vapor analyzer (OVA) for VOC headspace analysis. Based on the OVA screening, three samples per boring will be analyzed by the off-site laboratory for TCL VOCs plus TICs, TCL SVOCs plus TICs, TOC, and CEC.

The pilot test will run for three to four days and entail a full compliment of tests in vacuum mode to determine the vapor concentrations and the maximum transmissivity of air through the surrounding soil. Offgas monitoring will be performed so that the effects of the vapor extraction on the soil contaminants can be measured and a maximum area of influence under optimum operating conditions determined. Vapor samples will be collected for on-site screening by ERM-FAST® for the select VOCs and SVOCs.

Upon completion of the pilot test, ERM will prepare a report that presents an evaluation of the test and the configuration of a full scale SVE system at the pilot location if the data are favorable.

3.15 *QUARTERLY MONITORING*

Quarterly monitoring will be conducted for the sentinel wells and the surface water and sediment in the Susquehanna River. Per the Explanation of Significant Differences (ESD), the sampling will be conducted for a period of 5 years, until 1999. The sentinel wells, both shallow and intermediate, will be analyzed for the same parameters as the initial round of sampling (refer to Section 3.13.1.4). The purpose of the sampling will be to monitor the potential migration of contaminants to Middletown Borough's production well MID-04.

The surface water and sediment of the Susquehanna River will be sampled in four locations for the same parameters as the initial sampling described in Section 3.6. Five quarterly sampling events are expected to be completed by the time the OU#2 Preliminary Report is issued. The available data from the quarterly monitoring will be presented in the Preliminary Report.

3.16 *BASELINE RISK ASSESSMENT*

One of the specific objectives defined for the Supplemental Studies Investigation requires the performance of a baseline risk assessment to evaluate potential threats to human health and the environment associated with the Site under current conditions. The results of this risk assessment will support the development of remedial action alternatives that are protective of human health and the environment. This section of

the Work Plan provides a discussion of how the baseline risk assessment will be performed.

A Human Health Baseline Risk Assessment (HHBRA) and Environmental Evaluation (EE) will be performed to support the decision making process. The HHBRA and EE provide an analysis of potential risk through a comparison of detected constituent concentrations to media-specific action levels. These action levels are derived using conservative exposure assumptions and exposure limits for carcinogens (i.e., risk-specific doses) and noncarcinogens (i.e., reference doses).

The HHBRA-EE integrates information from previous investigations and from media characterization performed during the Supplemental Studies Investigation through the execution of a two-step process. The initial step in the HHBRA-EE is a potential receptor survey and exposure analysis. This task is designed to identify potential receptors and to determine the likelihood, frequency, magnitude, and duration of any exposures. In the second step, constituent concentrations are compared to USEPA-established action levels for specific media.

In instances where a constituent exceeds the USEPA-established action levels, a human health baseline risk assessment will be performed to evaluate the potential risk posed by site-specific exposure scenarios. All constituents found in excess of site-specific background concentrations will be carried forward to a quantitative ecological risk characterization.

3.17 *REPORTING*

Upon completion of the field activities, ERM will prepare a Preliminary Report. This report will discuss the tasks performed, present preliminary data results, provide analyses of the investigations performed and the preliminary data, provide required recommendations as needed, and include technical memoranda documenting field activities.

The preliminary reports will be summarized in an Operable Unit 2 Work Report. This report will also include the SVE Pilot Test Report and the Baseline Risk Assessment.

Upon EPA's acceptance of the Report, USACE will prepare a draft Record of Decision (ROD).

Section 4

Section 4

4.0 SITE INVESTIGATION METHODOLOGIES

The following section provides a detailed description of the investigation methodologies and techniques to be applied during the implementation of the tasks described in Section 3. The methodologies include:

- pipeline video surveying;
- direct push soil gas, soil, and ground water sampling;
- soil boring and soil sampling;
- surface water, sediment, and biological stream sampling;
- analytical field screening;
- well and piezometer installation;
- well borehole geophysical and television logging;
- aquifer pump testing;
- ground water sampling;
- SVE pilot testing and evaluation;
- risk assessment;
- decontamination procedures; and
- cuttings management.

This section along with the QAPP (Attachment 1) will serve as the principal source of information to guide the implementation of the Supplemental Studies Investigation.

4.1 PIPELINE INTEGRITY SURVEY

4.1.1 *Objective*

A video camera will be used to locate potential leak sites along the Building 142 pipeline. The data will be used to determine soil vapor, soil, and ground water sampling locations in later tasks. A more detailed discussion of the objectives is provided in Section 3.1.2.

4.1.2 *Locations*

This investigation will occur along Pipeline 142 in the Industrial Area. This pipeline runs from production well HIA-13 to Building 142 and from Building 142 to the wastewater lagoons. The portion from Building 142 to the lagoons will be tested.

4.1.3 *Techniques*

ERM's subcontractor, Pipe Data View Services (PVDS), will perform the pipeline integrity survey. PVDS personnel will use a remote-operated video camera to videotape and evaluate the integrity of the pipelines. A tractor driven video camera will be inserted into the pipeline system at Building 142 and will survey approximately 4200 linear feet of pipeline. The survey will be coordinated with HIA personnel to ensure the most appropriate time for the survey in order to minimize interference with operations.

The camera survey will be monitored on a real-time basis and simultaneously recorded on a VHS format video tape. Special attention will be given to determining the presence of catch basins, manholes, cracks, sections of broken pipe, and the condition of joints. The location of the camera and any identified leaks will be recorded within a horizontal accuracy of 1 foot. A footage meter will record distance from the starting point and continually project the distance on the video screen. Three copies of the final video tape will be made to store the results of the survey.

ERM estimates that no pipeline cleaning will be necessary prior to conducting the evaluation and that the level of flow in the pipeline will not hamper the transport of the camera. If flow is such that the camera cannot be transported through the pipeline, the possibility of temporarily rerouting flow through the line will be considered. If this is not possible, or if pipe cleaning is necessary, a technical scope change will be reuired and a modification to this task will be submitted to the USACE for review and approval.

4.1.4 *Sample Designations*

No samples will be collected using this investigation method.

4.1.5 *Sample Analyses*

Not Applicable

4.2 *DIRECT PUSH SOIL VAPOR SAMPLING*

4.2.1 *Objective*

A Geoprobe System® will be used to collect soil vapor samples along the pipelines 142 and 267 to determine whether contaminant leaks from or contaminant migration along the pipelines have resulted in a soil source area(s) for ground water contamination. Soil vapor samples will also be collected in the northern lagoon area, where elevated VOCs were detected in ground water, and in the vicinity of the Waste Sump House to determine the potential presence of soil contamination. The data will be used to determine soil and ground water sampling locations in later tasks.

4.2.2 *Locations*

The soil vapor sampling will be conducted along the same pipeline run as the video camera survey, following completion of the survey. Figure 3-2 shows the location of the pipeline. Up to 100 soil vapor samples will be collected. It is anticipated that 60 soil vapor samples will be collected along the Building 142 pipeline, and 40 soil vapor samples will be collected along the Building 267 pipeline and in the Waste Sump House Area.

At a minimum, one sample will be collected approximately every 100 feet of Pipeline 147. The pipeline between Building 142 and the lagoon is estimated to be approximately 4,200 feet long. Based on a 100-foot spacing, 42 points will be initially installed along the pipeline. The remaining 18 soil vapor sample points will be located based on potential pipeline leak locations evident in the video camera survey and the analytical results obtained in the field during the sampling of the initial soil vapor points. Additional sample locations may be selected to

complete horizontal delineation of "hot spots" identified along the pipeline from the initial soil vapor results.

The total length of the Building 267 pipeline is not known at this time. However, the 40 sampling points will be located to provide adequate coverage along the pipelines and around the Waste Sump House. The sampling locations will be determined to the field based on site conditions and consultation with the USACE.

The approximate pipeline locations will be determined from available utility plan maps. To avoid hitting the pipeline with the Geoprobe equipment, all soil vapor sampling locations will be placed a minimum of 5 feet from the approximate center line of the pipeline. The locations will be checked with HIA maintenance personnel to help ensure that the pipeline will not be struck or ruptured.

4.2.3 *Techniques*

The Geoprobe System® uses a hydraulic powered drive head to push small diameter probing tools into the subsurface using static force (the weight of the vehicle) and percussion (hydraulic hammer) to advance the tools. Sample points designed for collection of soil vapor, soil, or ground water samples are attached to the end of 1-inch outside diameter probe rods and pushed to the desired sample depth. Samples are then collected directly through the sample probe rods. Sampling activities will not be conducted when soil conditions are inappropriate, such as saturated with moisture or during cold weather.

Expendable sample points will be attached to the end of the Geoprobe rods and advanced to the desired sample depth at each location. The pipeline depth is expected to be between 4 and 8 feet below the ground surface. It is anticipated that soil vapor probes will be installed to a depth of approximately 6 to 8 feet below the ground surface. When the sample depth is reached, the rods will be retracted to disengage the expendable point and leave an open cavity for soil gas sampling. Dedicated tubing will be inserted down the inside of the probe rods to the expendable point holder attached to the bottom of the rods, resulting in a continuous run of tubing from the sample level to the surface.

The soil vapor sample will be collected using a pump to draw soil vapors to the surface. The pump will be attached to a 1 liter Tedlar bag with a Teflon-lined septum. The other end of the bulb will be attached to the

sample tubing. When the sample bag has been filled for an appropriate interval, it will be delivered to ERM-FAST® for field screening. After the sample has been collected, the probe rods will be removed from the hole. Probing tools will be decontaminated between locations according to the methods described in Section 4.17.

Soil vapor locations will be located on the base map using measured distances from adjacent facility features (i.e. building corners).

4.2.4 *Sample Designations*

The 100 Geoprobe soil vapor sample locations will be labeled with the prefix "IAP-SV" to designate "Industrial Area Pipeline-Soil Vapor", followed by the location number (from 1 through 100) and the sample depth. For example, a soil vapor sample collected from location number 20 at a depth of 6 feet below grade will be designated IAP-SV20.6.

4.2.5 *Sample Analyses*

Each soil vapor sample will be screened on-site by ERM-FAST®. Soil vapor will be collected for on-site gas chromatograph (GC) analysis by inserting a Hamilton® gas-tight syringe through the Teflon septum of the Tedlar bag. An appropriate volume of soil gas will be withdrawn from the bag and injected onto the column of the GC.

All soil vapor samples will be screened for the following select VOCs and SVOCs: PCE; TCE; 1,2-DCE; vinyl chloride; BTEX; 1,2-DCA; CCl_4; chlorobenzene; and
1,2-, 1,3-, and 1,4-dichlorobenzene. The samples will be analyzed with a 24 hour turnaround time to allow for selection of additional soil vapor points, if necessary.

4.3 *DIRECT PUSH SOIL SAMPLING*

4.3.1 *Objective*

A Geoprobe System® will be used to collect soil samples to provide screening level confirmation of the soil vapor sampling results. The data will be used to determine soil boring and monitoring well locations in later tasks.

4.3.2 *Locations*

Upon completion of the soil vapor sampling, up to 20 locations will be sampled by direct push soil sampling methods along the Building 142 and Waste Sump House pipeline runs. Two samples will be collected per location, for a total of 40 soil samples, and analyzed by ERM-FAST® to provide screening level data. Samples will also be collected from five additional locations (10 samples) around the first and second northernmost wastewater lagoons east of the Air National Guard facilities. Eighty percent of the sample locations will be in areas where positive soil vapor results were recorded, and 20 percent of the sample locations will be in areas where negative soil vapor results were recorded to verify the field screening results.

4.3.3 *Techniques*

The direct push soil samples will be collected using the Geoprobe System®. A 1-inch O.D., 10- or 24-inch long, stainless steel sample tube will be attached to the end of the probe rods and pushed or driven to the desired sample depth. Unlike split spoon samplers, the Geoprobe soil sample tube remains sealed by a piston tip while being advanced to the top of the sample interval. Extension rods will be inserted down inside the probe rods after the top of the sample interval is reached, and a piston stop-pin at the trailing end of the sampler will be removed. The probe rods and sampler will then be driven the appropriate distance (10 or 24 inches) for the desired sample interval. The piston will be displaced upward into the sample tube as the soil sample is collected. The probe rods will then be retracted from the borehole, and the soil sample will be recovered.

Two samples will be collected from each location, resulting in a total of approximately 50 samples. The first sample will be collected at a depth approximately equal to the pipe invert depth, and the second sample will be collected from just above the water table. The water table is expected to be encountered within 10 to 15 feet below grade.

If refusal is encountered before the desired sample depths are reached, the location will be abandoned, and a second location will be attempted adjacent to the first location. If refusal is encountered a second time at one location, an alternate sample location will be selected based on the soil vapor results.

Probing tools and samplers will be decontaminated between locations according to the procedures described in Section 4.17. Soil sampling locations will be located on the base map using measured distances from adjacent facility features (i.e. building corners).

4.3.4 *Sample Designations*

The 20 Geoprobe soil sample locations along the pipelines will be labeled with the prefix "IAP-GS" to designate "Industrial Area Pipeline - Geoprobe Soil", and the 5 Geoprobe soil sample locations around the wastewater lagoons will be labeled "IAL-GS" to designate "Industrial Area Lagoons - Geoprobe Soil". The prefix will be followed by the location number (1 through 20 for the pipelines and 21 through 25 for the lagoons) and the sample depth. There will be two samples collected from two different depths at each location. For example, the soil samples collected from location number 5 from depths of 4 to 6 feet below grade and from 13 to 15 feet below grade will be designated IAP-GS5.4-6 and IAP-GS5.13-15, respectively.

4.3.5 *Sample Analyses*

Each soil sample will be screened on-site by ERM-FAST® for the same select VOCs and SVOCs as the soil vapor samples. The samples will be analyzed with a 24 hour turnaround time to provide data for selection of soil boring locations.

4.4 *SOIL BORINGS AND SOIL SAMPLING*

4.4.1 *Objective*

This task is designed to collect additional soil samples to further define the occurrence of soil contaminant source areas and to delineate the extent of soil contamination identified from the direct push soil vapor and soil sampling tasks.

As part of a separate task, if existing background soil data are insufficient for risk assessment purposes, additional background soil samples will be collected and analyzed following the same protocols.

4.4.2 *Locations*

Soil borings will be advanced in the following areas, and soil samples will be collected from the unconsolidated material for both on-site field screening analyses and off-site laboratory analyses:

- 12 soil borings along the Industrial Area pipelines, including 10 borings along the pipelines and two borings in the wastewater lagoon area;
- 30 borings around the Industrial Area buildings, including 15 initial borings around the buildings plus 15 additional borings in locations determined based on the field screening results for the initial borings; and, if necessary
- up to five borings in locations yet to be determined which are indicative of background conditions. These locations will be approved by USACE prior to drilling.

4.4.3 *Technique*

Soil borings will be advanced using HSA drilling methods, and subsurface samples will be collected using split spoon samplers. The split spoon sampling will be accomplished using a 140-pound hammer to advance a 2-foot long stainless steel split spoon through the hollow stem augers (ASTM Method D1586-67). The number of hammer blows required to advance the sampler through each 6-inch interval over a distance of 2 feet will be recorded. Auger flights will be advanced only to the top of the interval to be sampled; the split spoons will then be driven ahead of the augers. Individual, decontaminated split spoons will be used to sample each interval. Decontamination procedures are described in Section 4.17.

Soil samples will be visually described in the field by an ERM geologist. Descriptions will include:

- USCS soil classification;
- consistency or density;
- moisture content;
- color;
- bedding characteristics, fractures, or other descriptive features; and
- depositional type (alluvium, till, etc).

Soil boring and sampling locations will be located on the base map by a licensed surveyor. Forms used to record lithologic information are found in Figure 4-1.

4.4.3.1 *Industrial Area Soil Sampling*

Formation samples will be collected from the ground surface to the water table in the Industrial Area borings according to the following criteria:

- at 2.5 foot intervals from the ground surface to 10 feet below grade, and
- at 5 foot intervals from 10 feet below grade to the water table.

It is estimated that boring depths will vary between 5 and 20 feet below grade, with an average depth of 15 feet.

Surface scrape soil samples will be collected from two boring locations along the pipelines, at the two locations in the lagoon area, and from 10 locations in the main buildings area. Samples will be collected from the top 2 inches of soil at each location by compositing soil using stainless steel spoons and bowls to achieve representative samples from each location.

4.4.3.2 *Background Soil Sampling*

If the background soil borings are required, formation samples will be collected continuously from the ground surface to the water table or bedrock in each of the five background borings to characterize the soils. Boring depths are expected to range from 5 to 20 feet, with an average depth of 15 feet below grade.

Soil samples for chemical analysis will be composited from each of the following intervals: 0 to 2 inches (surface scrape samples), 6 inches to 5 feet, 5 feet to 10 feet, and from the bottom two split spoon samples above the water table. The samples will be representative of the stratigraphy in the study areas for which additional background data are needed. One grab sample will be collected from each of the three lower intervals for VOC analysis. The surface scrape samples will not be analyzed for VOCs.

Figure 4-1

HTW DRILLING LOG

HOLE NO.

OMPANY NAME	2. DRILLING SUBCONTRACTOR
SHEET 1 OF SHEETS	
ROJECT	4. LOCATION
ELLER	6. MANUFACTURER'S DESIGNATION OF DRILL
ES AND TYPES OF DRILLING ND SAMPLING EQUIPMENT	8. HOLE LOCATION
	9. SURFACE ELEVATION
	10. DATE STARTED / 11. DATE COMPLETED
VERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
EPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
OTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

EOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	18. TOTAL NUMBER OF CORE BOXES

SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

SPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

EV. a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.

PROJECT

HOLE NO.

AR302869

Figure 4-1 (Continued)

HTW DRILLING LOG

HOLE NO.

PROJECT

INSPECTOR

SHEET

OF SHEETS

ELEV. L.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.

PROJECT

HOLE NO.

AR302870

4.4.4 *Sample Designations*

The soil borings in the Industrial Area will be designated as follows:

- "IAP-SB1" through "IAP-SB-10" for the borings along the pipelines,
- "IAL-SB11" and "IAL-SB12" for the borings in the wastewater lagoon area,
- "IAB-SB13" through "IAB-SB42" for the borings around the buildings, and
- "BG-SB43" through "BG-SB47" for the five background soil borings.

The soil samples collected from the soil borings will be labeled with the appropriate prefix to designate the area of the site and the boring number, followed by the depth interval. For example, a soil sample collected at a depth of 10 to 12 feet below grade from soil boring SB13 in the Industrial Area will be designated IAB-SB13.10-12.

The surface scrape samples collected from selected boring locations will be designated with the same prefix as the soil boring at that locations. However, rather than a depth designation following the boring number, the sample number will be given the suffix "SSC". For example, the surface scrape sample collected at soil boring location SB11 in the wastewater lagoon area will be designated IAL-SB11.SSC.

4.4.5 *Sample Analyses*

4.4.5.1 *Industrial Area Soil Samples*

Each of the soil samples from the Industrial Area borings will be screened in the field by ERM-FAST® for the select VOCs and SVOCs. The samples will be screened within 24 hours of submittal to allow timely selection of soil samples for laboratory analysis, selection of remaining boring locations, and selection of monitoring well locations.

Three of five samples from each of the Industrial Area borings will be selected for off-site laboratory analysis. Selection of sample intervals for laboratory analysis will be based upon the following criteria applied to the ERM-FAST® screening results:

- the uppermost sample interval having a detected concentration of 10 µg/kg or greater for the target compounds,
- the first sample interval after the deepest interval having a detected concentration of 10 µg/kg or greater (but not below the water table), and
- the sample interval with the highest detected total contaminant concentration eluting from the GC within the retention time of the target compounds.

If any of the criteria above do not apply in the field, samples will be selected for laboratory analysis based upon field judgment using the following criteria:

- sample interval is visually contaminated,
- sample interval exhibits a change in lithology, and
- sample interval just above the water table.

The soil samples will be analyzed on-site by ERM-FAST® for TCL VOCs plus TICs. The VOC analyses will be conducted with a 48 hour turnaround time. The samples will be analyzed by the off-site laboratory for TCL SVOCs plus TICs, TCL Pesticides, TAL total metals, cyanide (total and amenable), total organic carbon (TOC), and cation exchange capacity (CEC). The VOC and SVOC analyses will include a library search for 5-15 VOC TICs and 10-25 SVOC TICs (i.e., compounds not found on the TCL). Three split spoon samples from each of the two borings in the vicinity of the lagoons and 18 split spoon samples from borings in the vicinity of the current and former waste sumps and the oil/water separator will also be analyzed for TCL PCBs.

The surface scrape samples collected in the Industrial Area will be analyzed by the off-site laboratory for the TCL SVOCs plus TICs, TCL Pesticides, TAL total metals, cyanide (total and amenable), TOC, and CEC. The two surface scrape samples collected in the vicinity of the lagoons and four surface scrape samples collected in the vicinity of the waste sumps and oil/water separator will also be analyzed for TCL PCBs. The surface scrape samples will not be analyzed for VOCs.

Geotechnical analyses will be performed on two samples per boring in the pipeline areas and on 10 percent of the samples collected from the borings in the main buildings area to obtain representative soil type descriptions.

The geotechnical samples will be analyzed for grain size distribution (ASTM D 421 and 422), Atterberg limits (ASTM D 4318), and moisture content (ASTM D 2216).

4.4.5.2 *Background Area Soil Samples*

If required and approved by USACE, four composite samples from each of up to five background borings will be analyzed by the off-site laboratory for TCL SVOCs plus TICs, TCL Pesticides, TAL total metals, and cyanide (total and amenable). The sample composite intervals are described above. In addition, one grab sample will be collected from each of the lower three intervals, excluding the surface scrape sample, for on-site analysis of TCL VOCs plus TICs by ERM-FAST®, with a 48 hour turnaround time. The grab sample will be collected from the split spoon sample in each interval that exhibits the highest VOC headspace reading prior to sample compositing and homogenization.

4.5 *STORM SEWER SEDIMENT SAMPLING*

4.5.1 *Objective*

Sediment samples will be collected from the storm sewer system in the Main Airport and Industrial Area to determine whether contaminants are present in the system, their concentrations and distribution through the system, and the potential for discharge to and contamination of the Susquehanna River.

4.5.2 *Locations*

The sediment sample locations will be selected upon completion of the structural integrity survey described in Section 3.3.1. Samples will be collected at the end of each sewer outlet to the Susquehanna River. Additional samples will be collected downstream from locations such as floor drains or leaks where contaminants may enter the system, and along lines and line junctions to evaluate contamination distribution throughout the system. A maximum of 30 sediment samples will be collected.

4.5.3 *Techniques*

Sediment samples will be collected from the furthest downstream location and proceeding upstream through the storm sewer system to minimize potential cross-contamination due to re-suspension of materials caused by sampling activities. The samples will not be collected during or within 48 hours of a major rainfall event in order to minimize dilution and agitation effects from run-off and maximize potential for intercepting VOCs in the sediment.

Sediment samples collected from within the storm sewer system will be collected using a decontaminated stainless steel spoon or trowel. Samples from the Susquehanna River will be collected from depositional areas, where there is the greatest potential for contaminant accumulation. If there is sufficient sediment available and the water above the sediment is flowing or greater than four inches deep, a core sampling device will be used to minimize washing of the sediment as it is retrieved. Samples for VOC analyses will be placed directly into the sample containers. Bottles for the other analytical parameters will be filled after sediment has been composited and homogenized in a decontaminated stainless steel bowl. Sampling equipment will be decontaminated before its use at each location following the procedures described in Section 4.17.

ERM anticipates that certain sample locations along the storm sewer lines will require confined space entry. Detailed health and safety procedures for these locations are described in the Site Safety and Health Plan (SSHP) (Appendix C).

4.5.4 *Sample Designations*

The storm sewer sediment samples will be labelled with the prefix STSD followed by the location number 1 through 30. For example, the storm sewer sediment sample from location 1 will be designated STSD-1.

4.5.5 *Sample Analyses*

The storm sewer sediment samples will be analyzed by the off-site laboratory for the TCL VOCs plus TICs, TCL SVOCs plus TICs, TCL Pesticides and PCBs, TAL total metals, and cyanide (total and amenable). Sediment color, texture, and odor will be noted upon sample collection and recorded in the samplers field notebook.

4.6 DIRECT PUSH GROUND WATER SAMPLING

4.6.1 Objective

A Geoprobe System® will be used to collect soil stratigraphy information and ground water samples in the North Base Landfill area in order to define the stratigraphy of the alluvium aquifer, provide an understanding of the hydrogeology in the alluvium, estimate the horizontal extent of the VOC contaminant plume in the alluvium, and aid in the placement of monitoring wells.

4.6.2 Locations

Seventy-five direct push borings will be advanced and ground water samples will be collected in the area surrounding the North Base Landfill (see Figure 3-4):

- Sixty samples will be collected outside the boundary of the previous soil borings south of the landfill to delineate the extent of the VOC plume toward the Industrial Area and Main Airport;
- Samples will be collected between the landfill and MID-04; and
- Five samples will be collected north of the landfill, building 678/679 and north of the PA Turnpike to determine background contaminant concentrations.

4.6.3 Techniques

Ground water sampling with the Geoprobe System® is accomplished by attaching a slotted steel well point to the end of the probe rods. The well point consists of a solid drive point which is threaded to a 3-foot long section of 0.02-inch slotted screen. The sampler is driven to the desired depth in the same manner as the soil vapor and soil sampling points. It is estimated that the water table will be encountered between 5 and 25 feet below grade, with an average depth of 20 feet. The sampler is advanced to a depth of approximately 2 feet below the water table, and is then retracted approximately 2 feet. The expendable drive point is thereby disengaged, creating an open borehole. The inner core of the sampler, consisting of a stainless steel screen inside a perforated stainless steel sleeve, is then pushed into the borehole, and the ground water is allowed to enter the sampler. Ground water samples are collected using a stainless

steel mini-bailer inserted through the probe rods or using a peristaltic pump to lift water through a tubing system to the surface.

The direct push ground water sampling locations will be located on the base map by a licensed surveyor. The downhole tools and sampling equipment will be decontaminated between sample locations following the procedures described in Section 4.17.

4.6.4 *Sample Designations*

The 75 Geoprobe ground water sampling locations will be labeled with the prefix "NBL" to indicate their locations in or near the North Base Landfill area, followed by the designations "-GPW" through "-GPW75". The ground water samples will also be labeled"GPW1" through "GPW75" with the depth from which the sample was collected. For example, a direct push ground water sample collected at a depth of 20 to 22 feet below grade from location GPW50 will be designated NBL-GPW50.20-22.

4.6.5 *Sample Analyses*

The direct push ground water samples will be screened on-site by ERM-FAST® for the same select VOCs and SVOCs as the soil and soil vapor samples. These analyses will be completed with 24 hour turnaround time to permit timely selection of samples for laboratory analysis. Ground water samples will be collected in unpreserved vials because the addition of HCl preservative may have an unknown effect on the select SVOC compounds.

Twenty percent of the ground water samples (approximately 16 samples) will be selected for off-site laboratory analysis. Ten samples will be split from direct push samples that contained target compounds in order to confirm their presence, and six samples will be split from samples that did not detect contaminants in order to verify delineation of the plume. These samples will be analyzed for TCL VOCs plus TICs and select SVOCs (bis(2-chloroethyl)ether and 1,2-, 1,3-, and 1,4-chlorobenzene). Two of the samples which are sent to the off-site laboratory will be split with the USACE and submitted to the Missouri River Division Laboratory (the MRD Laboratory), the Government QA laboratory. One USACE split sample will be collected from a location upgradient of Well GF-301 and the North Base Landfill. The second split sample will be collected from a location downgradient from the North Base Landfill and Well RFW-1.

Because the direct push ground water samples for both onsite screening and off-site confirmatory analysis will be collected in unpreserved vials, the holding time for analyis will be reduced from 14 days to 7 days. In addition, due to the low estimated levels of contaminanats reported for nearby ground water monitoring wells in the RI report, special practical quantitation limits (PQLs) will be requested for the analyses. Therefore, the following notation will be indicated on the chain-of-custody and traffic report forms that accompany the samples to the respective laboratories: "No acid preservation - 7 day holding time. Bis(2-chloro) 8260; Target PQL=5µg/L for TCL VOCs, bis(2-chloroethyl)ether, and 1,2-, 1,3-, 1,4-dichlorobenzenes." The laboratories will also be notified by either the Field Operations Manager or the Laboratory Coordinator when this sampling event is initiated.

4.7 *FIELD SCREENING*

ERM-FAST® is a mobile field unit that provides rapid turnaround of analytical data. ERM-FAST® will be operated in a screening level mode (Level II) and also to provide Level III, laboratory grade quality data. Specific details regarding ERM-FAST® capabilities, data quality objectives and the field analytical procedures are presented in the ERM-FAST® Quality Assurance Plan (QAP), Attachment 2 to the QAPP.

Soil vapor, soil (direct push and split spoon), and direct push ground water samples will be screened for select VOCs and SVOCs to determine the presence and concentration of target compounds including: PCE, TCE, 1,2-DCE, 1,2-DCA, CCl_4, chlorobenzene, isomers of dichlorobenzene, vinyl chloride, and BTEX. Analyses will be performed within 24 hours to provide data necessary for performance of subsequent tasks, including the selection of additional sample locations and monitoring well locations.

Select split spoon soil samples from the Industrial Area soil borings and monitoring wells and from the soil samples from the background borings will be analyzed on-site by ERM-FAST® for the TCL VOCs plus TICs. These samples will be analyzed with a 48 hour turnaround time to provide data for subsequent decision making. Samples for other analytical parameters will be submitted to the off-site laboratory for analysis.

4.8 SURFACE WATER, SEDIMENT, AND BIOLOGICAL SAMPLING

4.8.1 Objectives

Surface water, sediment, and biological samples will be collected from the perennial stream at Meade Heights, and surface water and sediment samples will be collected from the Susquehanna River to determine potential Site impacts, if any, to the water quality within the stream and river and the aquatic receptors inhabiting the stream. The following sections describe the sampling methodologies for each media.

4.8.2 Surface Water and Sediment Sampling

4.8.2.1 Locations

Surface water and sediment samples will be collected from four locations along the perennial stream at Meade Heights as shown on Figure 3-5. One sample will be collected upstream of the Pennsylvania Turnpike and will represent background conditions. Two samples will be collected adjacent to the Site and the fourth sample will be collected downstream of the Site. Specific sampling locations will be determined in the field during the sampling investigation.

Surface water and sediment samples will be collected from the four locations along the Susquehanna River previously sampled during the Remedial Investigation. The sample locations are shown on Figure 3-6. The objectives for sampling those locations are to characterize background conditions and assess the contribution, if any, from the Fire Training Pit, the landfill covered by the runway, and the discharge from the lagoons.

The approximate distances from permanent physical structures such as bridges and power lines will be determined from each sampling station and recorded in the field notebook. In addition, a fluorescent painted stake with the station number will be placed along the stream and river bank at each sampling location for future reference so that the sampling locations in the Susquhanna River can be duplicated during subsequent quarterly monitoring events. A distance and compass measurement will be taken from each stake to the actual stream sampling location.

4.8.2.2 *Surface Water Sampling Techniques*

Surface water sampling will be conducted from the furthest downstream station and proceed to upstream stations to minimize potential cross-contamination due to the re-suspension of materials in the sediment caused by sampling activities. In addition, surface water samples will be collected before stream sediments and biological samples to minimize cross-contamination. The water samples will be collected by immersing a laboratory clean glass jar below the surface of the water and transferring the water to the appropriate sample container. Samples will be collected in this manner so that the preservatives in the sample bottles will not be lost during sampling. A separate clean glass jar will be used at each station to eliminate cross-contamination. Samples will be collected from the middle of the perennial stream and along the northern side of the Susquehanna River, depending on the depth.

4.8.2.3 *Sediment Sampling Techniques*

Stream and river sediments will be collected from depositional areas to assure that areas with the greatest potential for contaminant accumulation are sampled. Generally, samples will be collected using a decontaminated stainless steel trowel. If ample sediment is available and the water column above the sediment at the sample location is flowing or greater than 4 inches in depth, a sediment core sampling device will be used to collect the sample to minimize washing of the sediment as it is retrieved. Standing water from the top of the core sampler will be decanted off prior to withdrawing the sediment. In all cases, a decontaminated stainless steel trowel will be used to transfer the sample into the stainless steel bowl or directly into the sample containers. For VOC analyses, the sediment will be placed directly from the corer into the sample container. For all other analyses, stream and river sediments will be placed into a decontaminated stainless steel bowl, homogenized using a stainless steel trowel, then transferred into the appropriate sample containers.

Where possible, dedicated stainless steel trowels and bowls will be used at each station to eliminate cross-contamination. Non-dedicated equipment will be decontaminated before its use at each sampling station following the procedures described in Section 4.17.

4.8.2.4 *Sample Designations*

Surface water and sediment sample locations will be labeled with the prefix "MH" to indicate the stream at Meade Heights or "SR" to indicate the Susquehanna River locations. The sampling stations will then be designated as follows:

- MH-SW1 through MH-SW4 and MH-SED1 through MH-SED4, to designate the Meade Heights surface water and sediment samples, respectively; and
- SR-SW5 through SR-SW8 and SR-SED5 through SR-SED8, to designate the Susquehanna River surface water and sediment samples, respectively.

4.8.2.5 *Sample Analyses*

Stream and river surface water samples will be sent to the off-site laboratory for analysis of TCL VOCs plus TICs, TCL SVOCs plus TICs, TCL Pesticides/PCBs, TAL total metals, cyanide (total and amenable), hardness, alkalinity, and total dissolved solids. Field water quality parameters such as pH, dissolved oxygen, specific conductivity, and temperature will be measured in-situ at each sampling station. An assessment of water color, odor, and turbidity will be made upon collection of all surface water samples, and the results will be recorded in the field notebook.

Stream and river sediment samples will be sent to the off-site laboratory for analysis of TCL VOCs plus TICs, TCL SVOCs plus TICs, TCL Pesticides/PCBs, TAL total metals, cyanide (total and amenable), TOC, moisture content, pH, CEC, and grain size. Sediment parameters such as pH will be measured at each sampling station by mixing four parts distilled water to one part sediment. Sediment color, texture, and odor will be noted upon collection of all samples.

4.8.3 *Biological Sampling*

4.8.3.1 *Locations*

Macroinvertebrates and fish will be collected at four locations along the perennial stream at Meade Heights. The four biological samples will be collected at or within the vicinity of the surface water and sediment sampling stations. Specifically, these station locations will include a

background sample collected upstream of the Pennsylvania Turnpike, two samples adjacent to the Site, and the fourth sample downstream of the Site. Specific sampling locations will be determined in the field based on habitat quality.

4.8.3.2 Fish Characterization

A quantitative characterization of the fish community structure at each station along the perennial stream will be conducted according to Protocol V (RBP V) as described in the Rapid Bioassessment Protocols For Use in Streams and Rivers (USEPA/444/4-89-001). Sampling methods will also follow guidelines documented in Fish Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters (USEPA/600/R-92/111). General methods are described below.

Fish will be collected by electroshocking a predetermined stream section (generally 100 to 300 meters in length) at each station. Block nets will be placed in the stream at the upstream and downstream ends of the stream section so that fish will not escape capture. Large fish collected will be identified, counted, measured, and weighed then released back into the stream. Smaller fish will be preserved in 10% formalin and transported to ERM's taxonomic lab where they will be identified, measured, weighed, and enumerated. Each fish will be examined for external tumors or lesions and noted in the field notebook. Each stream section per station will include at least one riffle, run, and pool, if possible, so that all varieties of fish species may be collected.

An assessment of the stream habitat will be conducted according to the Rapid Bioassessment Protocol. This assessment will characterize parameters such as bottom substrate, cover, embeddedness, flow, channel alteration, bottom scouring, deposition, bank stability, bank vegetation, and streamside cover.

Potential impacts to the fish community from contaminants of concern will be evaluated by comparing the diversity and abundance of fish collected from the adjacent and downstream stations to the diversity and abundance of fish collected from the background station. In addition, data analyses will follow the procedures specified in the Rapid Bioassessment Protocols For Use in Streams and Rivers (USEPA/444/4-89-001).

4.8.3.3 *Macroinvertebrate Characterization*

The macroinvertebrate community structure of the perennial stream will be characterized by collecting samples from the three stations outlined above. These three stations will correlate with the surface water and sediment stations. The assessment of the macroinvertebrate community will be conducted according to Protocol III (RBP III) as described in the Rapid Bioassessment Protocols For Use in Streams and Rivers (USEPA/444/4-89-001). Field sampling methods will also follow guidelines described in Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters (USEPA/600/4-90-030).

According to the RBP III a representative sample of the macroinvertebrate fauna at each station will be collected from the riffle/run habitat and supplemented with the collection of a Coarse Particulate Organic Material (CPOM) sample. CPOM exists in the form of plant debris (leaves, needles, twigs, and bark) which accumulates in depositional areas. Macroinvertebrate sampling at each station will consist of two 10 second kick net samples collected from an area of approximately 1 m^2 within the riffle/run habitat. At least 100 organisms will be randomly picked off the net from each sample then composited into one sample for each station. In addition to the riffle/run sample, a CPOM sample will be collected by taking several handfuls of partially decomposed leaf packs, twigs, or bark and compositing them into one sample for each station. All samples will be labeled with the appropriate station number and preserved in alcohol. These samples will be transported to ERM's taxonomic laboratory for identification and enumeration. Sample sorting will follow the procedures outlined in the RBP III, and collected organisms will be counted and identified to the lowest possible taxonomic level (generally Genus).

Data analysis techniques will follow the procedures outlined in RBP III. Eight metrics will be calculated based on the raw macroinvertebrate data. These metrics include taxa richness, biotic index, ratio of scrapers to filtering collectors, ratio of EPT to chironomidae abundances, percent contribution of dominant taxon, EPT index, community similarity indices, and ratio of shredder functional feeding group to total number of individuals collected. Stations located adjacent to and downstream of the Site will be compared to the upstream (background) station to determine if the macroinvertebrate community is being impacted.

4.8.3.4 *Sample Designations*

The biological sampling locations will be labeled with the prefix "MH-BIO" to indicate a biological sample from the stream at Meade Heights. The samples will then be given the same location number as the nearest surface water/sediment location, followed by the letter "f" for fish samples or "m" for macroinvertebrate samples. For example, a fish sample collected from near the MH-SW1 location will be designated MH-BIO1f.

4.9 *WELL AND PIEZOMETER INSTALLATION*

4.9.1 *Objectives*

Various types of monitoring wells and piezometers will be used to delineate plumes in the ground water, further define contaminant source areas, and serve as observation points for evaluation of the overburden and bedrock aquifers.

4.9.2 *Locations and Designations*

Monitoring wells and piezometers installed during this investigation will be designated with the prefix "ERM" to avoid confusion with the existing monitoring wells at the Site. Wells which are installed in nests will have the same number followed by a letter which designates the well as shallow ("S"), intermediate ("I"), or deep ("D"). The designations for the wells in each area are as follows:

- Industrial Area Pipelines and Mid-Wastewater Lagoon - three shallow wells and three intermediate wells, designated ERM-1S/1I through ERM-3S/3I;
- Industrial Area Buildings - three shallow and three intermediate wells, designated ERM-4S/4I through ERM-6S/6I; and one deep well which will be assigned the same location number as the adjacent shallow and intermediate monitoring wells;
- North Base Landfill/MID-04 - two shallow and two intermediate wells to serve as sentinel wells for early warning of MID-04 well contamination, designated ERM-7S(SENT)/7I(SENT), and ERM-8S(SENT)/8I(SENT);
- MID-04 - three shallow, three intermediate and three deep piezometers for the capture zone analysis at well MID-04, designated

ERM-9S(PZ)/9I(PZ)/9D(PZ), ERM-10S(PZ)/10I(PZ)/10D(PZ), and ERM-27S(PZ)/27I(PZ)/27D(PZ);

- North Base Landfill - two shallow and two intermediate wells downgradient of the landfill and upgradient of the Industrial Area, designated ERM-11S/11I and ERM-12S/12I; and ERM-275(PZ)/271(PZ)/27D(PZ);
- North Base Landfill - two intermediate wells to delineate the western edge of the plume toward Buildings 678 and 679, designated ERM-13I and ERM-14I;
- Buildings 678 and 679 - three intermediate wells, including two downgradient and one upgradient of these buildings, designated ERM-15I and ERM-16I (downgradient) and ERM-17I (upgradient);
- Runway Area - three shallow and two intermediate wells, designated ERM-18S/18I, ERM-19S, and ERM-20S/20I;
- HIA Capture Zone - six shallow, six intermediate and six deep wells for use in the capture zone analysis and for ground water sampling, designated ERM-21S/21I/21D through ERM-26S/26I/26D; and
- Site wide - three deep wells for ground water flow determination across the Site in the deep bedrock zone, designated ERM-28D through ERM-30D.

4.9.3 *Drilling and Monitoring Well Installation Procedures*

Two general types of monitoring wells will be installed at the Site; overburden wells and bedrock wells. All wells will be logged and installed according to USACE guidelines. The drilling procedures and the well construction specifications for the various wells are described in the following sections. All downhole drilling and sampling equipment will be decontaminated between locations according to the procedures described in Section 4.17. Monitoring well construction details for overburden and bedrock wells are presented in Figures 4-2 and 4-3, respectively.

The monitoring wells and piezometers will be located on the base map by a licensed surveyor. The ground surface and top of casing elevations will also be surveyed. These data will be required for preparation of subsurface cross-sections and for calculations of ground water elevation.

Figure 4-2
Overburden Monitoring Well Construction Diagram
Middletown Airfield Site
Middletown, PA

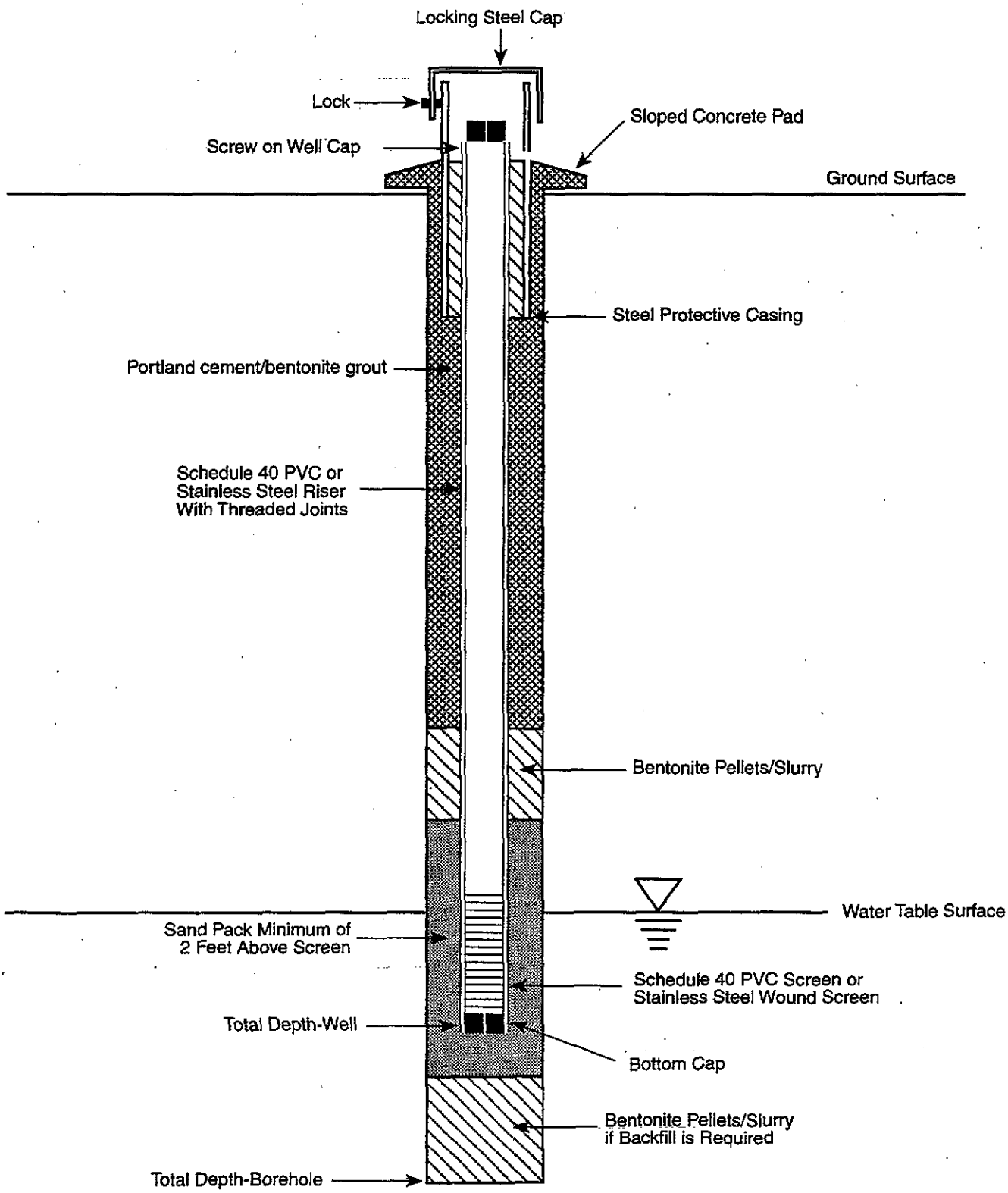
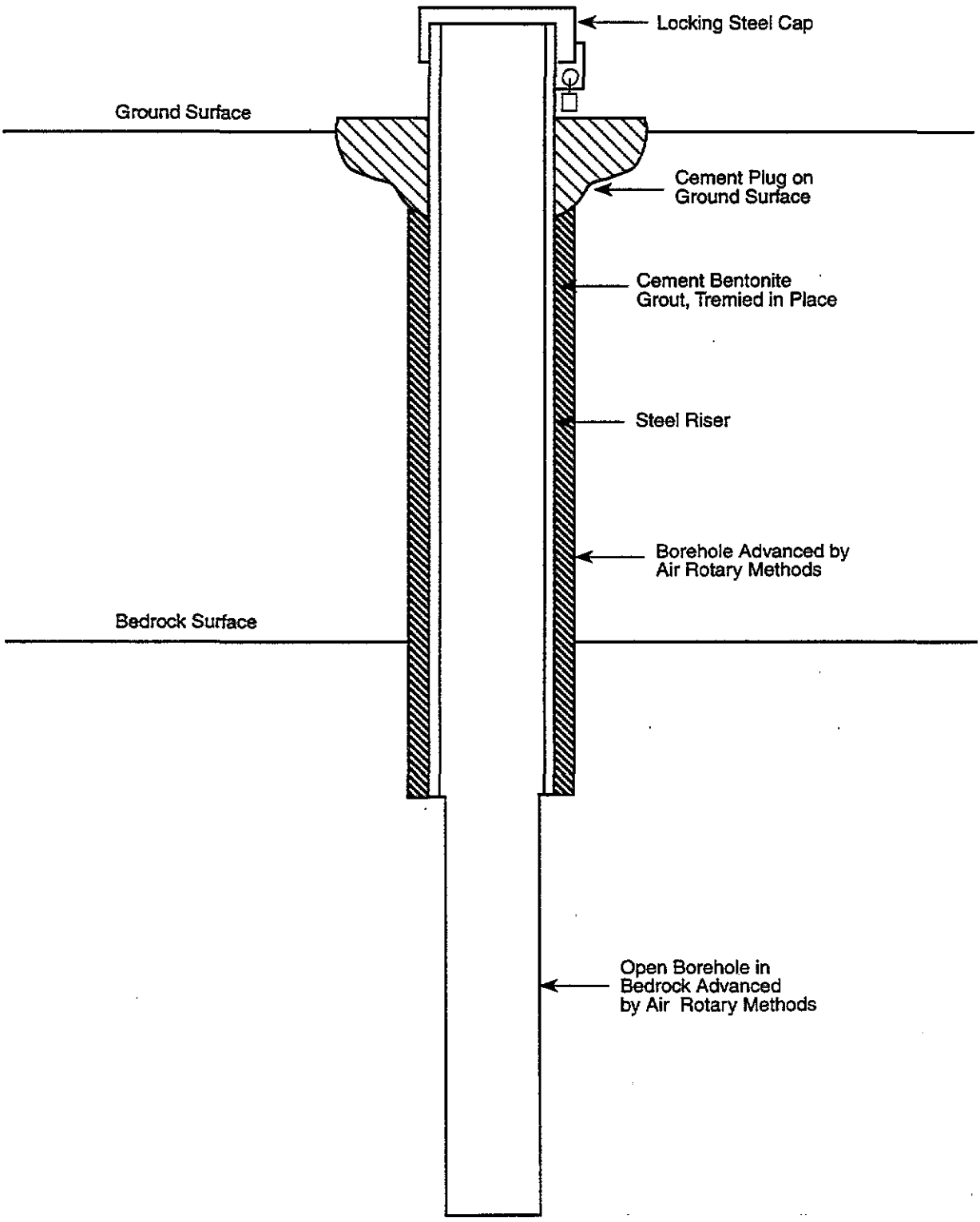


Figure 4-3
Bedrock Monitoring Well Construction Diagram
Middletown Airfield Site
Middletown, PA



Note: Well may have flush-mount completions

Not to Scale

4.9.3.1 *Overburden Wells*

Overburden wells will be drilled using HSA drilling techniques and are anticipated to reach a depth of approximately 25 feet below grade. Monitoring well borings will be sampled from the ground surface to ground water or bedrock, whichever is encountered first, according to the following:

- at 2.5 foot intervals from the ground surface to 10 feet below grade, and
- at 5 foot intervals from 10 feet below grade to the water table.

Samples will be collected using split spoon samplers. All soil sampling will be accomplished using a 140-pound hammer to advance a split spoon through the augers (ASTM Method D1586-67). The number of blows required to advance the sampler through each 6-inch interval over a distance of 2 feet will be recorded. Auger flights will be advanced only to the top of the interval to be sampled; the split spoon will then be driven ahead of the augers. Individual, decontaminated split spoons will be used to collect each sample.

Soil samples will be visually described in the field. Descriptions will include:

- USCS classification,
- consistency or density,
- moisture content,
- color,
- bedding characteristics, fractures, or other descriptive features, and
- depositional type (till, alluvium, etc.).

Soil samples from the six overburden monitoring well borings in the Industrial Area will be screened on-site by ERM-FAST® for the same select VOCs and SVOCs as the samples from the soil borings (Section 4.4.5.1). The samples will be analyzed with 24-hour turnaround. The samples will be designated with the prefix "IAP", "IAL", or "IAB" for the pipeline, lagoon, or building areas, respectively, followed by the monitoring well number and the sample depth. For example, a sample collected at a depth of 10 to 12 feet below grade from monitoring well boring ERM-1S in the pipeline area will be designated IAP-ERM1S.10-12.

Three samples from each boring will be selected for additional laboratory analyses based on the selection criteria described in Section 4.4.5. These samples will be analyzed on-site by ERM-FAST® for the TCL VOCs plus TICs and by the off-site laboratory for TCL SVOCs plus TICS, TCL Pesticides, TAL total metals, cyanide (total and amenable), TOC, and CEC. The samples from the three overburden monitoring well borings in the Main Buildings Area and from the overburden well boring in the mid-Lagoon Area will also be analyzed for TCL PCBs.

One surface scrape sample will be collected from one of the three overburden monitoring well locations in the Main Buildings Area and from the mid-Lagoon location. The surface scrape samples will be analyzed by the off-site laboratory for the same parameters as the split spoon samples, including TCL PCBs. The surface scrape samples will not be analyzed for TCL VOCs.

A minimum of two samples per shallow monitoring well boring will be retained for geotechnical analysis. The analyses will consist of grain size distribution (ASTM D 421 and 422), Atterberg limits (ASTM D 4318), and moisture content (ASTM D 2216). One of the samples for geotechnical analysis will be collected from the portion of the aquifer which will be screened in the monitoring well, and one sample will be collected from the unsaturated zone.

Table 4-1 summarizes the overburden monitoring well depths and construction details for the various areas on the Site. Monitoring well installation procedures are described in Section 4.9.3.3.

Table 4-1 Overburden Monitoring Wells

SITE	DEPTH (FT)	NUMBER	DIAMETER (IN)	MATERIAL	SCREEN LENGTH (FT)
Industrial Area Pipelines/Lagoon	25	3	2	PVC	10
Industrial Area Main Buildings	25	3	2	PVC	10
North Base Landfill	25	2	2	PVC	10
Runway	30	3	2	PVC	10
HIA Capture Zone	25	6	4	SS	10

4.9.3.2 *Bedrock Wells*

Bedrock monitoring wells will be installed using dual rotary drilling techniques. Dual rotary drilling allows a lower rotary drive unit to advance casing (up to 24 inches in diameter) through unconsolidated overburden. A carbide studded shoe, welded to the bottom casing joint, enables the casing to cut its way through the overburden. A top drive rotary head simultaneously handles a drill string equipped with a down-the-hole hammer, drag bit or rolling cone rock bit to drill inside or ahead through the casing. The lower rotary drive unit operates independently from the top drive rotary head. Once the casing has been set to the desired depth the dual rotary drill continues drilling in the same manner as a conventional top drive air drill. Advantages of the dual rotary method include minimization of cross contamination and borehole stability.

Forty-four bedrock wells are planned during this investigation. Their locations, proposed depths, diameters, and screened intervals are presented in Table 4-2. The monitoring well installation procedures are described in Section 4.9.3.3. The intermediate and deep monitoring wells in the Industrial Area pipeline and main building areas will not be installed until the shallow monitoring wells in those areas have been sampled and analyzed for TCL VOCs, as described in Section 4.11.2.1. Those analytical results will be used to determine the best locations for the intermediate and deep monitoring wells.

Borehole geophysical logging will be conducted in the bedrock boreholes prior to monitoring well installation, as described in Section 4.10. In addition, borehole camera surveys will be performed in the intermediate and deep HIA capture zone monitoring wells and the deep flow determination wells. The camera survey will be used to select intervals to be packer tested, and packer tests will be conducted to provide confirmation that the intervals to be screened are productive. Based on the borehole testing described above, ERM will select the screened interval and inform USACE of these decisions.

4.9.3.3 *Monitoring Well Installation Procedures*

Once the desired depth is reached and required downhole testing has been completed, monitoring wells will be constructed of the appropriate diameter and material as shown on Tables 4-1 and 4-2. All well materials will be steam cleaned prior to installation. All screen and riser material

Table 4-2 *Bedrock Monitoring Wells*
Middletown Airfield Site

SITE	DEPTH (FT)	NUMBER	DIAMETER (IN)	MATERIAL	SCREEN LENGTH (FT)
Industrial Area Main Buildings	100	3	2	PVC	20
	300	1	2	PVC	20
Industrial Area Pipelines/Lagoon	100	3	2	PVC	20
North Base Landfill/Wells Sentinel	50	2	4	SS	20
	200	2	4	SS	40
MID-04 North Base Landfill Piezometers	50	3	2	PVC	10
	100	3	2	PVC	20
	300	3	2	PVC	20
North Base Landfill Monitoring Wells	100	4	2	PVC	20
Buildings 678/679	100	3	2	PVC	20
Runway	120	2	2	PVC	20
HIA Capture Zone	200	6	4	SS	40
	600	6	4	SS	40
Deep Flow Determination	800	3	4	SS	20

will be threaded, flush jointed, Schedule 40 polyvinyl chloride (PVC) or type 304 stainless steel (SS). The screens will be continuous wrap PVC or SS.

The annular space around the well screen will be backfilled with clean, silica sand. This filter pack will be tremied into place to avoid bridging and will extend approximately 1 foot below and 3 feet above the well screen. A minimum 2 foot thick bentonite seal will be tremied into place above the filter pack. The seal will be composed of commercially manufactured sodium bentonite pellets. The seal will be allowed to hydrate a minimum of 4 hours before grouting begins. Cement grout will be placed above the bentonite seal and consist of a mixture of Portland cement and water in a proportion of not more than 7 gallons of approved water to one 94 pound bag of cement. Additionally, 3% by weight of sodium bentonite powder will be added to the grout mixture. Grout will extend from the top of the bentonite seal to ground surface.

The well riser will be surrounded by a protective steel casing extending 2 to 3 feet above and below ground level. The protective casing will be painted orange and have attached to it a permanent, corrosion resistant tag that identifies the well number, depth, date of installation, the U.S. Army Corps of Engineers, Omaha District, and the adjusted top of casing elevation. All wells will be secured with non-rusting, keyed alike brass locks. A concrete pad (3'x3'x4"), sloped away from the well, will be constructed around each well. Three 2-inch diameter, or larger, steel posts will be spaced evenly around the well and cemented in place outside the concrete pad at appropriate locations for additional protection.

4.9.4 *Well Development*

Within one week after installation, but no sooner than 48 hours after grouting, newly installed monitoring wells will be developed. Development will be accomplished by mechanical surging and bailing and will continue for a minimum of 2 hours. After 2 hours, the well will be continuously pumped using a submersible or centrifugal pump. Temperature, pH, specific conductivity, and turbidity will be monitored during this process at a rate of one reading per well volume. Pumping will continue until these parameters have stabilized and the water is clear and free of fines. A 1 liter sample of the last water withdrawn will be retained in a clear glass jar and photographed. This photograph will be submitted as part of the well installation diagram. A Well Development