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FINAL RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION WORK PLAN ZONE L CNC CHARLESTON SC

11/27/1996

ENSAFE

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY
NAVAL BASE CHARLESTON
CHARLESTON, SOUTH CAROLINA
CT0-29

FINAL
ZONE L RFI WORK PLAN

Prepared for:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, S.C.

SOUTHDIV CONTRACT NUMBER: N62467-89-D-0318

Prepared by:

EnSafe/Allen & Hoshall
935 Houston Northcutt Blvd., Suite 113
Mt. Pleasant, South Carolina 29464
(803) 884-0029

November 27, 1996
Revision No. 0

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
PO BOX 190010
2155 EAGLE DRIVE
NORTH CHARLESTON, S C. 29419-9010

5090/11
Code 1877
11 December 1996

Mr. G. Randall Thompson
Director, Division of Hazardous and Infectious Waste Management
Bureau of Solid and Hazardous Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Subj: SUBMITTAL OF ZONE L RCRA FACILITY INVESTIGATION WORKPLAN CHANGES

Dear Mr. Thompson,

This letter is the submittal of the page changes as a result of the comments made by Paul Bergstrand and Johnny Tapia of the South Carolina Department of Health and Environmental Control on the Zone L RCRA Facility Investigation (RFI) Workplan. These changes have been discussed with the Department personnel to ensure that the comments have been adequately addressed and that the workplan changes are satisfactory.

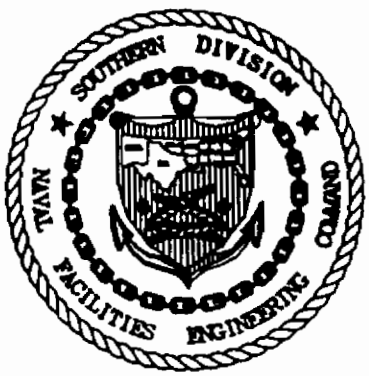
We request that the Department review and approve the Zone L RFI Work Plan based on the previous submittal as well as the page changes included in enclosure (1). If you should have any questions, please contact Gary Crawford or me at (803) 820-9985 (Ext. 32) and (803) 820-5525 respectively.

Sincerely,

Matthew A. Hunt

MATTHEW A. HUNT
Environmental Engineer
Installation Restoration III
By direction

Encl:
(1) Zone L RFI Workplan page changes
Copy to:
SCDHEC (Bergstrand, Tapia), USEPA (3) (Brittain)
CSO Naval Base Charleston (Crawford, Fontenot)



COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY
NAVAL BASE CHARLESTON
CHARLESTON, SOUTH CAROLINA
CTO-029

FINAL ZONE L RCRA FACILITY INVESTIGATION WORK PLAN RESPONSE TO REGULATORY COMMENTS

Prepared for:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA

SOUTHDIV CONTRACT NUMBER: N62467-89-D-0318

Prepared by:

ENSAFE/ALLEN & HOSHALL
935 HOUSTON NORTHCUTT BOULEVARD
SUITE 113
MT. PLEASANT, SOUTH CAROLINA 29464
(803) 884-0029

July 24, 1996

Response to South Carolina Department of Health and Environmental Control Comments For the Zone L RCRA Facility Investigation Work Plan, Dated October 18, 1995

GENERAL COMMENTS

Comment 1:
The Zone L RFI Work Plan refers to Direct Push Technology (DPT) procedures that NAVBASE Charleston has proposed for inclusion into the Comprehensive RFI Sampling and Analysis Plan. The Department and EPA are currently reviewing the proposed DPT procedures. However, it should be noted that NAVBASE Charleston cannot proceed with using the DPT procedures and techniques without formal approval of them by the Department. See comment 2 below.

Response 1:
No comments regarding the DPT methods proposed for Zone L were received in the comments on the Comprehensive Sampling and Analysis Plan. Both EPA and SCDHEC did comment on reservations concerning the Laser Induced Fluorescence (LIF) technology, however, LIF is not proposed for Zone L. Additionally, the DPT methods proposed for Zone L are similar to those recently approved for use in the Zone A investigation.

Comment 2:
The workplan is vague regarding the DPT to be employed. The DPT equipment, method of operation, advantages and disadvantages, as well as sampling procedures, accuracy, precision, quantitation limits, and any other relevant information should be discussed thoroughly either in the Comprehensive RFI Workplan, and/or in the Zone L workplan. In addition, technical justification for using such DPT methods as opposed to simply collecting the usual soil, sediment, surface water and groundwater samples should be thoroughly discussed. One important limitation noted in this review was found in Table 2-2 (Sanitary Sewer System Site-Specific Sampling Plan). According to the list of metals proposed for analysis when using the DPT, antimony, barium, copper, nickel, selenium, silver, thallium, and vanadium are not included in this list. Since these are hazardous constituents and have the potential to have been released into the sanitary sewer system, analyses should be conducted to determine the presence of these constituents. Thus, this is an important limitation to using DPT and is an example of the type of limitation that should be thoroughly discussed in the workplan, along with any other relevant limitations of DPT. This is an important issue. If NAVBASE Charleston cannot justify the use of the proposed DPT, then additional DQO Level III and/or IV samples must be proposed in the revised workplan. The workplan should be revised accordingly.

Response 2:
Specifics regarding the DPT equipment and analytical requirements are included in the revised Comprehensive RFI Work Plan. Additional justification for using DPT is included

in the revised Final Zone L RFI Work Plan, along with an acknowledgement of its limitations. The list of metals analysis has simply been expanded to include the entire target analyte list (TAL) suite of metals similar to what has been done in all other zones.

Comment 3:
In Section 1.2 on page 1-6, the workplan discusses the criteria for defining the extent of contamination. The workplan states "For purposes of this investigation the extent of contamination is defined as the horizontal and vertical area in which the concentrations of COPCs in the investigated media are above either preliminary remediation goals (PRGs) or background concentrations, which ever is appropriate. If the proposed sampling efforts do not achieve this goal, sample collection will continue until sufficient data are obtained." Until sufficient data are obtained to do what? The workplan is unclear on point. Sufficient data should be collected to define the extent of contamination to the levels mentioned above. The workplan should state such specially.

Response 3:
This sentence has been deleted since it was previously stated that one of the purposes of the investigation is to delineate the nature and extent of contamination. The overall sampling strategy as presented in the Comprehensive RFI Work Plan already implies that sampling will continue until this objective is achieved.

Comment 4:
Due to fact that the SWMU and AOCs under investigation per this workplan are linear features and therefore are located in all contiguous zones of the base (Zones A through I), labeling of samples is problematic. The Zone L RFI Workplan proposes a scheme to insure samples have unique designations. The workplan states "Each site will be listed by its AOC or SWMU designation, followed by an assigned two-letter code representing the order in which the site was encountered." Then the workplan offers the following example: "The second site encountered while investigating SWMU 37 will be labeled: SWMU 37 - AC. (A =0, B = 1, C= 2, ...Z = 24: Letters I and O will not be used per Volume II, Section II of the CSAP)." Thorough review of this sampling scheme reveals that after reaching letter "L", the first digit of "A" (which A = O becomes unnecessary, yet the workplan used this designation for sites designated AOC 504-AM, 504-AN, 504-AP, and 504-AQ. This sampling scheme is vague and ambiguous. Either the workplan should be revised to clearly and thoroughly discuss this sampling scheme such that any possible ambiguities are eliminated, or, preferably, a more simple, accurate sampling scheme is proposed in the revised workplan.

Response 4:
The labeling scheme has been revised to incorporate the above concerns.

Comment 5:
In both Tables 2-2 (Sanitary Sewer Site-Specific Sampling Plan) and 2-7 (Storm Sewer System Site-Specific Sampling Plan), the number of soil confirmation and groundwater confirmation samples is listed as "To Be Determined". It is understood that the reason for listing this as such in the workplan is that the workplan proposes to collect confirmation (DQO Level III) samples at approximately 10% of the locations sampled using screening technologies. The Department does not agree with this approach. The screening technologies proposed by the Navy are unproven, as indicated in comment 2 above. Until such technologies can be proven in accordance with the above comment, they can't be used to limit the number of DQO Level III or IV samples collected. Therefore, a minimum number of DQO Level III and/or IV samples must be proposed in the revised workplan in order to determine whether or not a release to the environment has occurred.

Response 5:
Based on a review of the Comprehensive RFI Work Plan Comments provided by EPA and SCDHEC, the "unproven" DPT method is laser-induced flourescence which is not proposed for use in Zone L.

As stated on Page 2-3, initial soil and groundwater samples for the sanitary and storm sewer systems will be collected using DPT for a screening level analysis to meet DQO Level II. This data will be used to determine the presence/absence of contaminants and define the nature and extent of contaminants if necessary. The screening data will be compared with higher quality, DQO Level IV, samples collected for conformation purposes. The quantity of conformation samples will, at a minimum, equal to 10% of the total number of DPT sample locations and will be taken by standard sampling equipment (i.e. hand augers and monitoring wells). Therefore, Tables 2-2 and 2-7 have been revised to indicate the proposed number of DQO Level IV samples.

Comment 6:
On page 2-4, the workplan notes that Radiological Surveys will be completed prior to sample collection to ensure that radioactive materials are not present. The workplan goes on to note that such surveys are described in separate work plans and reports. This is vague. The workplan should be revised to state the names of these other surveys and reports and to describe how the information in these other reports was used in preparation of the Zone L RFI Workplan, or will be used in the field while assessing Zone L. The workplan should be revised accordingly.

Response 6:
The radiological surveys were performed to determine if radioactive residues remained at facilities which stored, used, or generated radioactive materials. These surveys were very important in ensuring that a safe working environment exists for all individuals who have

or may have access to a concerned facility. There were two separate surveys performed at NAVBASE Charleston: *General Radioactive Material (G-RAM) Survey Plan: Radiological Surveys Conducted to Support Closure of Charleston Naval Base Facilities* and *Radiological Survey Plan for the Decommissioning of Charleston Naval Shipyard*. The G-RAM Survey Plan investigated facilities where general radioactive material (i.e. instrumentation, calibration of instrumentation, etc.) were used, stored or generated. The *Radiological Survey Plan for the Decommissioning of Charleston Naval Shipyard* investigated facilities associated with the Navy Nuclear Propulsion Program (NNPP).

If, during the survey, residual was found to be within a facility, the contaminated material was removed and the surface area cleaned. However, the Zone L Work Plan did not utilize these surveys because: (1) at the time of the development of the Zone L Work Plan all surveys were not complete, and (2) as of April 1, 1996, all radioactive materials and residues had been removed and the surface area cleaned.

Section 2.2 - SWMU 37, Sanitary Sewer System
Comment 7:
Page 2-6 notes that during heavy rain events, the capacity of the treatment plant was exceeded and waste water was discharged directly to the receiving water course without treatment. Where was the treatment plant? When did it begin operation? This and any other relevant information about the treatment plant should be included in the revised workplan.

Response 7:
The above statements referred to the combined sewer system which existed prior to the early 1970's. The combined sewer system discharged all sanitary and industrial waste, as well as storm water runoff, into adjacent waterbodies. However, there was no pretreatment of these discharged wastes. The work plan has been revised to include this modification.

Comment 8:
Several points are listed on page 2-7 (Section 2.2) as general background information. These points are basically data gaps which have been used to focus the Zone L RFI Workplan. For example, item number 3 notes that "identifying known cross-connects and determining their status" was completed as a step in preparing this workplan. However, other than a listing of the known cross connects in Appendix F, this information is not included in the text of the Zone L RFI Workplan. Not only should the locations of the known cross connects be indicated on the appropriate maps, but the Zone L RFI Workplan should be revised to discuss the information gathered in preparation of the workplan. It is also important to discuss fully the

impact(s) this information from all of the points listed on page 2-7 had on the preparation of the Zone L RFI Workplan. This information should be included in the revised workplan.

Response 8:
The work plan has been revised to further discuss the impact(s) concerning the general background information listed on Pages 2-7 and 2-10 required to develop the Zone L Work Plan. In reference to the specific comment concerning point # 3, the major concern of cross-connects is the existence of sanitary to storm sewer connections. This scenario would allow wastewater to be potentially released directly into a waterbody, which would violate the Clean Water Act. Table F-1 (Appendix F) is a list of all known cross-connects, however, these are storm to sanitary sewer connections and are not associated with nor downgradient of an industrial or a potential source of contaminant. Therefore, the cross-connections in Table F-1 will not be investigated under the Zone L Work Plan. For clarity, the work plan has been revised to indicate that the known cross-connects are storm to sanitary as opposed to sanitary to storm and will not be investigated.

Comment 9:
The workplan states on page 2-11 that "Only septic systems that are down-stream of an industrial source will be investigated." It would be more accurate to state that only septic systems which are or ever have been downgradient of an industrial source will be investigated. As the workplan is written, it does not take into account past operations. This clearly is not the case in the overall strategy of the Zone L RFI Workplan.

Response 9:
The work plan has been revised to indicate that only septic systems which are or have been associated with or down-stream of an industrial source will be investigated.

Page 2-11, Section 2.2.1 (Previous Investigations)
Comment 10:
Section 2.2.1 (Previous Investigations) notes information that may be pertinent to investigation of SWMU 37 (the Sanitary Sewer System). In this section it is noted that specific problems with the sewer are described in a report entitled "Wastewater Facilities Evaluation". In addition, the spill reports apparently document material spilled on the ground surface, quantity, location, and remedial efforts taken. However, nowhere in this section is it stated that this information was used in preparation of this workplan, how the information was used, etc. This deficiency has been commented on in previous reviews, both by the EPA and the Department. The locations of known breaks in the sewer line, spills as indicated in the spill reports, remediation efforts taken, etc. are pertinent to investigation of this SWMU. NAVBASE Charleston must not only

take such pertinent information into account in preparation of workplan, but should also describe the information considered and how it influenced the development of the Zone L RFI Workplan.

Response 10:
Appropriate sections of the work plan have been revised to expound on the efforts taken to develop background information and how it was used to develop the work plan. However, as stated in past meetings, it should be noted that the spill documents do not include spills or releases associated with the railroad, sanitary sewer, or storm sewer systems. It should also be noted that the spill or release reports do not include, nor are there maintenance records which identify segments of pipeline that have been repaired due to integrity problems (i.e. collapses, differential settlement, etc.).

Comment 11:
In reviewing Figures 2-1 and 2-2 (AOC 699 - Storm Sewer System and SWMU 37 - Sanitary Sewer System), it is curious that apparently some buildings on NAVBASE Charleston are not served with sewer lines. This is particularly apparent in the southern portion of the base. See for example Building 642, which was the McDonald's restaurant located on base. This figure does not indicate that a sanitary sewer line was available at this building. Likewise, Figure 2-2 does not show that sanitary sewer lines are located in the vicinity of Buildings 675, 676, 677, 668, 669, etc. This is by no means a complete listing of buildings depicted in these figures at which sanitary sewer lines are not shown. NAVBASE Charleston should clarify the presence or absence of sanitary sewer lines at all buildings at NAVBASE and modify the Zone L RFI Workplan accordingly.

Response 11:
The electronic maps, which show the base-wide sanitary and storm sewer systems, made available by the Public Works Department, did not include service lines to each facility; they only indicate collector and main trunk lines. In order to determine the approximate location of service lines to each facility, building files had to be reviewed. Since the Zone L Work Plan will only investigate pipelines which transport wastewater from industrial and potential source facilities, it was determined to only review building files of facilities to be investigated. Therefore, the base-wide maps will only indicate service lines associated with facilities to be investigated, and it will not be necessary to revise the maps, since the information will have very little, if any, relevance.

With the exception of Building 675, the remaining facilities mentioned in Comment 11 are not listed in Tables C-1 and D-1; therefore, no investigative action will be taken at these facilities under the Zone L Work Plan. The building files for Facility 675, Dental Clinic, only indicate there is one sanitary service line which exits the facility, and it is indicated on Figure 2-8.

Page 2-13, Section 2.2.3 (Objectives)
Comment 12:
The workplan reads: "if cross-connect locations cannot be determined by visual examination of manholes, smoke tests or TV surveys may be necessary." The workplan should state exactly what will happen if visual examination does not determine the existence and location of cross-connects. A TV survey, or other means, must still be completed to make this determination. The workplan should be revised accordingly.

Response 12:
The work plan has been revised to indicate that if visual examination of manholes does not pinpoint the location of a sanitary to storm sewer cross-connect identified by dye tests, remote television inspections will be performed on the section of pipeline in question. If a sanitary to storm cross-connect is identified, the Caretaker's Site Office will be notified immediately so correction actions can be performed by the appropriate parties.

Page 2-15, Section 2.2.4 (Sampling and Analysis Plan)
Comment 13:
The workplan notes on page 2-15 that in the case in which contaminant concentrations along a section of pipe are ubiquitous and the source is not obvious, the pipeline will be investigated by remote television cameras. Following this evaluation, if no defects in the pipeline are apparent, no further evaluation will be conducted. The Department does not agree with this approach. It is recognized that there may be some situations in which the source of contamination is not readily apparent based upon data collected up to that point. However, additional assessment may be necessary to identify the source. Simply because the television survey does not detect defects in the section of sewer line under investigation does not mean that further assessment is not warranted. The workplan should be revised accordingly.

Response 13:
It is the intent of this work plan, as it is all of the work plans, to define the nature and extent of contamination. If a contaminant is found to be ubiquitous along a section of pipeline, all measures, whether under Zone L or any other adjacent zone, will be taken to find the source of contamination.

The intent of the statement, "if no defects in the pipeline are apparent, no further evaluation will be conducted", refers to the remote television inspection. If no defects are found by the TV inspection, no additional internal investigation of the pipeline will be performed.

Page 2-16, Section 2.2.4 (Sampling and Analysis Plan)
Comment 14:
The workplan proposes to begin collecting samples along the sanitary sewer system a distance of 200 feet from the intersection of the face of a building that is a "potential source of contaminants". This is in contrast with a building that is determined to be an "industrial source". In the case of a building that is an industrial source, samples will be collected from beside the sewer line immediately adjacent to the point at which the line exits the building face. The reason(s) for the difference in sampling protocol between buildings that are categorized as "potential sources of contaminants" and those called "industrial sources" is unclear in the workplan. It would seem more appropriate to collect samples immediately adjacent to the potential source of contamination. Although it is reasonable to assume that "industrial" sources have a greater potential to cause a release from the sewer system than a "potential source", both are in fact potential sources of contaminant releases to the sewer system. Thus each should be sampled in the same manner, i.e. the first sample location should be adjacent to the building face. The workplan should be revised accordingly.

Response 14:
The work plan and figures have been revised to indicate the first sample taken at a potential source will be collected near the intersection of the sanitary pipeline with the building's face.

Page 2-24, Section 2.2.4 (Sampling and Analysis Plan)
Comment 15:
Sampling locations for oil/water separators (OWS) and septic tanks are proposed on page 2-24. The text on this page states "Due to the limited accuracy of available information, the general schematic of subsurface sample locations presented here is preliminary. Actual location must be determined by field conditions." The exact meaning of these sentences is unclear. Samples should be collected in the exact locations that are proposed in the approved workplans. Field conditions should be taken into account when proposing sampling locations. The workplan should be revised to clarify the meaning of these sentences and to propose specific sampling locations.

Response 15:
As stated on numerous occasions, the information (i.e. maps, plans, documents, etc.) supplied by the Public Works Department does not indicate actual "as-constructed" layouts; they only represent proposed locations. Without physically field locating all of the underground structures in question, the actual horizontal and vertical position, as well as, the dimensions of each structure are unknown. Therefore, a general schematic which represents the structures (i.e. oil/water separators and septic tanks) was developed. Should the general sampling schematic deviate significantly due to a major change in the "field-

located" structure verses the general schematic, a revised site-specific sampling plan will be submitted to the EPA and SCDHEC for review and approval. The work plan has been revised to clearly state this intent.

Page 2-26, Section 2.2.4 (Sampling and Analysis Plan)
Comment 16:
The Zone L RFI Workplan is vague with respect to the groundwater sampling procedures proposed for septic tanks and oil/water separators. Figure 2-9 schematically depicts proposed locations for collection of groundwater samples. According to the legend on this figure, three soil borings downgradient of a septic tank and one downgradient of an oil/water separator will be converted to a shallow monitoring well. However, in the text on page 2-27, it is stated that "The sampling scheme for septic tanks consists of collecting 3 DPT groundwater samples." However, screening technologies such as DPT cannot be used to prove that contamination does not exists; it can only be used to indicate the presence of contamination. Therefore, DPT cannot be used as proposed in the text to determine that groundwater has not been contaminated by either septic tanks or oil/water separators. Shallow monitoring wells are required in order to collect data of sufficient quality (either DQO Level III or IV) to make the determination of whether groundwater is contaminated or not. The workplan should be revised accordingly.

Response 16:
The work plan has been revised to indicate that at each septic tank and drain field one shallow monitoring well shall be installed, where the groundwater sample shall be taken for DQO Level III type analysis. In addition, the work plan will be revised to indicate at each OWS, one shallow monitoring well will be installed and three soil samples will be taken. Each sample shall be taken for DQO Level III type analysis.

If the analytical results require further assessment, additional samples will be obtained by DPT equipment to define the area of contamination. As previously stated, the DPT samples shall be taken for DQO Level II type analysis followed up by DQO Level IV confirmation analyses.

Page 2-27, Section 2.2.4 (Sampling and Analysis Plan)
Comment 17:
The last paragraph on this page states in its entirety:
Related concerns to the septic tanks are former latrines, or "outhouses," which were used as communal toilets. The former latrines will be investigated under the Zone L RFI Work Plan due to the potential for a hazardous material to be discharged into the "open pits" within the latrine. One soil sample will be obtained near the center of each former facility.

The workplan does not describe the number or locations of the former latrines, nor does it include a figure illustrating the proposed sampling locations. The workplan should be revised accordingly.

Response 17:
The work plan has been revised to discuss the investigation of the latrines and outhouses.

Section 2.3 - AOC 504, Railroad System
Comment 18:
According to the Zone L RFI Workplan, NAVBASE Charleston is served by the Chessie Seaboard System (CSX) and the Norfolk Southern (NS) railway. However, according to the Environmental Baseline Survey for Lease (EBSL) and Finding of Suitability to Lease (FOSL) for the railroad system, two different railroad lines have served the base; the Seaboard Coastline Railroad (SCR) and the Southern Railway (SR). This discrepancy should be clarified and the corrected in the revised Zone L RFI Workplan.

Response 18:
During the mid 1980's, Seaboard Coastline Railroad and Southern Railway merged with CSX and NS railways. The Zone L Work Plan accurately reflects the current names of the railroad systems.

Comment 19:
The workplan states on page 2-30 that the investigation of the railroad system will focus on sections of lines where known releases of hazardous materials have occurred. These locations were identified by interviewing railroad personnel, reviewing the CNSY OSHE office spill reports, and by visual inspection. Based on the information obtained, 10 sections of the railroad system have been identified as requiring assessment. However, it is unclear in the workplan who was interviewed and the information that was obtained by these interviews. Likewise, it is unclear what information, if any, was obtained from spill reports. Locations at which spills occurred, when the material spilled, any response measures taken to mitigate the spill, etc. should be summarized in the text of the workplan. From the sites proposed for assessment in this workplan, it appears the primary factor regarding whether a section of the railroad would be assessed was due to visual evidence of contamination. Sections of the railroad that are visibly contaminated should be assessed, however, this isn't the only reason for choosing a section for assessment. Past operations, spills, etc. are also relevant factors that should be considered. Similarly, it is unclear in the workplan why AOC 504-AQ, a section of the railroad located in the DRMO storage area, was identified as a suspect area at which a release may have occurred. The justification for not assessing the entire railroad system in a manner similar to the sewer

systems (such as collecting samples over set intervals), or for designating certain sections of the railroad system as requiring assessment should be included in the revised workplan.

Response 19:
During past meetings to discuss the Zone L Work Plan it was determined not to include actual employees names associated with the rail or sewer systems since they will most likely not be employed due to the closure at NAVBASE Charleston. However, in order to ensure all possible avenues were taken to locate any and all data pertinent to the development of this work plan, the interviewee's name and title has been included in the revised work plan.

As stated previously, the spill reports did not include spills or releases associated with the railroad system; therefore, no response measures are known to have occurred. Based upon the interviews with railroad personnel, past and present locations of possible spills or releases, known releases or spills, and areas where rail cars were stored which contained suspect materials were identified. These areas, as well as areas where staining was visually observed, have been defined as areas to be investigated under the Zone L Work Plan. The work plan has been revised to discuss the information obtained during the interviews.

Railroad personnel identified the DRMO area as a potential site because of the storage of rail cars containing unknown or suspect materials prior to unloading or removal from the base property.

Comment 20:
The text of the workplan notes on page 2-30 that locations of abandoned railroad lines were determined based on review of historical maps of the base. The locations of such railroad lines should be shown on a map and included in the workplan.

Response 20:
Figure 2-10 has been revised to include abandoned rail lines and spurs.

Comment 21:
Ten areas of potential contamination of the railroad system were identified as requiring assessment according to this workplan. Of this number, the Zone L RFI Workplan proposes assessment for three of the sites (AOC-504-AE, AOC-504-AK, and AOC 504-AN). According to the Zone L RFI Workplan, adequate assessment of the remaining seven sites is proposed in other zone workplans. These seven sites are located in various zones, including zones A, F, G, and J. Except for Figures 2-14, 2-23, and 2-24, the figures in the workplan for these seven sites do not indicate the sampling locations proposed in the other zone-specific workplans. Since the workplan purports that adequate sampling is proposed for these sites under other zone-specific

workplans, it appears appropriate to include figures form these other zone workplans in the Zone L RFI Workplan. The workplan should be revised accordingly.

Response 21:
The figures have been revised to indicate the proposed sampling scheme, whether proposed under the Zone L Work Plan, or any other work plan.

Comment 22:
The last bullet on page 2-32 discusses a section of the railroad adjacent to SWMU 109. In part, this bullet states: "During the visual inspection, it was noted that the ground surface in the area of the tracks [AOC 504-AL] and hoppers was covered with a blast media that appeared to be "Black Beauty". For reasons mentioned, no samples are proposed in this work plan." The Zone L RFI Workplan does not state which zone workplan AOC 504-AL is included in, nor the reason samples are not proposed for assessment of this area. If adequate assessment of AOC 504-AL is proposed in another zone-specific RFI workplan, then it should be clearly noted in the Zone L RFI Workplan. Otherwise, sampling of AOC 504-AL should be proposed in the revised Zone L RFI Workplan.

Response 22:
The Zone L RFI Workplan has been revised to state which zone workplan AOC 504-AL is included in, and the number of samples proposed. It should be noted this site is currently planned for interim measure activities to remove the grit on the ground surface.

Comment 23:
The third bullet on page 2-42 notes that AOC-AP is being investigated under the Zone A RFI Workplan. This bullet does not state whether or not additional sampling is proposed at this site, however according to Figure 2-23, eight additional soil samples are proposed to be collected in this area. The workplan should be revised to state explicitly that sampling is proposed at this site.

Response 23:
Figure 2-23 indicates that sampling has been performed under the Zone A Work Plan. The work plan has been revised to explicitly state that additional sampling will be performed in conjunction with the Zone A RFI at SWMU 2.

Page 2-47, Section 2.3.1 (Previous Investigations)
Comment 24:
This section discusses previous and ongoing investigation work that is relevant to assessment of the railroad system. The second sentence on page 2-47 notes that "Spill reports associated with the sites [to be investigated] are available from the Department of Navy Occupational Safety, Health, and Environmental Office." The relevance of this sentence is vague. Were these reports reviewed in preparation of this workplan? If so, this should be clearly stated in the revised Zone L RFI Work Plan.

Response 24:
Since there are no spill or release documents associated with any of the proposed sites, the third sentence on Page 2-47 has been removed.

Comment 25:
Figure 2-24 depicts previous sampling locations and proposed sampling locations in the vicinity of the Defense Reutilization and Marketing Office (DRMO). However, due to the size of the symbols used, it is nearly impossible to distinguish the previous sampling locations from those that are proposed in this workplan. Figure 2-24 should be revised to clearly indicate previous sampling locations from those that are proposed. It is recommended that symbols similar to those used in Figure 2-23 be incorporated into Figure 2-24 to make this distinction.

Response 25:
Figure 2-24 has been revised to ensure the size of all symbols are consistent with other drawings and can be easily differentiated.

Section 2.4 AOC 699, Storm Sewer System
Comment 26:
Section 2.4.3 (Objectives) notes that if cross connections between the sanitary sewer and the storm sewer system are discovered during the RFI, further assessment of the potential of contamination will be completed. The Department certainly agrees with this approach. In addition, since such cross connects would mean that the Navy is in violation of the Clean Water Act by discharging untreated wastewaters to a surface water body, the Navy should be prepared to take immediate action to eliminate such cross connects if they are discovered.

Response 26:
It is agreed if a sanitary to storm sewer cross-connect exists, the Navy could be in violation of the Clean Water Act. The investigation of these cross-connects are being performed under SWMU 37, Sanitary Sewer System. Section 2.2.3, Objectives for SWMU 37, has been revised to state " Once a sanitary to storm sewer cross-connect has been identified,

the Navy will be notified immediately, so corrective measures can be performed by the appropriate parties." Since the storm to sanitary sewer cross-connects have already been identified under the "Wastewater Facilities Evaluation", no further investigations of storm to sanitary sewer connections will be required for AOC 699 in the Zone L Work Plan.

Page 2-52, Section 2.4.4 (Sampling and Analysis Plan)
Comment 27:
It is noted in this section that "sampling will be performed only on storm sewer lines downgradient of industrial sources." This should be clarified that sampling will be completed on storm sewer lines that are downgradient of industrial sources, both past and present.

Response 27:
Both past and present locations of industrial sources are identified in Table C-1. The work plan text has been revised to state that both past and present industrial sources will be investigated.

Comment 28:
On page 2-55 it is noted that if analytical results from sampling along the stormsewer lines indicate a release has occurred but does not provide adequate data to pinpoint the release location, then the pipeline will be investigated by remote television cameras. The workplan then goes on to note that "E/A&H personnel will view all videotapes of the television inspection to locate potential defects." Since these tapes are to be used to determine additional sampling requirements, copies of the tapes should be made available to both EPA Region IV and the Department. EPA Region IV and the Department should have ample opportunity to review the tapes in order to provide concurrence on the Navy's decision of the additional sampling locations and requirements.

Response 28:
All tapes will be made available to the BCT. If a section of pipeline is deemed damaged by reviewing the tapes, an amended sampling plan will be submitted, along with the video tape, to the BCT for review and approval. In addition, the tapes will be made available to the BCT during the 30%, 60% and 90% progress meetings. The work plan has been revised to clearly state the availability of the tapes.

Response to Environmental Protection Agency
Comments For the Zone L RCRA Facility Investigation Work Plan,
Dated October 18, 1995

Comment 1:
Page 1-6, Section 1.2, Last Paragraph. Naval Base Charleston makes a distinction between "industrial sources" and "potential sources." Within itself, this distinction causes EPA no significant concern. In the investigation of Solid Waste Management Unit (SWMU) 37, both terms are used. However, in the investigation of Area of Concern 699, the only term used is "industrial sources" - "potential sources" is not used. Regardless of the term used, EPA is concerned that there be sufficient sampling along both the sanitary and storm sewers to confirm the presence or absence of discharges of hazardous wastes into the environment, i.e., the storm sewers must be investigated downstream of both "industrial sources" and "potential sources."

Response 1:
The purpose of the distinction between the two types of sources is related to historical building operations and the degree of probability that hazardous materials may have been introduced into the sewer systems. As discussed in earlier Project Team meetings, the sampling scheme for "potential" sources was designed due to the low probability that hazardous materials were discharged into the sewer systems, yet sampling was still proposed along the sanitary sewer lines exiting these buildings as a conservative measure. Unless a cross-connect from the sanitary to the storm sewer is found at one of these buildings the Navy feels that adequate sampling to detect a release has been proposed.

Comment 2:
Page 1-7, Section 1.2, First Paragraph. Sumps and drains need to be added to the items to be investigated. There is no discussion of how these will be investigated. These pose a significant potential for the release of hazardous wastes to the environment.

Response 2:
A reference to sumps and drains as they relate to the sanitary and storm sewer systems will be added.

Comment 3:
Page 1-8, Section 1.2, First paragraph. Reference is made to information obtained from the Public Works personnel including "past breaks, separations, collapses, or new construction of pipelines in either sewer system, and of known spills or releases associated with the railroad system." This is important information. However, EPA can not identify where this information has been considered in the Zone L RFI Work Plan. Nowhere in the Sampling and Analysis Plan is this information considered. These locations need to be identified on the maps and addressed within the text; they need to be investigated within this RFI.

Response 3:
With respect to both sewer systems, the information obtained through interviews with Mr. Cleatwood Droze was very limited and only identified one section of pipeline along Second Street in Zone C that meets the criteria listed above. As for the railroad system, Mr. Droze suggested that a Mr. Rhodes, head of the NAVBASE Charleston Railroad Department, be interviewed concerning specific matters concerning the railroad system. Mr. Rhodes was able to identify areas of possible concern; however, he did not have nor did he know of any records of past releases or spills associated with the railroad system. The areas discussed in Section 2.3 were identified by Mr. Rhodes as areas where railcars were parked and "heels" may have been allowed to discharge onto the railroad tracks. The work plan will be revised to include information obtained during interviews with all Public Works personnel. This information, along with other pertinent background information, served as the basis for the sampling and analysis plan. The intended purpose of Section 1.2 was to provide the reader with a general description of the types of information that were considered to develop a sampling strategy for Zone L.

Comment 4:
Page 1-9, Section 1.3, First Paragraph. The assumption is made that storm sewers are the only sources which may need to be investigated in Zone J. It is not clear that sanitary sewers will also be investigated. It is not clear that former sewers will be investigated. At one time there was only one combined sewer which has since the 1970s been separated into the sanitary sewer and the storm water sewer; the completeness of this separation has not been documented. As noted on Page 1-7, there have been former sewer lines which have been abandoned or removed. Cross-connects between the sanitary sewers in some cases may have been removed. In any case, all former and present sewers with the potential of transferring and discharging hazardous wastes need to be identified and investigated.

Response 4:
The purpose of Section 1.3 was to merely inform the reader that Zone L is only a part of the RFI being conducted at NAVBASE Charleston and that, where possible, data sharing between zones is being closely coordinated to ensure no problems are overlooked or duplicate information is generated. The reference to the storm sewers is only one example provided for the reader's benefit to describe a situation where inter-zone coordination will be critical. More specific detail of regarding the various elements of what the Zone L investigation will encompass are provided in Section 2.0 of the work plan.

Comment 5:
Page 2-3, Section 2.1.4, First Paragraph. The assumption is made that all sampling will be at the Data Quality Objective (DQO) Level II or IV. While DQO Level II is acceptable as a

screening tool, it should identify where DQO Level III sampling should be performed. DQO Level IV sampling should be performed for Zone L just as with all other zones. DQO Level II data can not be used to conclude that an area is "environmentally clean." Rather it is very useful in identifying where DQO Level III data should be collected.

Response 5:
Based on the sampling strategy outlined in the work plan, DQO Level III sampling is viewed to be an unnecessary intermediate step. The samples described as DQO Level II are identified primarily because they are being collected with a direct push sampling device. The only proposed modification to the strategy is that samples be analyzed at a fixed base laboratory using SW-846 Methods rather than a field laboratory. This should result in a higher degree of quality assurance for the screening level sample analysis. The screening analysis will be used to direct Level IV confirmation sampling at a minimum of 10% of the screening locations. It should be noted that this is the same frequency used in the other zone investigations to provide confirmation of the Level III results. The higher level samples will be collected at locations where both positive and non-detect Level II results are reported; so, in essence, conclusions are not being drawn based solely on Level II results. The work plan provides criteria for increasing the frequency of higher quality samples should the margin of variance in results between the Level II and Level IV samples exceed an unacceptable margin.

Comment 6:
Page 2-3, Section 2.1.4, Third Paragraph. The statement is made that:

> If the initial DQO Level III and IV samples proposed for the railroad system fail to define the nature and extent of contamination, screening level data may be collected to complete the site characterization.

EPA disagrees. DQO Level II screening data are acceptable to identify where DQO Levels III and IV sampling need to be performed but are no substitute for DQO Levels III and IV sampling. DQO Levels III and IV data must be collected to complete the site characterization, including both the presence and absence of contaminants.

Response 6:
The sampling strategy is not complete. It has been revised to state that upon completion of the screening level analyses, a percentage of DQO Level IV samples will be collected for confirmation.

Comment 7:
Page 2-10, Section 2.2, Penultimate Paragraph. Appendices C and D list facilities or sites driving the Zone L investigation. Are these existing, active sources, or do they include former sources too? Former as well as current sources which stored or transferred hazardous wastes need to be investigated.

Response 7:
The paragraph has been revised to indicate that the lists are composed of both current and former facilities/sources.

Comment 8:
Page 2-11, Section 2.2. No additional information is provided concerning which oil/water separators discharge water to the Cooper River via the storm water system. This information should be provided if available, and determined if it is not currently available.

Response 8:
Presently it is unknown as to which OWS discharges into either the sanitary or storm sewers. The work plan has been revised to incorporate dye tests on OWSs to determine which sewer system it is connected to.

Comment 9:
Page 2-13, Section 2.2.4, Paragraph 2. Again, DQO Levels II and IV are mentioned; DQO Level III is not mentioned. See previous comments regarding DQO Levels II, III, and IV samples.

Response 9:
See Response 5.

Comment 10:
Page 2-13, Section 2.2.4, Second Paragraph. EPA agrees with the first sentence but disagrees with the second sentence. Pipelines leak anytime and anywhere their integrity has been comprised, i.e., above or below the water table, surcharged or practically empty. EPA has made this point on numerous occasions before and asks that it not raised again in future Work Plans.

Response 10:
The statement has been revised.

Comment 11:
Page 2-15, Section 2.2.4, First Paragraph.

a. It needs to be made clear that a contaminated area in the vicinity of a pipeline will be evaluated and the source identified, e.g., migration of contaminants from a nearby Solid Waste Management Unit (SWMU), the pipeline is currently discharging hazardous wastes into the environment, or the pipeline discharged hazardous wastes into the environment at some time in the past.

b. The remote television inspection is designed to:
   1) Locate segments of pipelines where hazardous materials are being discharged from the pipeline into the environment, and to

   2) identify existing cross-connects.

Response 11a:
The work plan will be revised to clearly state that if it is determined that a contaminated area in the vicinity of a pipeline exists, the pipeline will be investigated and the source identified. This will include areas where abandoned or existing pipelines were or are located.

Response 11b:
The work plan will be revised to clarify the intended purposes of the remote television inspections.

Comment 12:
Page 2-16, Section 2.2.4, Third Paragraph. The statement is made that "The interval-based sampling will terminate at the exiting point of the main trunkline from the NAVBASE property." This is acceptable for existing conditions. However, it does not take into consideration former sewer lines with particular attention to the combined sewer system which existed prior to the 1970s. This combined sewer system needs to be investigated, including its discharges into the adjacent waterbodies and septic tanks.

Response 12:
As stated on numerous occasions, Zone L will investigate both existing and abandoned sewer pipelines. This includes pipelines which were constructed as part of the combined sewer system. The work plan will be revised to clarify this concern.

Comment 13:
Page 2-24, Section 2.2.4, First Paragraph. It is mentioned that sampling will be conducted downstream of storm lines where cross-connects are indicated by the dye test. This is acceptable but it should be kept in mind that sampling is not limited to existing cross-connects; it includes former cross-connects as well.

Existing cross-connects need to be identified so they can be eliminated and prevent problems for future property users.

Response 13:
The work plan will be revised to indicate that if existing or former sanitary to storm sewer cross-connects are identified, they will be referred to the Caretaker's Site Office for corrective measures.

Comment 14:
Page 2-24, Section 2.2.4, Second Paragraph. See previous comments regarding DQO Level IV.

Response 14:
See Response 5.

Comment 15:
Page 2-30, Section 2.3, First Full Paragraph. The statement is made that "The investigation of the rail system will focus on sections where known releases of hazardous materials have occurred, and areas where sections were removed and residual contamination from the cross ties may be present." This is acceptable as far as it goes. However, there is no information regarding releases from the rail system. This information should be readily available from either the Public Works Office or the Environmental Office (Code 106). There is no mention of tank wash areas, or rail spurs where railcar-tanks were parked and the heels were allowed to discharge to the railroad tracks. This information should be available from the Public Works Office. Some of this information may not be documented but Cleatwood Droze in that office can identify these areas from memory.

Response 15:
Mr. Cleatwood Droze was interviewed on several occasions to obtain information concerning the railroad system, as well as the sanitary and storm sewer system. Mr. Droze was able to provide information relevant to the Zone L investigation; however, he suggested that Mr. Bobby Rhodes, head of the NAVBASE Charleston Railroad Department, be interviewed concerning specific matters concerning the railroad system. Mr. Rhodes was able to identify areas of possible concern; however, he did not have nor did he know of any

records of past releases or spills associated with the railroad system. The areas identified by Mr. Rhodes included locations where railcars were parked and where "heels" were allowed to discharge onto the railroad tracks. The work plan will be revised to indicate how and what information was obtained in order to develop the basis for investigating the railroad system.

Comment 16:
Page 2-48, Section 2.3.4. No mention is made of interviews with the Public Works Office. Again, Cleatwood Droze needs to be consulted.

Response 16:
The names of all Public Works personnel who were interviewed have been included in the revised work plan.

Comment 17:
Page 2-52, Section 2.4.3. No mention is made of the combined sewer system or former cross-connects. No mention is made of former or abandoned sewer systems. These need to be considered in the investigation of the storm sewer system.

Response 17:
The work plan has been revised to reiterate that abandoned or former sewer lines, as well as existing sewer lines downgradient of industrial sources, will be investigated. The sanitary to storm sewer cross-connections will be investigated in SWMU 37 -Sanitary Sewer System.

Comment 18:
Page 2-52, Section 2.4.4. No mention is made of "potential sources." (See EPA comment above regarding Page 1-6, Section 1.2, Last Paragraph.) Both "industrial sources" and "potential sources" need to be investigated.

Response 18:
See Response 1.

Comment 19:
Pages 2-52 to 2-59, Section 2.4.4. This section does not clarify how the investigation of the storm sewer system will address the potential for surface soil contaminants to be transported into the storm sewer system (and potentially into the Cooper River) via surface water runoff.

However, it is likely that such transport of contaminated surface soils will occur and therefore needs to be addressed either in the Zone L, or other Zone-specific investigations.

Response 19:
Sediment that accumulates in storm sewer catch basins in the vicinity of SWMUs and AOCs is being sampled in conjunction with the other zone investigations. An example is SWMU 2 in Zone A where sediment in catch basins has been sampled to determine if lead residue from the DRMO storage bins is being washed into the sewer system during rainfall events. There are also a number of sites in Zone E that have been sample in the same manner and the catch basins are now the focus of an interim measure intended to remove contaminated sediment. The work plan has been revised to clarify this point.

Comment 20:
Page 2-53, Section 2.4.4, First Paragraph. See previous comments regarding DQO Levels.

Response 20:
See Response 5.

Comment 21:
Page 2-53, Section 2.4.4, Second Paragraph. See comment above regarding Page 2-13, Section 2.2.4, Second Paragraph.

Response 21:
See Response 10.

Comment 22:
Page 2-54, Section 2.4.4, Second Paragraph. See previous comments regarding potential sources, and the combined sewer system.

Response 22:
See Responses 17 and 18.

Comment 23:
Page 2-55, Section 2.4.4, First Paragraph. See comment above regarding Page 2-15, Section 2.2.4, First Paragraph.

Response 23:
See Response 11.

Comment 24:
Page 2-59, Section 2.4.4, Last Paragraph. See previous comments regarding the combined sewer system and cross-connects.

Response 24:
See Responses 17 and 18.

Comment 25:
Incorporation of Zone L data into Baseline Risk Assessments. Because Zone L is essentially linear, i.e. the sewer lines and rail tracks, and moves through all the other zones, the exposure units to which receptors may be exposed under the various exposure scenarios may include samples unique to Zone L. In addition, these unique Zone L samples may contain different contaminants than proximal SWMUs because of the ease of contaminant transport in the sewer lines. Hence, the consideration of these unique Zone L samples as possible "hot-spots" and the use of the FI term is encouraged when performing risk assessments.

Response 25:
The fraction ingested from contaminated source will be considered when quantifying exposure to "hot spots" associated with Zone L. This approach will be particularly pertinent for soil pathway assessment. With respect to groundwater, results from Zone L and SWMUs/AOCs associated with other zone investigations will be evaluated in order to obtain an estimate of reasonable maximum exposure.

Comment 26:
Direct Push Technology (DPT) Groundwater Sampling.

a. This method is proposed for use around sewer pipelines downgradient of potential contaminant sources. Groundwater samples obtained with DPT may produce spuriously high analytical results for metals because of fines entrained in the sample. For example, on page 2-17, Table 2-2 proposes 256 groundwater samples to be screened for arsenic, beryllium, cadmium, chromium, lead, mercury, and zinc as well as organic chemicals. The levels of metals in these DPT samples, if elevated, may not be cause for concern. Interpretation of metals analyses from these samples will need to be performed with care. It might be advisable to collect filtered groundwater samples in addition to unfiltered samples. Neither the filtered, nor the unfiltered DPT samples may be of sufficient

quality for a risk assessment. Again, care will need to be exercised in the interpretation of these data and the possible need for further investigation based on these DPT groundwater samples.

b. Extensive use of DPT has been proposed in lieu of the use of a video camera to examine the sewer system. In a conversation on December 4, 1995 with Jack Mayfield of EnSafe in Charleston, the EPA reviewer learned that difficulties in tracking the camera through the sewers had been previously encountered. These prior difficulties should be made explicit in the document.

Response 26a:
Section 2.1.4 of the work plan has been revised to state filtered samples will be collected in addition to the unfiltered samples. It is agreed that care will need to be exercised in the interpretation of these data. At a minimum, permanent wells will be installed at 10% of the screening locations to help confirm the results of the screening study.

Response 26b:
Section 2.2.3 of the work plan has been revised to discuss past difficulties in tracking the camera through the pipelines.

Comment 27:
Sampling Scheme for Industrial versus Contaminant Sources. A figure presenting this scheme as a tree diagram should be included. It would make the text read more clearly.

Response 27:
A tree diagram presenting the sampling scheme for industrial verses potential contaminant sources has been included as Figure 2-3 in the revised work plan.

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ABBREVIATIONS AND ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AL	Action Level
AOC	Area of Concern
BCT	BRAC Cleanup Team
bgs	below ground surface
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
CEC	Cation Exchange Capacity
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CHASP	Comprehensive Health and Safety Plan
CMS	Corrective Measures Study
CNSY	Charleston Naval Shipyard
CRZ	Contamination Reduction Zone
COPC	Contaminants of Potential Concern
CSAP	Comprehensive Sampling and Analysis Plan
CSI	Confirmatory Sampling Investigation
CSX	Chessie Seaboard System
DPT	Direct Push Technology
DRMO	Defense Reutilization and Marketing Office
DQO	Data Quality Objectives
E/A&H	EnSafe/Allen & Hoshall
EBS	Environmental Baseline Survey
EMT	Emergency Medical Technician
EZ	Exclusion Zone
FID	Flame Ionization Detector
FISC	Fleet Industrial Supply Center
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDLH	Immediately Dangerous to Life and Health
LEL	Lower Explosive Limit
LF	Linear Feet
MSDS	Material Safety Data Sheet
mg/m^3	milligrams per cubic meter
NAVBASE	Naval Base Charleston
NCSD	North Charleston Sewer District
NIOSH	National Institute for Occupational Safety and Health
NS	Norfolk Southern

OSHA	Occupational Safety and Health Administration
OSHE	Occupational, Safety, Health, and Environmental
OWS	Oil/Water Separator
PAH	Polynuclear aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PEL	Permissible Exposure Limit
PHSM	Project Health and Safety Manager
PID	Photoionization detector
POL	Petroleum, Oils, and Lubricants
PPE	Personal Protective Equipment
ppm	Parts per million
PRG	Preliminary Remediation Goals
PVC	Polyvinyl chloride
PWD	Public Works Department
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SAR	Supplied-air respirator
SCBA	Self-contained breathing apparatus
SCDHEC	South Carolina Department of Health and Environmental Control
SHSO	Site Health and Safety Officer
SOUTHDIV	Southern Division
SVOA	Semivolatile Organic Analysis
SVOC	Semivolatile organic compounds
SWMU	Solid Waste Management Unit
SZ	Support Zone
TCLP	Toxicity Characteristic Leachate Procedure
TIC	Tentatively Identified Compound
TLV	Threshold Limit Value
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
USEPA	U.S. Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compounds
ZLHASP	Zone L Health and Safety Plan

1.0 INTRODUCTION

As part of the U.S. Navy Comprehensive Long-Term Environmental Action Navy program, the following Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan has been prepared for Zone L at Naval Base Charleston (NAVBASE). This work plan addresses field investigation techniques and sampling and analysis requirements specific to the sites within Zone L and is intended for use in conjunction with the *Final Comprehensive RFI Work Plan* prepared for NAVBASE. The Solid Waste Management Units (SWMU) and Areas of Concern (AOCs) to be investigated within Zone L are presented in Appendix A.

Zone L is unique in the respect that it has no geographic boundary within the contiguous property of NAVBASE and is comprised of the sanitary sewer system excluding domestic sources, the storm sewer system, and the railroad system. At least a portion of one or more of the components of Zone L exists within the boundaries of the remaining 10 investigative zones within the contiguous NAVBASE property. The BRAC Cleanup Team (BCT) elected to designate the sewer systems and railroad system as a separate "zone" that could be evaluated in its entirety at one time rather than conduct a piecemeal investigation of each as the individual zones were investigated.

1.1 Environmental Settings

Physiography

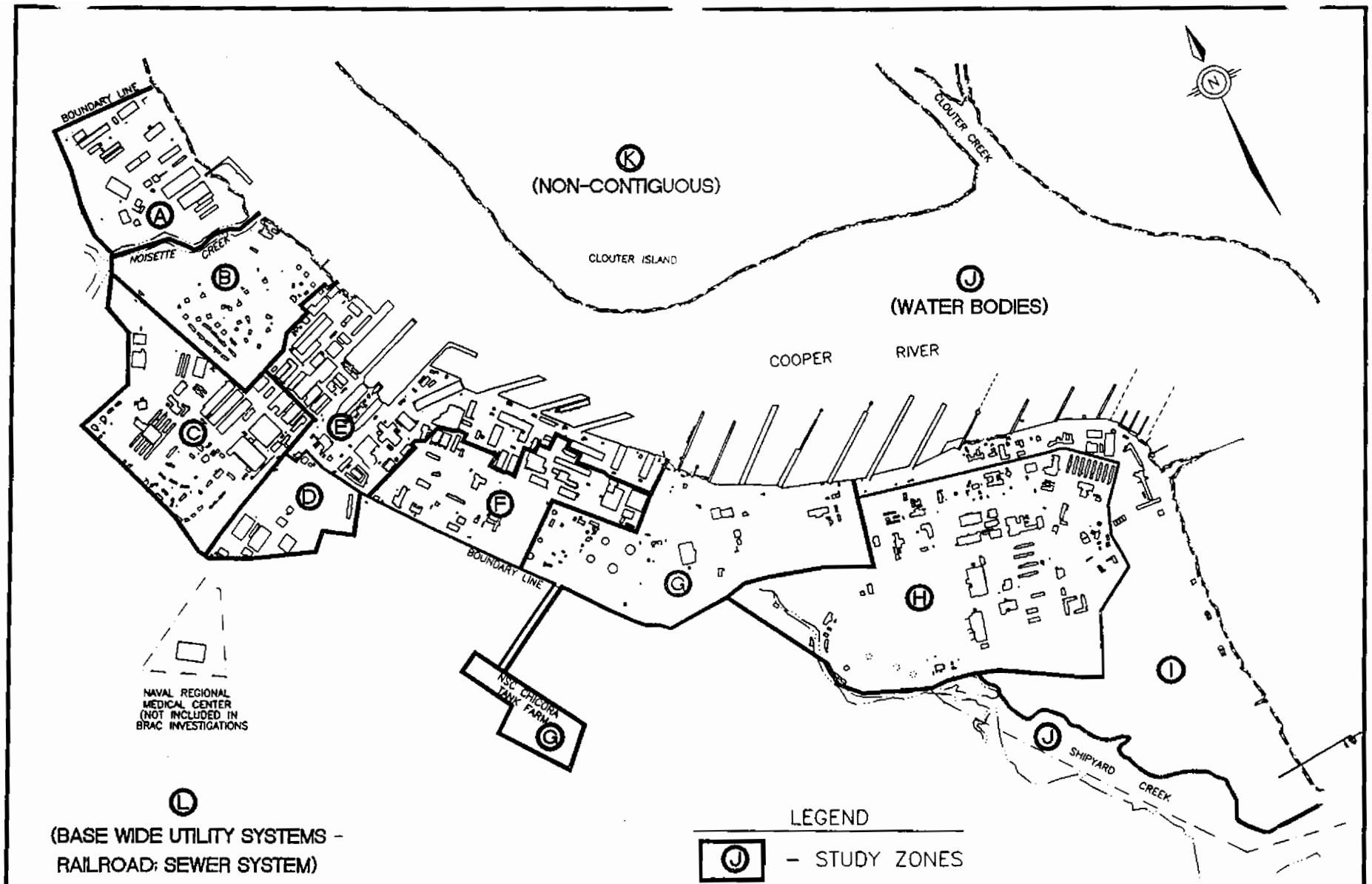
As previously described, Zone L encompasses the entire NAVBASE, which is made up of 2,985.64 acres situated on the western bank of the Cooper River. The area is relatively flat topographically and is drained by Noisette Creek, Shipyard Creek, and the Cooper River. Figure 1-1 identifies the boundaries of NAVBASE (Zone L) and Zones A through K, which are being investigated under other work plans.

Geologic and Hydrogeologic Information

The local and regional geologic/hydrogeologic characteristics are described in Volume II, Sections 1.2 through 1.5 of the *Final Comprehensive RFI Work Plan*. Of particular relevance is the origin of soil throughout NAVBASE. Like most of the Charleston peninsula bordering the Ashley, Cooper, and Wando Rivers, NAVBASE was low-lying marsh when it was established in the early 1900s. Portions of the northern end and almost the entire southern end of the base were filled with a wide variety of known and unknown materials to make the property suitable for development. Most of the filling activity took place during the 1930s and 1940s. Figure 1-2 indicates the extent of filling operations.

Climatology

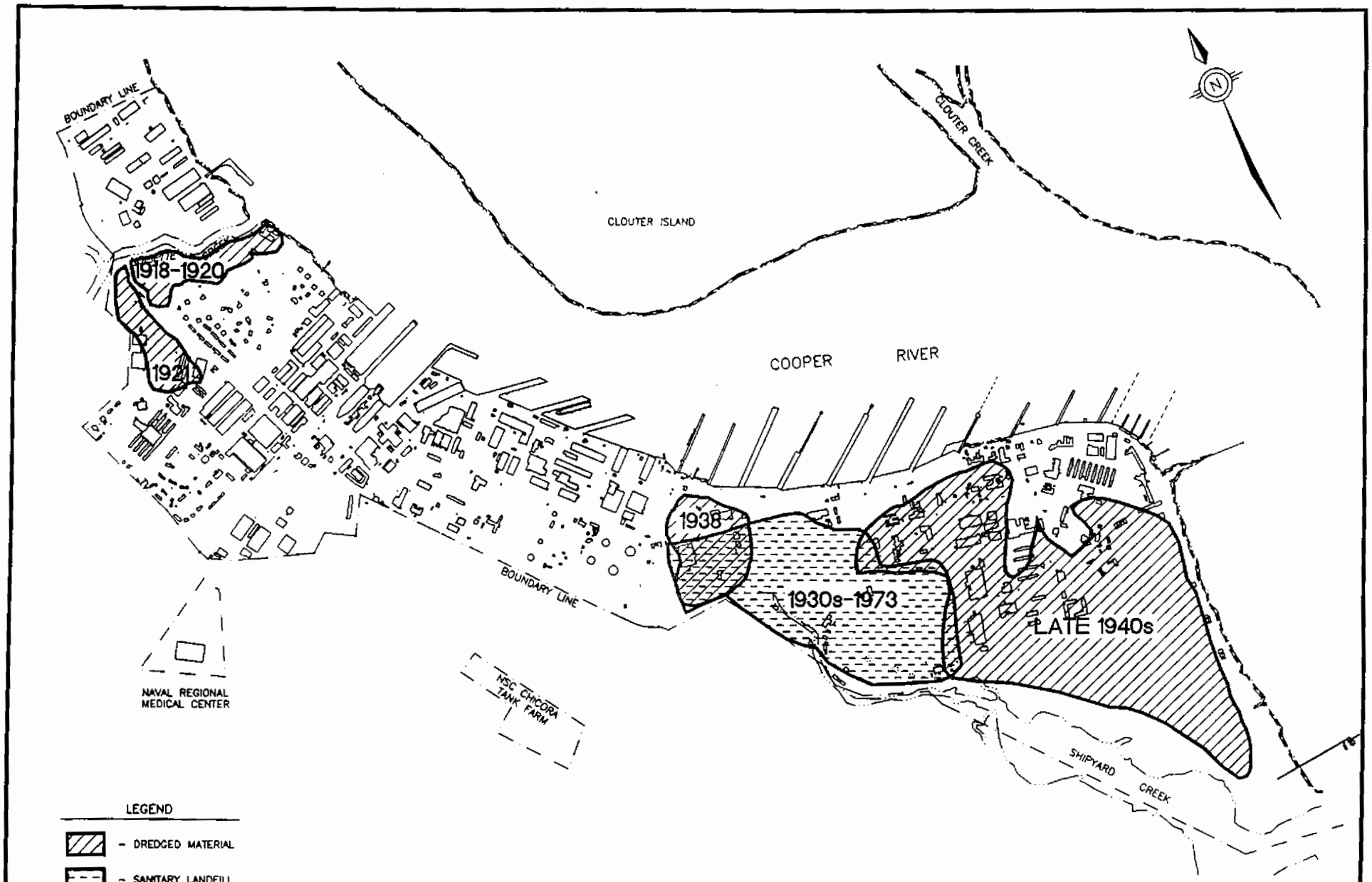
The climate of NAVBASE is described in Volume II, Section 1.6 of the *Final Comprehensive RFI Work Plan*.



FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 1-1
ZONE BOUNDARIES

DWG DATE: 10/18/95 | DWG NAME: 029ZONE



FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 1-2
NAVBASE FILL AREAS

DWG DATE: 08/18/95 | DWG NAME: 29FILCH1

1.2 Investigative Strategy

The proposed investigative approach for each AOC and SWMU in Zone L was developed in consultation with the BCT and in accordance with the overall investigative strategy presented in Section 2, Volume I, of the *Final Comprehensive RFI Work Plan*, which emphasizes the "Fast-Track Cleanup" program. The purpose of the RFI is to collect data that will ultimately identify contaminants of potential concern (COPCs), if present, to define nature and extent of contamination, and to provide data to support a baseline risk assessment (BRA) and corrective measures study (CMS). As defined in the Comprehensive RFI Work Plan, the extent of contamination is the horizontal and vertical area in which the concentrations of COPCs in the investigated media are above either preliminary remediation goals (PRGs) or background concentrations, whichever is appropriate. To determine the necessity for sampling beyond what is proposed in this work plan, the data will be evaluated regarding potential human health impacts expressed as PRGs, ecological risk, and technical requirements for a CMS. For some chemicals, additional information regarding background concentrations will be required, resulting in further onsite data collection. Background concentrations, migration pathways, human and ecological receptors, and PRGs are discussed in Section 1, Volume III of the *Final Comprehensive RFI Work Plan.*

The varying concerns associated with the sanitary sewer, storm sewer, and railroad systems required that differing approaches be developed for investigating sites associated with each. Below is a description of the general approach used to develop an investigative strategy to adequately characterize each site. The general approach which was followed to develop an investigative strategy to provide an adequate site characterization is described below.

The RFI to be conducted on the sanitary sewer system will focus on sections of the line downgradient of industrial sources and potential sources of contaminants where releases to the environment may have occurred. For purposes of this investigation, industrial sources are

facilities where wastewater containing potentially hazardous materials were routinely discharged to the sanitary sewer system. These types of facilities include plating shops, galvanizing shops, etc. Potential sources of contaminants are facilities where the potential for a "one-time" discharge of hazardous materials to the sanitary sewer system may have occurred. Of considerable concern to the investigation of the sanitary sewer system is the existence of sanitary sewer to storm sewer system cross-connections, which may result in improper discharges of wastes to surface water bodies such as the Cooper River. Other areas included in the sanitary sewer investigation are septic systems, oil/water separators (OWS), latrines, and sumps/drains associated with industrial sources that are connected to the system. The investigation of the storm sewer system will focus on identifying sections of the pipeline downgradient of industrial sources of contaminants where releases to the environment may have occurred. The investigation of the railroad system will concentrate on areas where hazardous materials may have been spilled during loading/off-loading operations, tank car "heels" were possibly drained, and sections of rail lines were abandoned.

The first step in the strategy for investigating the sites in Zone L involved intensive research due to the enormous size of the zone and limited information readily available. As part of the development of this work plan, aerial and utility system maps were obtained to determine the boundary limits of each system. The more recent maps provide schematics representing the "present day" location of each system's lines. However, they do not indicate the location of abandoned or removed lines which also could have served as potential sources of contaminant release. Therefore, in an effort to identify the latter, historical maps dated back to 1901 were reviewed.

Additional background information was obtained by reviewing all reports and records associated with each system. Previous reports and records included *Wastewater Facilities Evaluation*, September 1990; *Environmental Baseline Survey* (EBS), Volumes I through IV, March 1995;

RCRA Facility Assessment (RFA), Volumes I through V, June 1995; and the Charleston Naval Shipyard (CNSY) Occupational Safety, Health, and Environmental (OSHE) office spill reports. It should be noted that upon review of the OSHE office spill reports, no documentation of spills and/or releases associated with either the railroad, sanitary sewer or storm sewer system was located. Specific information obtained from the *Wastewater Facilities Evaluation* included the location of known storm sewer to sanitary sewer cross-connects, septic tanks, and oil/water separators. The locations of the cross-connects, whether active and inactive, are important to determine where a contaminant from one sewer system could potentially be transferred to the other sewer system.

Information obtained from the EBSs and RFAs includes the history of each facility located at NAVBASE Charleston. These documents discussed the specific process conducted at each facility. This information was critical in developing a list of facilities which generated, stored, or used known hazardous materials. The spill reports indicate locations of spills, or releases, onto the ground surface. This information established the location of releases which may have had the potential to enter either sewer system or contaminate the railroad system. The final task associated with obtaining background information consisted of interviewing Navy and Public Works personnel. These interviews established "first hand" knowledge of past breaks, separations, collapses, or new construction of pipelines in either sewer system, and of known spills or releases associated with the railroad system.

The information reviewed resulted in a focused list of facilities, current and former, where the potential of a release of hazardous materials to the environment exists. To the extent possible, data from other ongoing zone investigations will be utilized in the characterization of these sites to prevent a duplication of effort. Relevant background information and specific procedures for investigating the sites are presented in Section 2 of this document.

The proposed schedule for conducting the Zone L investigation is included in the revised *Corrective Action Management Plan* prepared for the NAVBASE RFI. Zone L investigative activities will be closely coordinated with U.S. Environmental Protection Agency (USEPA) Region IV and South Carolina Department of Health and Environmental Control (SCDHEC).

1.3 Other Relevant Investigations

Because the Zone L investigation is part of a larger investigative strategy, some pathways included for examination in Volume III, *Final Comprehensive RFI Work Plan* that may be relevant to this effort will be considered in other investigations. For example, to identify potential impacts from point sources such as storm sewer outfalls, sediment and surface water sampling may need to be addressed in the Zone J investigation.

Groundwater flow and hydrology are dependent upon base wide conditions. Information gathered in this investigation will contribute to characterizing groundwater but will not fully characterize all groundwater processes. Background concentrations for chemicals or metals relevant to the Zone L RFI will be determined as part of the respective zone investigation in which the affected Zone L site is located.

2.0 SITE INVESTIGATION PLANS

2.1 SWMU- and AOC-Specific Investigatory Approach

The SWMUs and AOCs in Zone L requiring RFI activities, as determined in the RFAs, Volumes I, II, and V, June 1995, are presented in the following sections. Each site or group of sites to be investigated is summarized, including site history, previous investigations, data gaps, and investigative objectives. The last discussion addresses the investigative approach, including general sampling locations where appropriate.

Tables A-1 and A-2 (Appendix A) list the locations of sites within Zone L, the investigative approach, and the section in which each site is discussed in this work plan.

As discussed in Section 1.2, an investigative strategy was developed in consultation with the BCT in order to ultimately define the nature and extent of contamination associated with the sanitary sewer, railroad, and storm sewer systems. The strategy began with obtaining general background information. This section discusses specific background information required to complete the approach.

2.1.1 Treatment Alternatives

As outlined in the overall sampling strategy in the *Final Comprehensive RFI Work Plan*, treatment alternatives are being identified for sites likely to require remediation. Data collection efforts will support the evaluation of these alternatives. Table B-1 lists treatment alternatives for groundwater and surface water runoff; Table B-2 lists treatment alternatives for soil and sediment, and Table B-3 lists treatment alternatives for soil gas. These tables are found in Appendix B.

2.1.2 Migration Pathways

The migration pathways identified for each site in this work plan are, at a minimum, consistent with the write-ups in the RFAs. Additional pathways have been added to some sites based on information more current than the applicable RFA. Conversely, if pathways have been deleted from some sites based on additional information, justification is included in the applicable site-specific section. Pathways anticipated for sampling are denoted in bold type in each site-specific description table.

2.1.3 Potential Receptors

Potential receptors that may be exposed to site contaminants include current land users, such as NAVBASE personnel, and any future users this area may support following base closure. Data will be generated during the investigation to determine the level of risk to the spectrum of current and potential future receptors, including any highly sensitive individuals within the population, who may be exposed through invasive or noninvasive activities. The risk evaluation will also consider ecological receptors that may be present. Investigation and sampling efforts will include characterizing all potential pathways of exposure at the site, including those in bold type in the description tables.

The subsurface utility system may have acted as a conduit for moving products or waste released from sites and, as such, could expose personnel working on the subsurface systems, as well as provide a contaminant route to NAVBASE water bodies. The Zone J Work Plan will address water bodies in greater detail. NAVBASE water bodies could receive contaminated sediment, surface water runoff, and groundwater discharges, thus exposing biological receptors other than humans.

2.1.4 Screening Alternatives

The decision to use screening methods must fit into the overall objective of the investigation being conducted. For the Zone L RFI direct push technology (DPT) sampling has been identified as a technically viable, time efficient, and cost effective means of preliminarily characterizing sites. While there are many benefits to this type of sampling there are also limitations that need to be recognized prior to describing the intended scope of the screening investigation. These limitations are as follows:

- Sample collection efficiency (particularly groundwater) is highly depending on subsurface lithologic conditions.
- Sampling volume capabilities may be too limited to provide adequate sample volume for a multiple scan analysis.
- Sediment fines entrained in groundwater samples tend to result in high turbidity levels which may result in falsely elevated results for metals analysis.
- Samples may not result in data of sufficient quality to support a baseline risk assessment.

Presently, very little sampling has been conducted to determine COPCs associated with the sanitary sewer, storm sewer, or railroad systems. Due to the enormous area of the sanitary sewer and storm sewer systems to be evaluated, soil and groundwater samples will be collected using a DPT method in accordance with Revision 1 to the *Comprehensive RFI Work Plan*. Samples collected will be sent for analysis by SW-846 Methods to one of the laboratories identified in the *Comprehensive RFI Work Plan*. Sample results will be requested within a time frame that supports an expedited decision making process should additional sampling be required. The data to be generated is intended to meet EPA Data Quality Objective (DQO) Level II criteria at a minimum. DQO Level II data is suitable for preliminarily determining the presence/absence of contaminants and defining the nature and extent of contaminants if necessary. To verify the results, the screening data will be compared with higher quality, DQO

Level IV samples collected for confirmation purposes at a minimum of 10% of the screening locations, or with these samples made available as a result of other zone investigations. The confirmation samples will be collected at locations where both positive and non-detect results are reported with the screening analysis. If the screening results vary from the confirmation results by more than 2 orders of magnitude, additional confirmation samples will be collected. To assist with the interpretation of groundwater metals data, samples filtered with a 0.45 micron membrane will be collected to supplement the total or unfiltered metals sample analysis. Comparison of filtered versus unfiltered sample data will provide a reasonable and practical distinction between true solute material and particulate matter.

If the initial DQO Level III and IV samples proposed for the railroad system fail to define the nature and extent of contamination, screening level data may be collected to complete the site characterization. Upon completion of the screening level data, additional DQO Level IV samples will be taken. These DQO Level IV samples will be used as a comparison with the screening data and, at a minimum, shall equal 10% of the total DQO Level II locations.

Similar to well installations, all DPT locations intended for the collection of groundwater samples will be installed by a South Carolina licensed well driller. Upon completion of sample collection at each location, the sample probe will be retracted and the open hole properly abandoned with a high solids bentonite grout.

Soil gas is a potential migration pathway at the sites; however, quantitative analyses for contaminants in the soil gas are not proposed for this work plan. Instead, qualitative screening will be conducted in routine health and safety monitoring and soil sampling protocols. Boreholes and samples will be screened for volatile organic compounds (VOCs) using a flame ionization detector (FID) or photoionization detector (PID) when drilling soil borings and monitoring wells. All screening results will be recorded in field logbooks and boring logs.

2.1.5 Radiological Potential

The CNSY Radiological Control Office has determined a number of sites in Zone L have a low potential for radioactivity. CNSY will perform detailed radiological surveys at these locations and document that radioactive materials have been removed. This process may be independently verified by USEPA and SCDHEC. There were two separate surveys performed at NAVBASE Charleston: *General Radioactive Material (G-RAM) Survey Plan: Radiological Surveys Conducted to Support Closure of Charleston Naval Base Facilities* and *Radiological Survey Plan for the Decommissioning of Charleston Naval Shipyard*. The G-RAM Survey Plan investigated facilities where general radioactive material was used, stored, or generated. The *Radiological Survey Plan for the Decommissioning of Charleston Naval Shipyard* investigated facilities associated with the Navy Nuclear Propulsion Program (NNPP). The Zone L Work Plan did not utilize these surveys because: (1) at the time of the development of the Zone L Work Plan all surveys were not complete, and (2) as of April 1, 1996 all radioactive materials and residues had been removed and the surface area cleaned.

Contractor sampling within Zone L will not proceed until applicable Navy radiological verification surveys have been completed at the sampling location. As sampling is scheduled, and before sampling at any point in Zone L, EnSafe/Allen & Hoshall (E/A&H) will contact the CNSY General Survey Project Superintendent to determine if the verification surveys have been completed. Once the completion of surveys has been verified, no gamma screening will be required for samples collected in the verified areas. CNSY will support E/A&H sampling schedules by adjusting its survey schedules with reasonable advance notice.

2.1.6 Site Labeling

Breakdown of AOCs and SWMU into smaller sites requires developing a labeling scheme that ensures a unique label for each site. The labeling scheme presented below also uses the sample-labeling format specified in Volume II, Section 11 of the *Final Comprehensive Sampling*

and Analysis Plan (CSAP), which is essential for sample management. Each site will be listed by its AOC or SWMU designation, followed by an assigned two-letter code representing the order in which the site was encountered. The assigned two-letter code will not include the letters I and O per the direction of Volume II, Section 11 of the CSAP. As a result the letters "A" through "K", excluding the letter "I" will represent the numeric digits 0 through 9 (A=0, B=1, C=2, D=3, E=4, F=5, G=6, H=7, J=8, K=9). The following example is an application of the numbering scheme to several of the fourteen sites associated with AOC 504 which is discussed in Section 2.3.

- AOC 504-AB is equivalent to site 01 of AOC 504.
- AOC 504-AK is equivalent to site 09 of AOC 504.
- AOC 504-BE is equivalent to site 14 of AOC 504.

2.2 SWMU 37, Sanitary Sewer System

The sanitary sewer system at NAVBASE has been identified as SWMU 37 and designated for an RFI as described in the *Final RFA* (Volume I, June 1995). In this investigation, the sanitary sewers — including gravity pipelines, manholes, lift and pumping stations, force mains, latrines, septic tanks, and OWS — will be addressed. SWMU 37 is described below and in Table 2-1.

Table 2-1
SWMU 37
Site Information

Number	Description	Material Generated or Stored	Potential Pathways
SWMU 37[a] **Sanitary Sewer System** (Including OWS, Septic Tanks, and Latrines)	See Description in Text Following This Table	Acids Organotin Tributyltin Surfactants Heavy Metals Caustics Solutions Chlorinated Solvents Petroleum Hydrocarbons (Volatile Organic Compounds [VOCs], Semivolatile Organic Compounds [SVOCs], Metals, Cyanide and Polychlorinated Biphenyls [PCBs])	Air **Soil** **Soil Gas** **Groundwater** Surface Water Surface Runoff

Note:

[a] Described in the *Final RCRA Facility Assessment*, Vol. I, June 1995.
Pathways bolded will be sampled.

Sanitary Sewer System

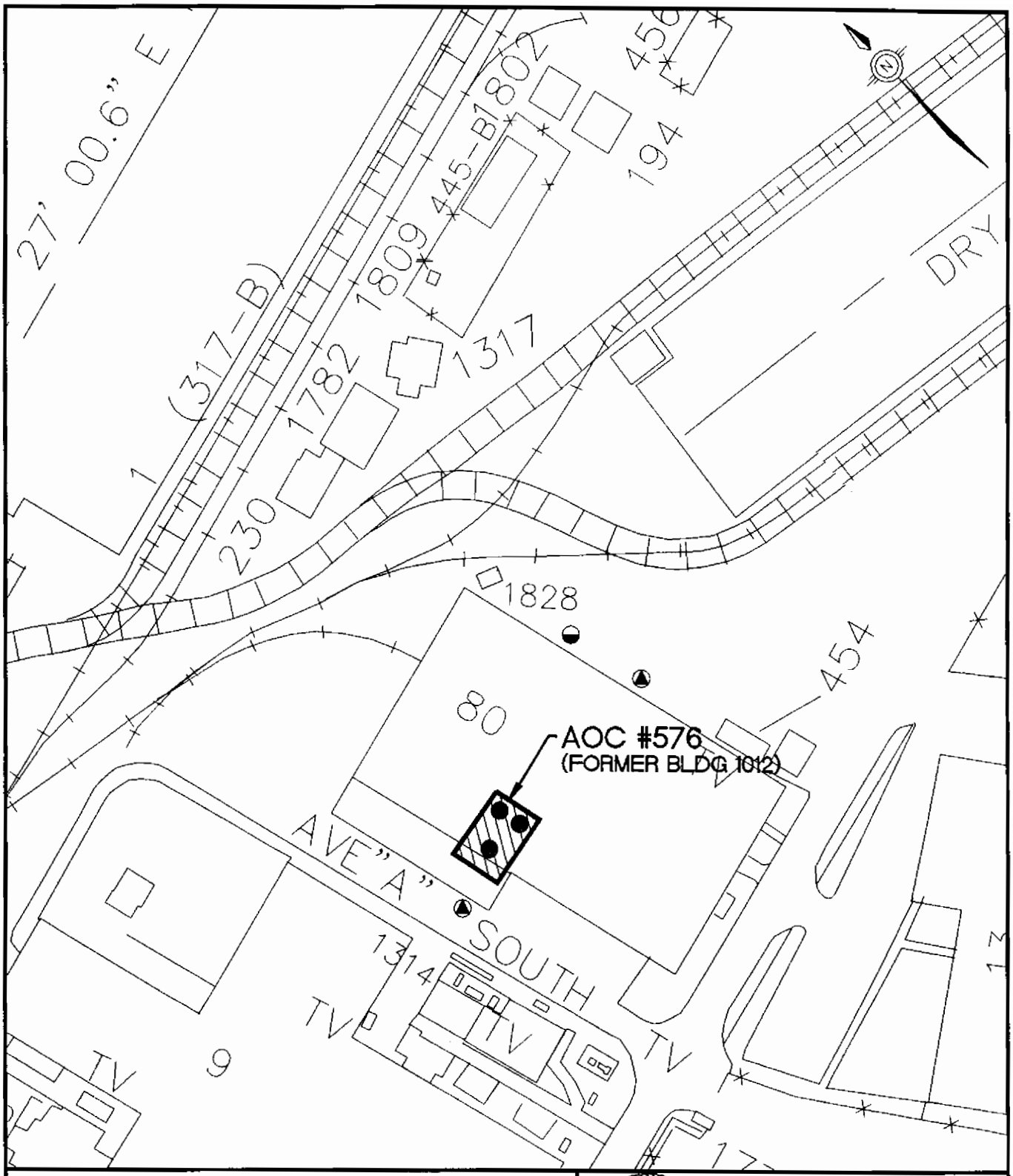
Prior to the 1970s, NAVBASE had a combined wastewater collection system which collected domestic wastewater, industrial wastes, and storm water runoff, where it was discharged directly into the receiving watercourse without treatment. During the 1970s, a separate sanitary sewer system was developed. A majority of the sewer lines were constructed of vitrified clay, with the rest being ductile iron and polyvinyl chloride (PVC). The system has been periodically

upgraded to accommodate base growth and expansion. Presently, the system consists of approximately 90,000 linear feet (LF) of gravity sewer and 29 pumping stations with associated force mains. Figures 2-1 and 2-2 show the NAVBASE sanitary sewer system, along with the storm sewer system. Wastewater enters the system from five major sources: residential areas, commercial facilities, industrial facilities, medical facilities, and naval vessels.

All wastewater generated at NAVBASE is collected by one of two trunk lines. Generally speaking, one serves the northern half of the base, while the other serves the southern half. Generally, the wastewater flows through the trunk line toward the center of the base, where it is collected by the NAVBASE discharge line. This line, which parallels Viaduct Road, transports wastewater to the North Charleston Sewer District's (NCSD) Navy Yard Pumping Station on Bainbridge Avenue. The wastewater then enters the NCSD's system and ultimately receives secondary biological treatment at the NCSD Felix C. Davis plant before being discharged into the Cooper River. The Public Works Department (PWD) of the CNSY operates and maintains the NAVBASE wastewater collection system.

As discussed in Section 1.2, an investigative strategy was developed to assist in the preparation of this document. First, general background information was needed before the basic scope of this work plan could be finalized. The general background information included:

1. Identifying current and former sources where the potential for the release of hazardous materials or waste existed. This information establishes the origination of potentially hazardous materials which could have been released or spilled into the sewer systems.



LEGEND

- E – PROPOSED SOIL BORING – ZONE E
- E – PROPOSED DEEP MONITORING WELL – ZONE E
- E – PROPOSED SHALLOW MONITORING WELL –ZONE E

GRAPHIC SCALE 100 0 100 200

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FIGURE 2–11
AOC #576 – PRINT OFFICE/
OIL AND PAINT STOREHOUSE
FORMER BUILDING 1012

DWG DATE: 7/20/96 | DWG NAME: FIGURE38

Figure 2-1 SWMU 37 - Sanitary Sewer System and AOC 699 - Storm Sewer System Northern Portion of NAVBASE

Figure 2-2 SWMU 37 - Sanitary Sewer System and AOC 699 - Storm Sewer System Southern Portion of NAVBASE

2. Obtaining copies of the sanitary and storm sewer system maps since 1901. The maps made available by the Public Works Department represent the approximate location and general flow direction of the sanitary and storm sewer pipelines which served NAVBASE Charleston. This data was critical in understanding which pipeline segment(s) had the possibility to transport a potentially hazardous material from the facilities identified in Item 1 above.

3. Identifying known cross-connects and determining their status. A major concern of the Zone L Work Plan is determining the existence of sanitary sewer to storm sewer cross-connects associated with, or downstream of, either industrial or potential sources of contaminants. This scenario would allow potentially hazardous wastewater to conceivably be released into a waterbody, such as the Cooper River. Presently, only storm sewer to sanitary sewer cross-connections are known to exist. Appendix F lists all known storm sewer to sanitary sewer cross-connects. No further assessment of the storm to sanitary sewer cross-connects will be conducted in Zone L.

4. Contacting the Public Works Department (PWD) to obtain maintenance logs of sewer system repairs. Points of contact with the PWD included:

   - Mr. Pete Stabovitz (PW Engineer) - is familiar with the sanitary and storm sewer systems,
   - Mr. Cleatwood Droze (PW Surveyor) - is familiar with the railroad, sanitary, and storm sewer systems, and
   - Mr. Gus Holiday (PW Contracts Inspector) - is familiar with the sanitary and storm sewer systems.

   These PWD employees all conferred that no maintenance logs existed which detailed past maintenance repairs performed by the PWD on either sewer system.

5. Interviewing PWD personnel to determine if any sewer system activity could have released materials or wastes into the environment. This includes anything which could affect the integrity of the sewer systems. Based on the interviews with the individuals listed in Item 4, three sections of pipeline had been repaired due to pipeline integrity damage (i.e. collapse). However, of the three sections repaired, only one section was associated with, or downstream of, a facility listed as either an industrial or potential source of contamination. The section identified was a section of sanitary sewer pipeline along Second Street located in Zone C.

6. Utilizing other ongoing zone investigation sampling locations to prevent duplicated efforts. Once the proposed sampling locations were determined for Zone L, they were compared with all other sample locations proposed in all ongoing zone investigations to ensure that unnecessary duplication of sampling would not occur.

Having obtained the general background information, the next step was to define segments of the sewer systems to be investigated. In this project, segments of the sewer systems which have or have had the potential for transporting and releasing hazardous materials will be investigated. Areas which are known not to have had the potential to transport hazardous materials can be eliminated from this investigation. Such areas include the residential subdivision and segments of each system which are not downgradient of facilities which have, or have had, the potential to release hazardous materials. Therefore, this work plan will concentrate only on segments of the sewer system downstream of a potential source of hazardous materials. The sampling plan is dependent upon which classification of facility, either industrial source or potential source, is upgradient of the pipeline. The specifics in sampling will be discussed in the Sampling and Analysis Plan section hereafter. Appendix C lists both current and former facilities or sites determined to be an industrial source, and Appendix D lists both current and former facilities or sites determined to be potential sources of contaminants.

Septic Tanks

The EBS identified seven septic tank systems on NAVBASE which are either active or inactive (not in use or piped directly into the sanitary sewer system). The individual septic tanks are listed in Table E-1 and shown in Figures E-1 and E-2, in Appendix E. Only septic systems that are, or ever have been, downstream of an industrial source will be investigated.

Oil/Water Separators

The EBS identified 25 OWSs on NAVBASE. The individual OWSs are listed in Table E-2 and shown in Figures E-1 and E-2, in Appendix E.

On-base OWSs discharge water either to the Cooper River through the storm water system, or to the sanitary sewer system, under the NCSD permit. Presently, it is unknown as to which OWSs are connected to the sanitary or storm sewer system. Section 2.2.4 describes the method to be used to determine to which system the OWS is connected. Responsibility for water discharge programs is divided among the Fleet Industrial Supply Center (FISC), CNSY Shop 99, Naval Shipyard Occupational Safety, Health and Environmental Office (Water Programs Branch), Naval Station Port Services, PWD Transportation, and PWD Utilities.

Waste oil removed from the separators was collected by PWD and taken to FISC, where it was off-loaded at Truck Offload Stand 3913 and pumped to one of the collection tanks (39A or 39D). These collection tanks also received ballast water and other oily water wastes from shipboard activities. From there, the water was processed through the Ballast Waste Treatment Plant and discharged to the sanitary sewer, under NCSD Permit 008. The resulting waste oil was collected, segregated, tested for conformance with the used oil specifications, shipped to FISC Norfolk as "Fuel Oil Reclaimed," and resold.

2.2.1 Previous Investigations

Previous reports and/or records pertinent to this investigation are the *Wastewater Facilities Evaluation,* September 1990 and the Department of the Navy Occupational Safety, Health, and Environmental Office's spill reports. The *Wastewater Facilities Evaluation* identifies specific problems in the sewer system. No analytical data have been found regarding the sanitary sewer system, OWSs, or septic tanks.

2.2.2 Data Gaps

Currently, no environmental media data have been collected to characterize the sanitary sewer system, OWSs, or septic tanks, or to support a detailed evaluation of treatment alternatives, where necessary. To ensure data collection efforts are sufficient and meet the stated investigative objectives, the following data gaps have been identified and will be resolved:

Sanitary Sewer System:

- There are limited data to evaluate the sanitary sewer line integrity.
- There are no chemical data to determine if releases of hazardous materials from the sewer systems have occurred.
- There are no environmental data to establish whether COPCs are present for any of the potential migration pathways.
- No data exist to support a detailed evaluation of treatment alternatives, where necessary.
- No data exist to identify which sewer system each OWS is connected to.

OWSs/Septic Tanks:

- There are no environmental data to establish whether COPCs are present for any of the potential migration pathways.

- No data exist to support a detailed evaluation of treatment alternatives, where necessary.

2.2.3 Objectives

The objective of the proposed field investigation for the sanitary sewer lines, latrines, septic tanks, and OWSs is to fill the identified data gaps by establishing whether contaminants are present for the identified migration pathways or have been released into the storm sewer system via cross-connects. For purposes of this work plan, cross-connects are defined as improper connections of the sanitary sewer to the storm sewer system. To fill these data gaps, soil and groundwater samples will be collected, and sanitary sewer lines downgradient of industrial sources will be dye tested to determine the existence and location of cross-connects. If visual examination of the manholes does not identify the general location (i.e. between two known manholes) of a sanitary to storm sewer cross-connect, or it can not be identified by the dye test, remote television inspections will be performed on the section of pipeline in question. If a sanitary sewer to storm sewer cross-connect is identified, the Caretaker's Site Office will be notified immediately so corrective measures can be performed by the appropriate parties. If contaminants are detected, the horizontal and vertical extent and rate of any contamination will be delineated concurrently. Data collection efforts will also support the technical evaluation of treatment alternatives. Although the use of remote television cameras is very useful, there are several limitations in its use. These limitations include:

- Prior to the insertion of the remote television cameras, the investigated segments of pipe must be cleaned of all debris in order to provide "visual" access to the pipe's interior.

- The debris must be treated as potentially hazardous material.

- If the pipeline joints are separated, the pipe has collapsed, or there is an obstruction (i.e. roots), the camera may be restricted in movement.

- Several manhole covers are known to be "missing-in-action." These manholes have been paved over, have been covered by fill, or have had structures built upon them. By not having these access points and due to the limitations in the total length of the remote television camera wiring, some segments may not be accessible.

2.2.4 Sampling and Analysis Plan

Sanitary Sewer System

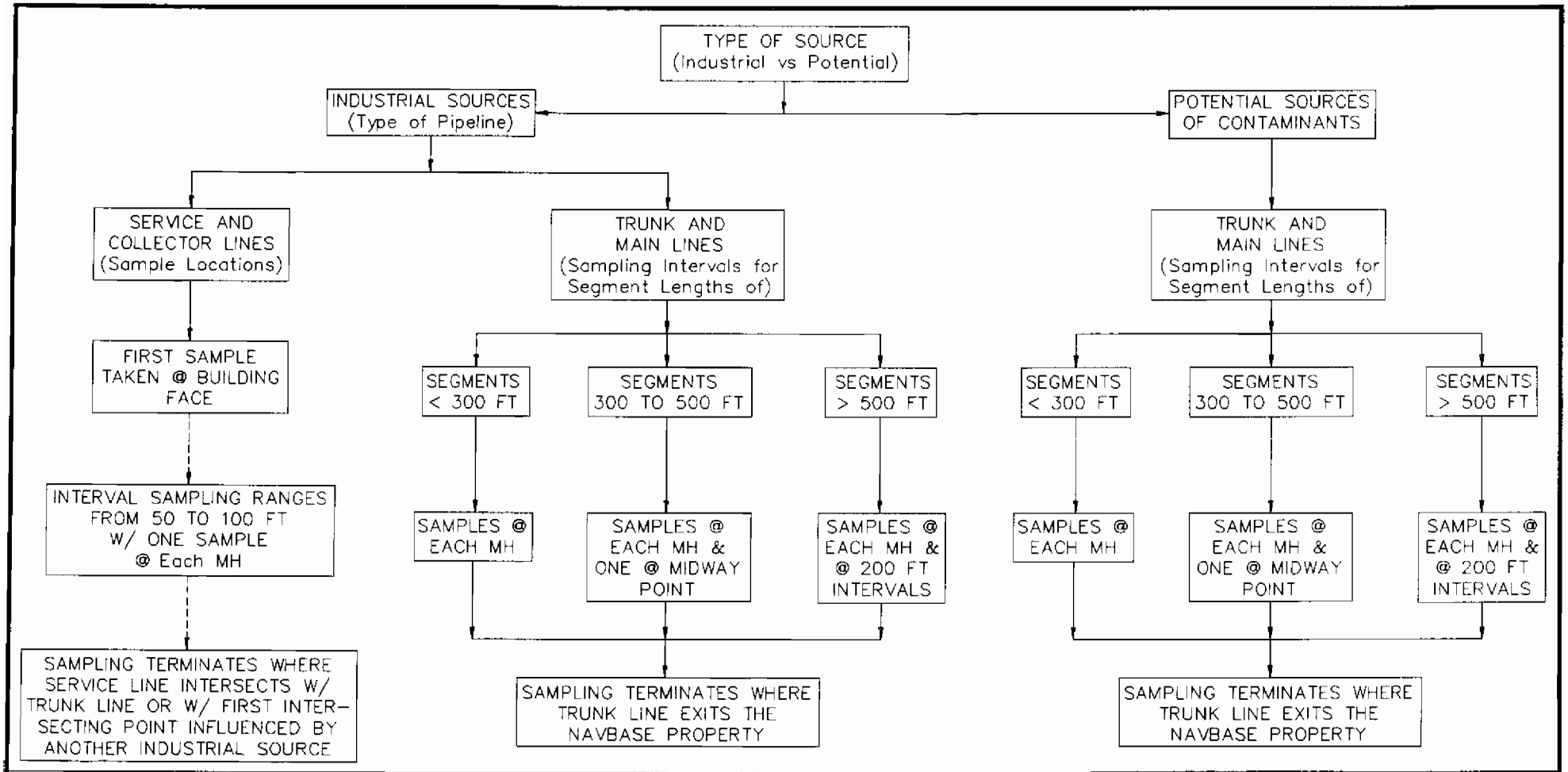
The sampling plan for the sanitary sewer system is divided into two phases. The first phase will focus on identifying which pipeline has released COPCs and locating unknown cross-connects. This will be accomplished by performing interval-based sampling using DPT on sanitary sewer lines downgradient of industrial sources and potential sources of contaminants, and dye testing on sanitary sewer lines exiting industrial facilities. Based on the results of the interval-based sampling and field investigations, a decision will be made concerning the need for additional sampling if a contaminant associated with the sanitary sewer system is located, or a cross-connect is located. Field sampling will consist of collecting a predetermined number of soil and groundwater samples at locations throughout NAVBASE by using DPT. This type of sampling will provide DQO Level II analysis and serve as a screening mechanism to determine the presence of contaminants. Additional DPT samples will be obtained as necessary to adequately define the nature and extent of contamination. Confirmation sampling using DQO Level IV samples will be performed at a minimum frequency of 10%. If the screening results vary from the confirmation results by more than 2 orders of magnitude, additional confirmation samples will be collected.

The primary pathway of contaminant migration from the sanitary sewer system is exfiltration of COPCs into the surrounding soil, and subsequently into the groundwater, from damaged pipelines or manholes. COPC exfiltration occurs along structurally defective pipelines, and when pipelines and manholes are surcharged. For purposes of this document, surcharged periods are defined as times when manholes and pipelines have been filled beyond their capacity.

Should the DPT equipment be unable to access a particular soil boring location, standard sampling equipment such as hand augers may be used to obtain the sample. If DPT equipment is unable to access a groundwater sample location, the groundwater sample location may be relocated to an accessible area as close as possible to the original location. The DPT subcontractor will be required to analyze samples in the field. Each sample will be taken as close to the pipe as possible, and below the elevation of the pipe's invert. An invert is defined as the lowest point of the pipeline. If a pipeline is below the groundwater table, a groundwater sample shall be taken; however, if the pipeline is above the groundwater table, a soil sample shall be taken. The reason for taking the sample at this location is due to the standard construction practice of installing underground utility lines. When constructing a sanitary or storm sewer line, a trench is dug into the native ground and the pipe is placed on a granular bedding material such as gravel. The trench is then filled with this same granular material to a certain height above the pipe, then native backfill material is used to bring the top of the trench to the ground surface. The cross sectional area which contains the granular material may then act as a "conduit," or pathway, for fluids released from the pipeline. It can be expected that this fluid will travel along this "conduit" to the next downgradient manhole. Here, the fluid may continue past the manhole or be trapped in the granular bedding material below the base of the manhole. Therefore, when sampling at a manhole, two samples shall be taken. One groundwater sample will be taken near the bottom of the manhole on the inlet side to determine the presence of contaminants in the bedding material; one soil sample shall be taken near each

manhole frame and cover to provide data concerning the possibility of surcharging at the manholes.

Zone L proposes two sampling schemes for the sanitary sewer system: one for pipelines downgradient of industrial sources and one for pipelines downgradient of potential sources of contaminants. Figure 2-3 is a tree diagram which differentiates the sampling schemes of the industrial sources and potential sources of contaminants. There are two approaches for sampling pipelines downgradient of an industrial source: one involves sampling along service and collector lines; the second involves sampling along the trunklines. Sampling along service and collector lines will be taken at intervals which range from 50 to 100 feet, dependent upon the distance to the nearest downstream manhole and with samples taken at each manhole. Again, the type of sample taken along the pipeline is dependent upon the location of the pipeline, in reference to the groundwater table. The first sample will be collected near the intersection of the pipeline with the building's face, with additional samples taken at intervals of 50 to 100 feet (dependent on the distance to the first manhole) along the pipeline on alternating sides of the pipe, with one sample at each manhole. The interval-based sampling will terminate at its intersection with a trunkline manhole or to the first intersecting point influenced by another industrial source. At the termination point for this interval sampling, a soil or groundwater sample will be taken along the trunk line approximately 25 feet downstream of the manhole , or downstream of the first intersecting point. Where the contaminant concentrations along a section of pipe are ubiquitous, it may be difficult to pinpoint the area of release. This may indicate either the industrial waste discharged into the system has corroded or disintegrated the pipeline, a break in the line exists, or that contaminants from adjacent sites have migrated into the bedding material. If the sampling does not conclusively identify the point of release, the pipeline will be internally investigated by remote television cameras. This task will be performed by a subcontractor, with E/A&H providing oversight. Prior to video taping the pipeline segment's interior, it shall be



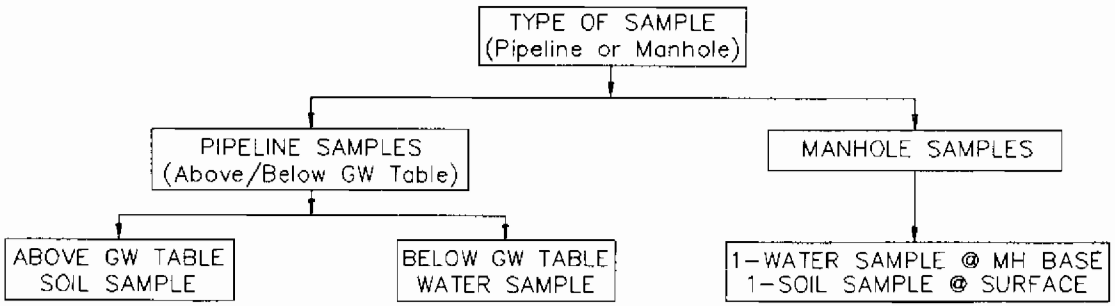


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FIGURE 2-3
TREE DIAGRAM OF SAMPLING
SCHEME FOR INDUSTRIAL SOURCES
VERSUS POTENTIAL
SOURCES OF CONTAMINANTS

DWG DATE: 7/20/96 | DWG NAME: TREEDIAG

cleaned of all sediment and debris to ensure the cameras provide an adequate visual representation. This waste material will be removed, drummed, analyzed, and properly disposed. The remote television inspection is designed to help assist in identifying segments of pipelines where hazardous materials released into the pipeline have corroded or disintegrated the pipeline , or where hazardous materials have been released from the pipeline into the environment due to integrity problems of the pipeline (i.e. collapse, breaks, etc.). E/A&H personnel will view all videotapes of the television inspection to locate potential defects. If defects are detected, their locations will be measured from the upgradient manhole and labeled. If no defects are apparent, no further evaluation of the pipe's interior will be conducted. However, further assessment will be required to identify the source of contamination. A revised site-specific sampling plan, along with the video tape showing the defect, will be developed and submitted to the BCT for approval. All tapes will be made available to the Project Team during the 30%, 60%, and 90% progress meetings.

The remaining sections of pipelines downgradient of industrial sources will be sampled at intervals of 200 feet, with one sample at each manhole. However, if the distance between manholes is less than 300 feet, samples will be taken only at each manhole. If the distance between manholes is 300 to 500 feet, one sample will be taken at the midway point, with one sample at each manhole. For lines greater than 500 feet, the interval spacing will be 200 feet, with one sample at each manhole. The interval-based sampling will terminate at the exiting point of the main trunkline from the NAVBASE property.

The reason for a denser interval sampling along the service and collector lines, as opposed to the trunklines, is that lines immediately exiting an industrial facility will have little or no dilution from upstream facilities. Therefore, the highest concentration of an industrial pollutant will occur within this segment of pipeline.

The second sampling scheme proposed in this work plan is for all pipelines downgradient of potential source of contaminants. These segments will be sampled at 200-foot intervals. The first sample will be collected near the intersection of the pipeline with the building's face. Additional samples will be taken on alternating sides of the pipeline at 200-foot intervals, with one soil and groundwater sample at each manhole. However, if the distance between manholes is less than 300 feet, samples will be taken only at each manhole. If the distance between manholes is 300 to 500 feet, one sample will be taken at the midway point, with one sample at each manhole. For lines greater than 500 feet, the interval spacing will be 200 feet, with one sample at each manhole. The interval-based sampling will terminate at the exiting point of the main trunkline from the NAVBASE property.

Once the areas to be investigated have been defined, the proposed sampling locations will be compared to the other zones' investigations to ensure duplicate sampling efforts are prevented. When information concerning subsurface conditions along pipelines of interest supplied by sampling in the other zones adequately characterizes the pipeline, sampling under the Zone L Work Plan for that particular segment of pipeline will be eliminated. Therefore, the analytical data from the other zones' samples will be used to evaluate the pipeline segment. Should the results from the other zone's sampling indicate a contaminant is present, further evaluation to define the nature and extent of contamination will be performed under the direction of that particular zone. For areas where there are no samples from the other zones in the general vicinity of pipelines in question, sampling will be performed under the Zone L RFI Work Plan. Figures 2-4 through 2-9 represent the proposed sample location selected based on the strategy, research, and justification outlined in this work plan. The layout of sample locations was determined based on the best information available. However, due to the limited accuracy of available information, some of the actual locations may changed slightly based on field conditions. If a suitable sampling location cannot be found, the field crew will notify USEPA and SCDHEC to discuss an alternative sampling strategy before continuing. All sampling will

adhere to the NAVBASE *Final Comprehensive RFI Work Plan*. Table 2-2 summarizes the type of samples and analytical parameters.

Table 2-2
Sanitary Sewer System
Site-Specific Sampling Plan

Matrix	Quantity	Analysis
Soil Screening (pipe invert)	111	Volatile Organic Analysis (VOA),
Groundwater Screening	256	Metals, Cyanide
Soil Confirmation (pipe invert) *	11 **	VOA, Semivolatile Organic Analysis (SVOA) w/Tentatively Identified Compounds (TICs), Metals, Cyanide, Pesticides, and PCB.
Groundwater Confirmation *	26 **	

Notes:

The quantities presented are estimated numbers of samples believed to be needed to fulfill the objectives of the investigation. Expansion of the investigation may be necessary to meet the stated objectives.

All analyses will be performed per SW-846, except where other methods are specified. Duplicates will be collected at the location where contaminants are most likely to be found. The sample quantities presented do not include Quality Assurance/Quality Control (QA/QC) samples.

* Confirmation samples shall taken for DQO Level IV type analysis.
** The quantities of soil and groundwater confirmation samples are estimates only. Per this work plan, the quantity of confirmation samples shall, at a minimum, equal to 10% of the total screening samples obtained by DPT equipment. An exact quantity will not be available until all DPT samples are obtained at each investigative location.

As previously discussed, an objective of the proposed field investigation for the sanitary sewer lines is to establish whether contaminants have been released from an industrial source into the storm sewer system via cross-connects. Confirmation of sanitary to storm sewer cross-connects is of great importance since they represent potential pathways for discharge of industrial materials or wastes to surface water bodies. To locate these cross-connects, a subcontractor will dye test the sanitary sewer lines with E/A&H providing oversight. This task will attempt to identify cross-connects other than those listed in Table F-1 (Appendix F). The focus of the *Wastewater Facilities Evaluation* was to locate cross-connects (Table F-1) resulting in storm water flow into the sanitary sewer. A dying agent with large volumes of water will be introduced into the process waste effluent lines of industrial facilities. Once this has been

Figure 2-4 Proposed Sampling Locations for Sanitary Sewer in Zones A and B

Figure 2-5 Proposed Sampling Locations for Sanitary Sewer in Zones C and D

Figure 2-6 Proposed Sampling Locations for Sanitary Sewer in Zone E (North Sections)

Figure 2-7 Proposed Sampling Locations for Sanitary Sewer in Zone E (South Section)

Figure 2-8 Proposed Sampling Locations for Sanitary Sewer in Zones F and G

Figure 2-9 Proposed Sampling Locations for Sanitary Sewer in Zones H and I

2.3 AOC 504, Railroad System

The railroad system at NAVBASE has been identified as AOC 504 and designated for an RFI as described in the *Final RCRA Facility Assessment* (Volume II, June 6, 1995). For purposes of this investigation, the railroad system will include all existing and abandoned railyards, rail lines, and hazardous material loading/unloading areas. The railroad system is described in Table 2-4 and shown in Figure 2-12.

Table 2-4
AOC 504
Site Information

Number	Description	Material Generated or Stored	Potential Pathways
AOC 504[a] **Railroad System**	See Description in Text Following This Table	Acids Metals Petroleum Hydrocarbons Coal Coal Derivatives Solvents Wood Preservatives (Creosote) Herbicide Pesticide (VOCs, SVOCs, Metals, Herbicides, PCBs and Pesticides)	Air **Soil** **Soil Gas** **Groundwater** Surface Runoff

Note:

[a] Described in the *Final RCRA Facility Assessment*, Vol. II, June 6, 1995.
Pathways scheduled for sampling are bold.

Railroad System

The railroad system has been in existence since the early 1900s. Base maps show rail lines as early as 1909. Over the years, the system has been modified and expanded to accommodate

growth and changing needs. Presently, approximately 13 miles of railroad line are within NAVBASE confines. The railroad continues to transport various materials, including fuels, chemicals, machinery, supplies, and waste materials. NAVBASE is served by two railroad systems: the Chessie Seaboard System (CSX) and the Norfolk Southern (NS) railway. CSX enters the western portion of NAVBASE at McMillan Avenue, and the NS spur enters the northern portion at Avenue B North.

The investigation of the rail system will focus on sections of lines where known releases of hazardous materials have occurred, and areas where sections of line were removed and residual contamination from the cross ties may be present. These locations were identified by interviewing railroad personnel, reviewing the CNSY OSHE office spill reports, and performing visual inspections of the abandoned and existing railroad tracks. Interviews with railroad personnel included discussions with Mr. Bobby Rhodes, head of NAVBASE Charleston Railroad Department, and Mr. Alan Ducker, track expert at NAVBASE Charleston. Mr. Ducker provided information concerning the type of herbicides used on the railroad right-of-way, while Mr. Rhodes provided information concerning areas where the potential of a release, from a rail car, could have occurred. The areas identified as potential release "spots" are discussed below. In reviewing the CNSY OSHE Office Spill Reports, no documents concerning spills or releases pertaining to the railroad system were found.

To determine the location of the abandoned or removed lines, maps of the railroad system since 1901 were obtained. The older maps were compared with the "present-day" maps, and the location of each abandoned or removed line was noted. The general area of the abandoned or removed lines were visually inspected. In several instances, the areas identified during this search were found to be associated with other SWMUs and AOCs. These areas have been listed as Zone L concerns but will be investigated under the other zone investigations to avoid duplicative effort.

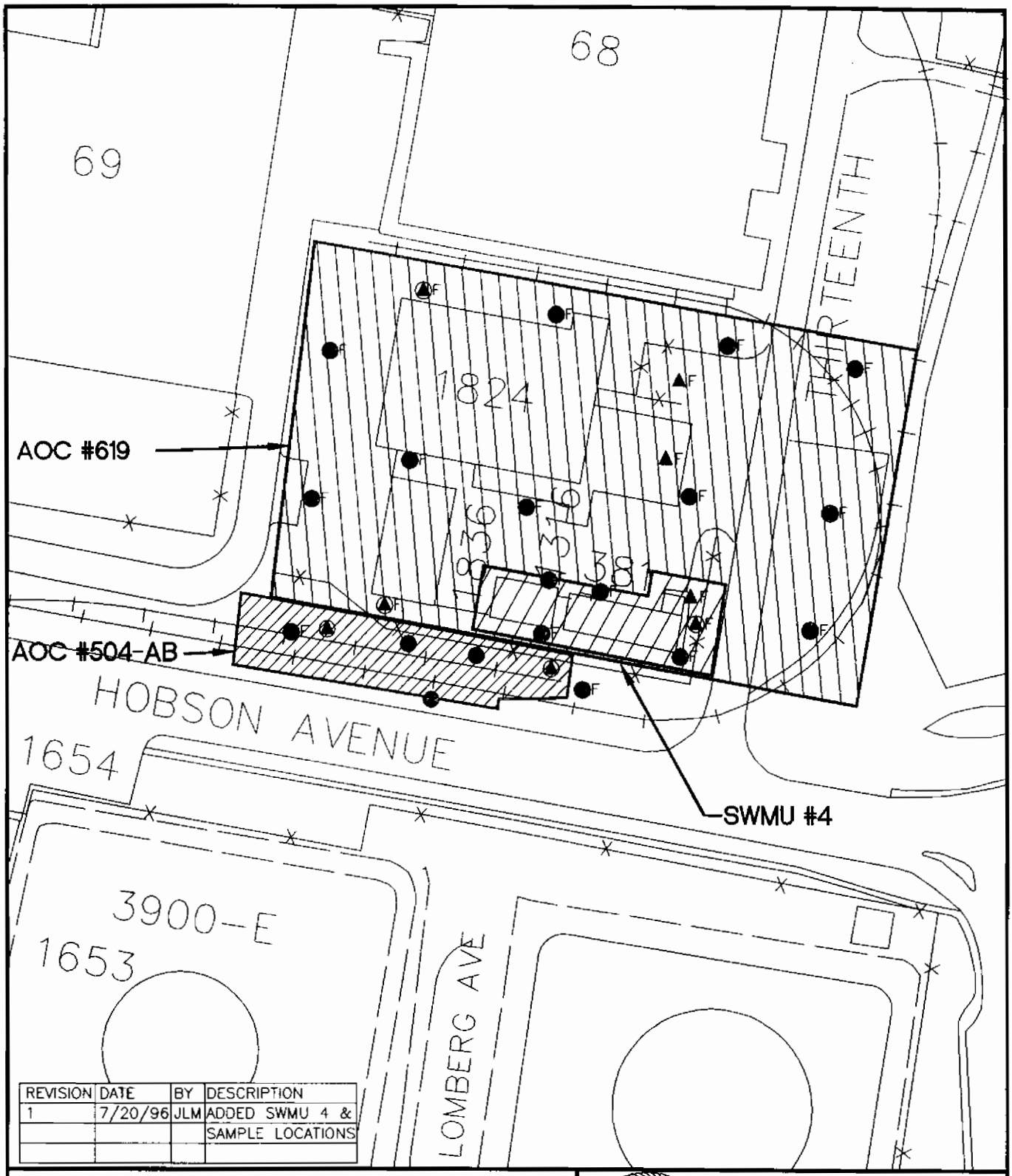
Areas potentially impacted by current or former uses of the rail system are:

- AOC 504-AB is a former fuel off-loading facility partially associated with AOC 619. This area will be investigated jointly under Zone F and Zone L (Figure 2-13). A section of rail line that ran parallel to the existing tracks has been abandoned by removing the rail and cross ties; however, the ballast material remains. Because the investigation being proposed for AOC 619 encompasses a much larger area, that includes AOC 504-AB, no sampling is proposed in this work plan. This area was identified by Mr. Rhodes as a potential release "spot," as well as by stains observed during the visual inspection performed by E/A&H.

- AOC 504-AC is a section of rail line servicing a reclaimed oil facility identified as AOC 629, which is included in the Zone G RFI (Figure 2-14). Due to the nature of the operations in the vicinity of the rail line and obvious soil staining, this area was identified for further investigation. However, because it is only a small area within a larger site proposed to be investigated in Zone G, no sampling is proposed in this work plan. This area was identified by Mr. Rhodes as a potential release "spot," as well as by stains observed during the visual inspection performed by E/A&H.

- AOC 504-AD is an abandoned section of rail line that formerly served as an off-loading point for materials used in the Building 36 battery shop, which is identified as SWMU 36 and will be investigated under Zone F (Figure 2-15). For reasons similar to those mentioned above, no sampling is proposed in this work plan. This area was identified by Mr. Rhodes as a potential release "spot."

- Five surficial stains of unknown origin or composition were observed at the locations designated as AOC 504-AE through AOC 504-AJ (Figures 2-16, 2-17, 2-18, 2-19 and 2-20). These areas will be investigated in Zone L. This area was identified by signs of stains observed during the visual inspection performed by E/A&H.



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	ADDED SWMU 4 & SAMPLE LOCATIONS

LEGEND

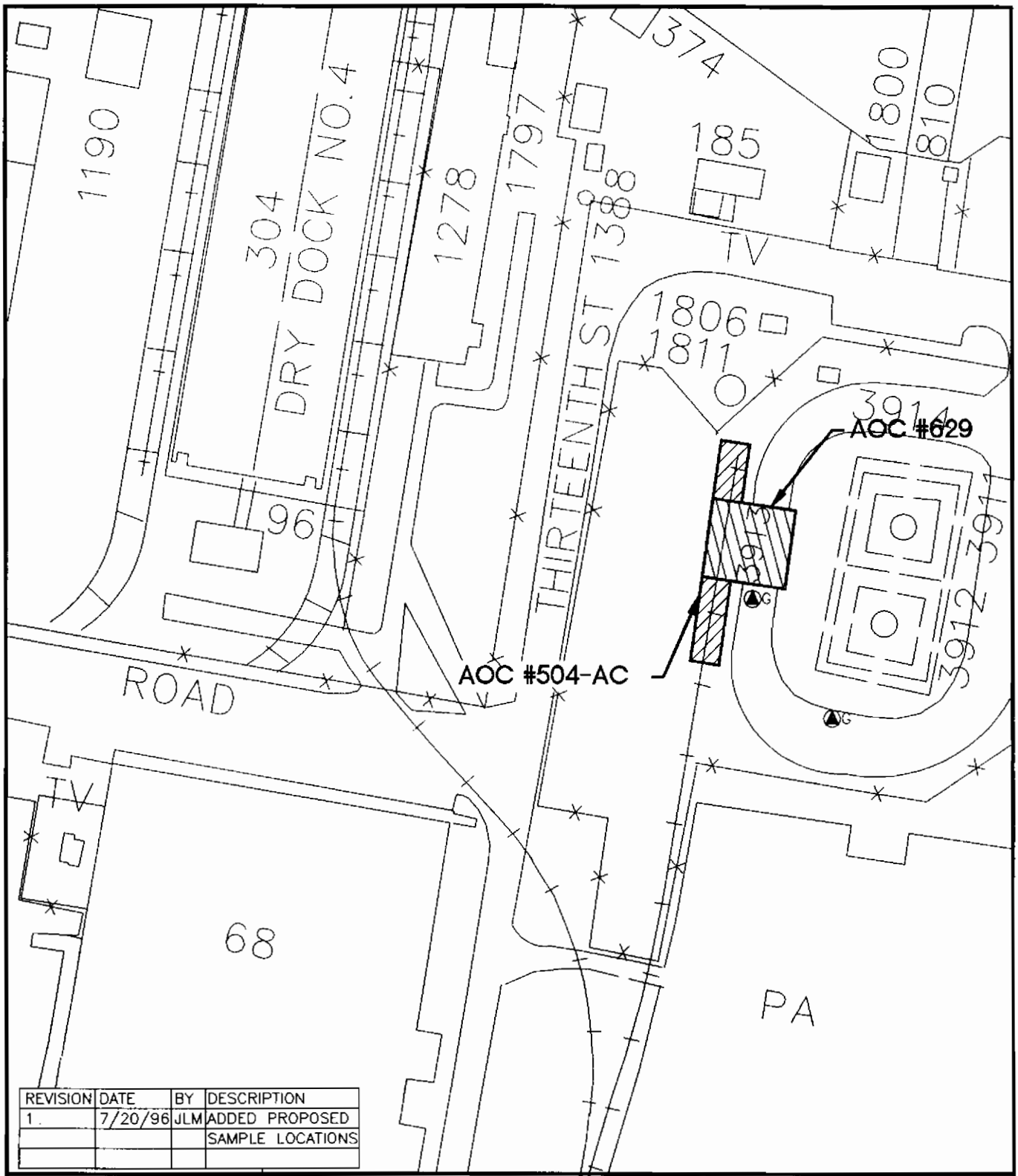
- ● – PROPOSED SOIL BORINGS – ZONE L
- ◭ – PROPOSED SHALLOW MONITORING WELLS – ZONE L
- ●F – PROPOSED SOIL BORINGS – ZONE F
- ◭F – PROPOSED SHALLOW MONITORING WELLS – ZONE F
- ▲F – PROPOSED SEDIMENT SAMPLE – ZONE F

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-13
AOC 504-AB: RAILROAD SYSTEM
FORMER FUEL OFF-LOADING SYSTEM
RAILROAD SYSTEM

DWG DATE: 7/20/96 | DWG NAME: FIG2-13



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	ADDED PROPOSED
			SAMPLE LOCATIONS

LEGEND

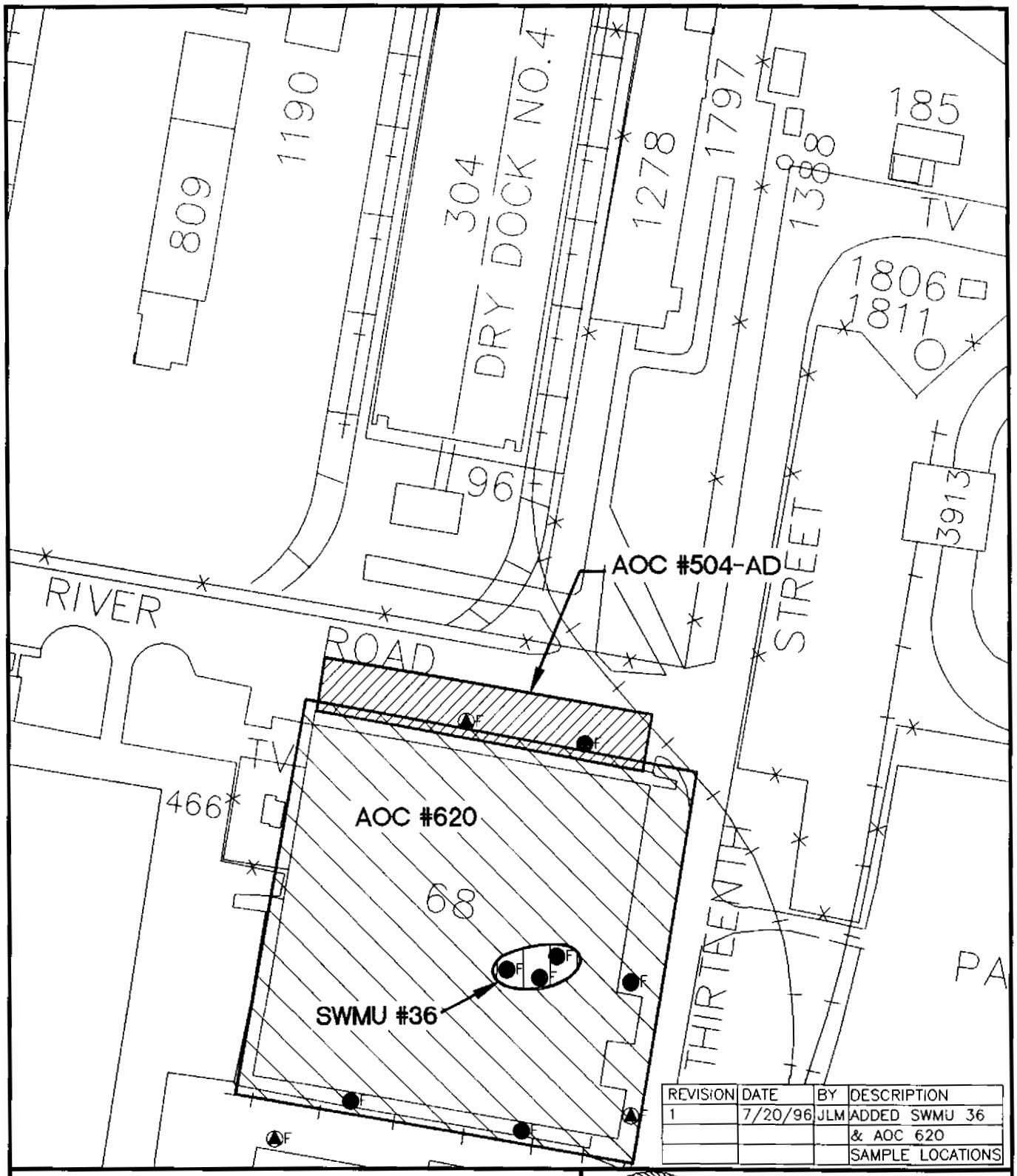
- ● – PROPOSED SOIL BORINGS – ZONE L
- ▲ – PROPOSED SHALLOW MONITORING WELLS – ZONE L
- ●G – PROPOSED SOIL BORINGS – ZONE G
- ▲G – PROPOSED SHALLOW MONITORING WELLS – ZONE G

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2–14
AOC 504–AC: RAILROAD SYSTEM
TANK TRUCK/CAR LOADING/UNLOADING
FACILITY, BUILDING 3913
RAILROAD SYSTEM

DWG DATE: 7/20/96 | DWG NAME: FIG2–14



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	ADDED SWMU 36
			& AOC 620
			SAMPLE LOCATIONS

LEGEND

- ● – PROPOSED SOIL BORINGS – ZONE L
- ▲ – PROPOSED SHALLOW MONITORING WELLS – ZONE L
- ●F – PROPOSED SOIL BORINGS – ZONE F
- ▲F – PROPOSED SHALLOW MONITORING WELLS – ZONE F

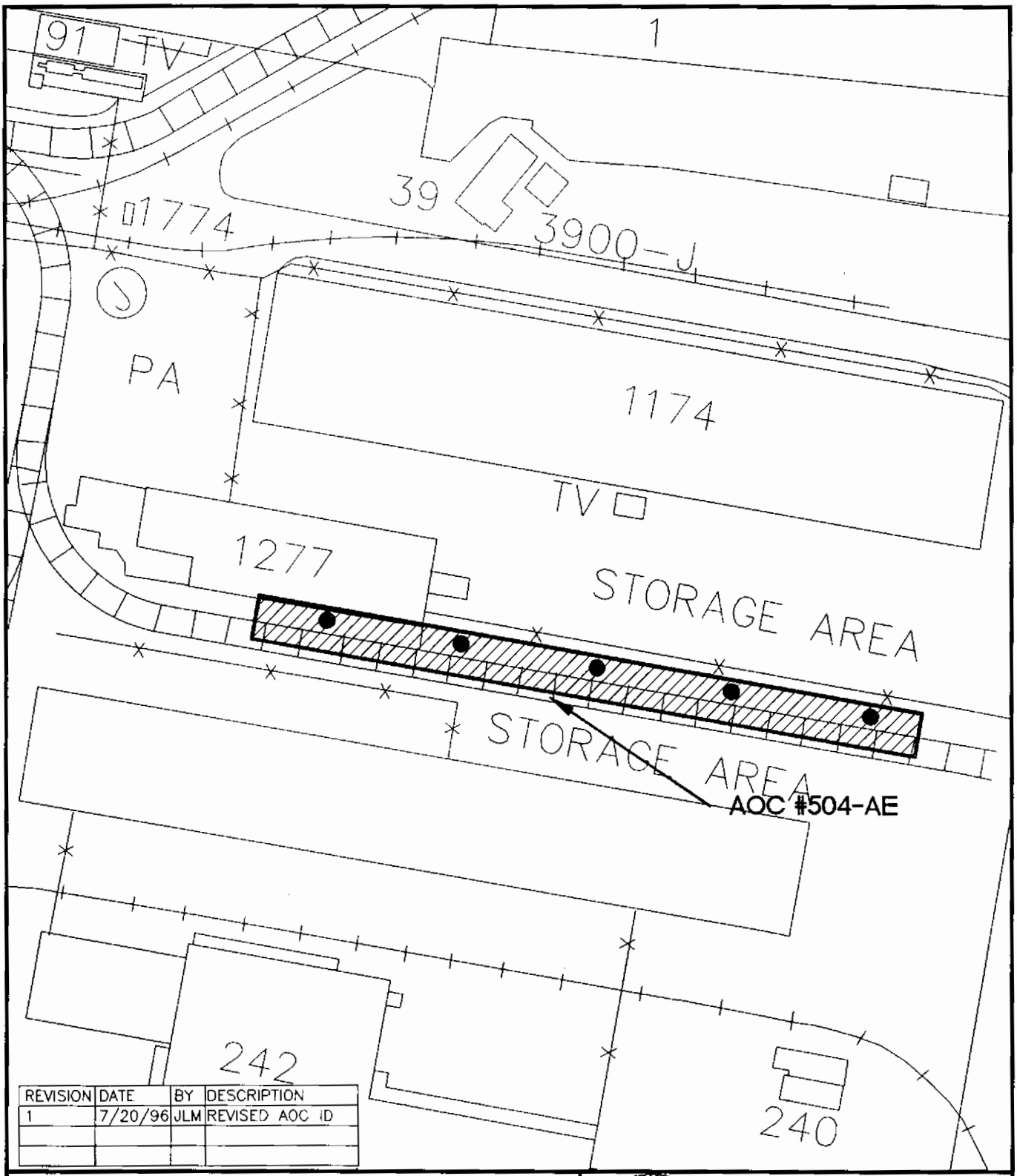
GRAPHIC SCALE 100 0 100 200

SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-15
AOC 504-AD: RAILROAD SYSTEM
ABANDONED OFF-LOADING FOR
BATTERY SHOP, BUILDING 68
PROPOSED SAMPLE LOCATIONS

DWG DATE: 7/20/96 | DWG NAME: FIG2-15



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	REVISED AOC ID

LEGEND

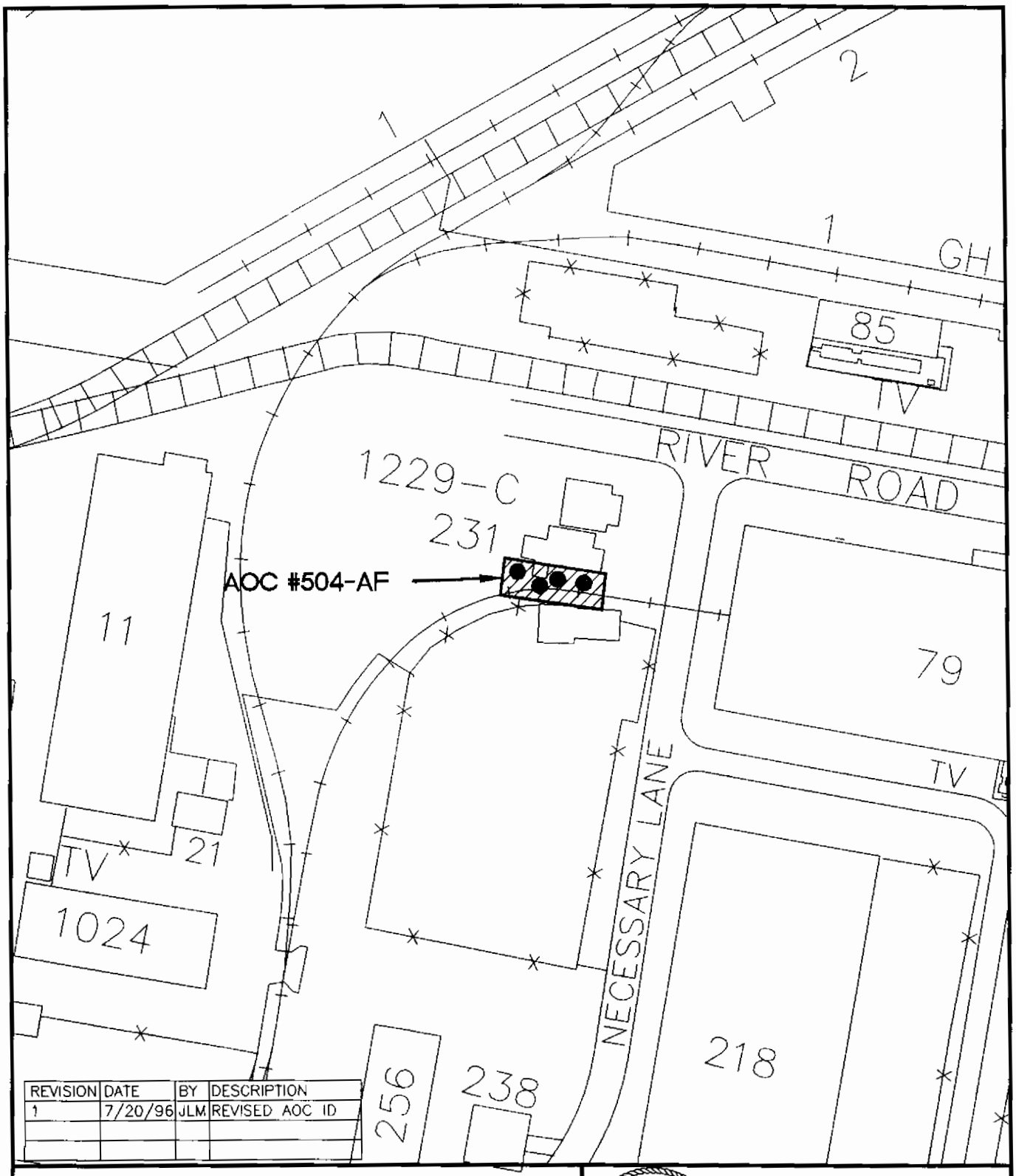
- ● – PROPOSED SOIL BORINGS – ZONE L
- ▲ – PROPOSED SHALLOW MONITORING WELLS – ZONE L

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-16
AOC 504-AE: RAILROAD SYSTEM
FORMER TRAIN CAR MAINTENANCE AREA
PROPOSED SAMPLE LOCATIONS

DWG DATE: 7/20/96 | DWG NAME: FIG2-16



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	REVISED AOC ID

LEGEND

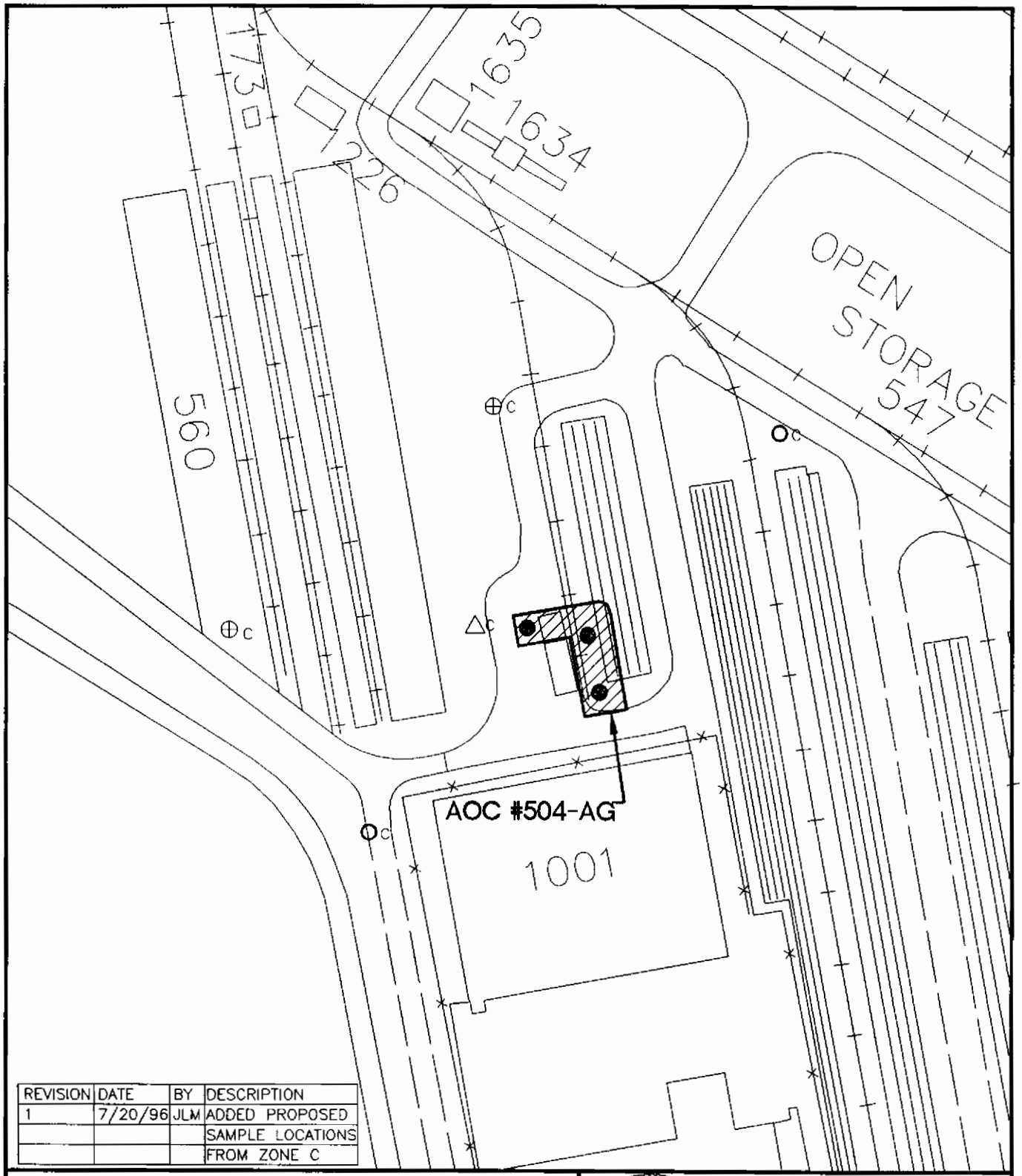
- ● – PROPOSED SOIL BORINGS – ZONE L
- ▲ – PROPOSED SHALLOW MONITORING WELLS – ZONE L

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-17
AOC 504-AF: RAILROAD SYSTEM
CANTEEN #3 – BUILDING 231
PROPOSED SAMPLE LOCATIONS

DWG DATE: 7/20/96 | DWG NAME: FIG2-17



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	ADDED PROPOSED
			SAMPLE LOCATIONS
			FROM ZONE C

LEGEND

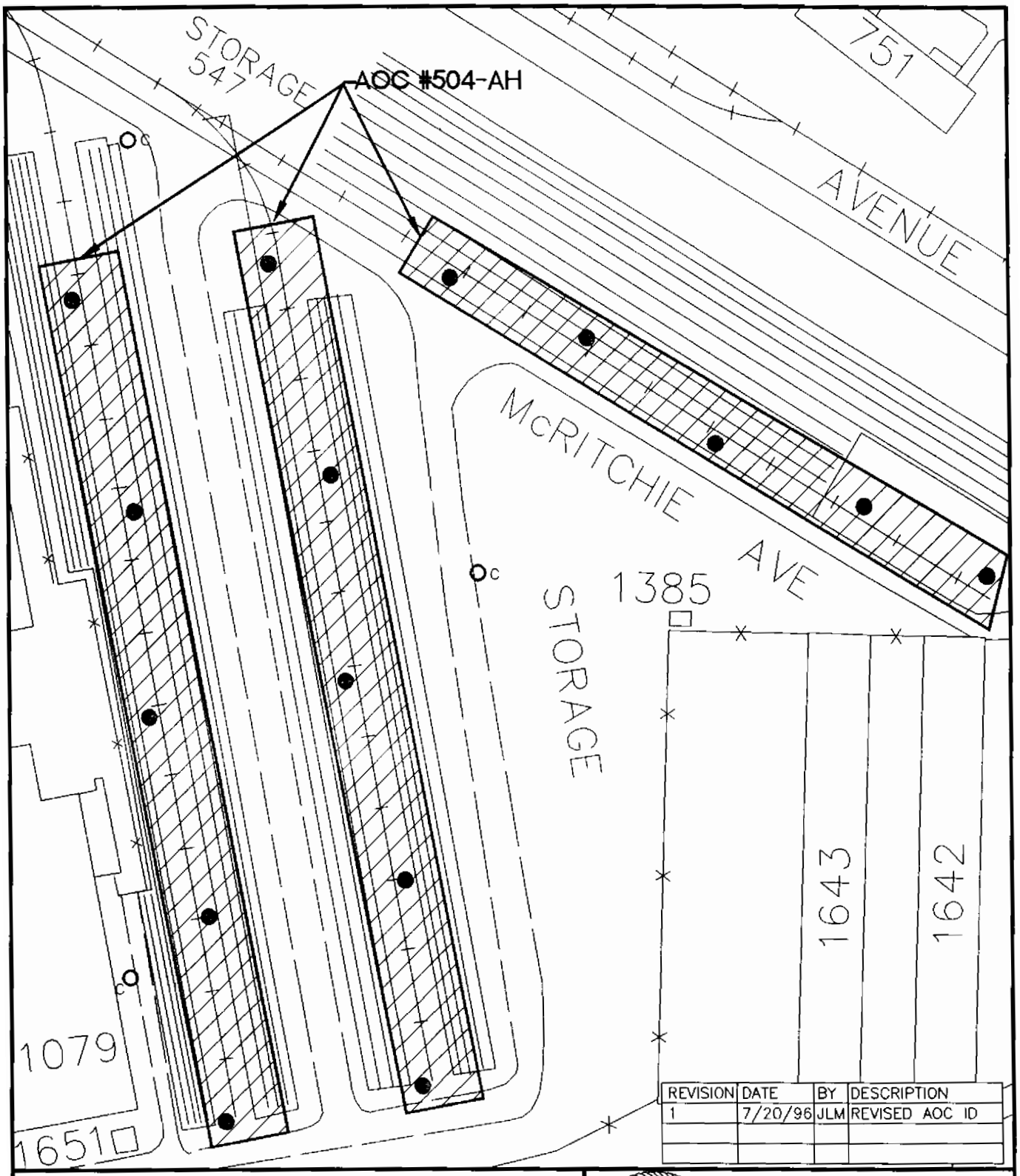
- ● – PROPOSED SOIL BORINGS – ZONE L
- △C – EXISTING SEDIMENT SAMPLE – ZONE C
- OC – EXISTING SOIL BORINGS – ZONE C
- ⊕C – EXISTING SHALLOW WELLS – ZONE C

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2–18
AOC 504–AG: RAILROAD SYSTEM
CYLINDER/POL STORAGE SHED
LOADING/UNLOADING RAMP
PROPOSED SAMPLE LOCATIONS

DWG DATE: 7/20/96 | DWG NAME: FIG2–18



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	REVISED AOC ID

LEGEND

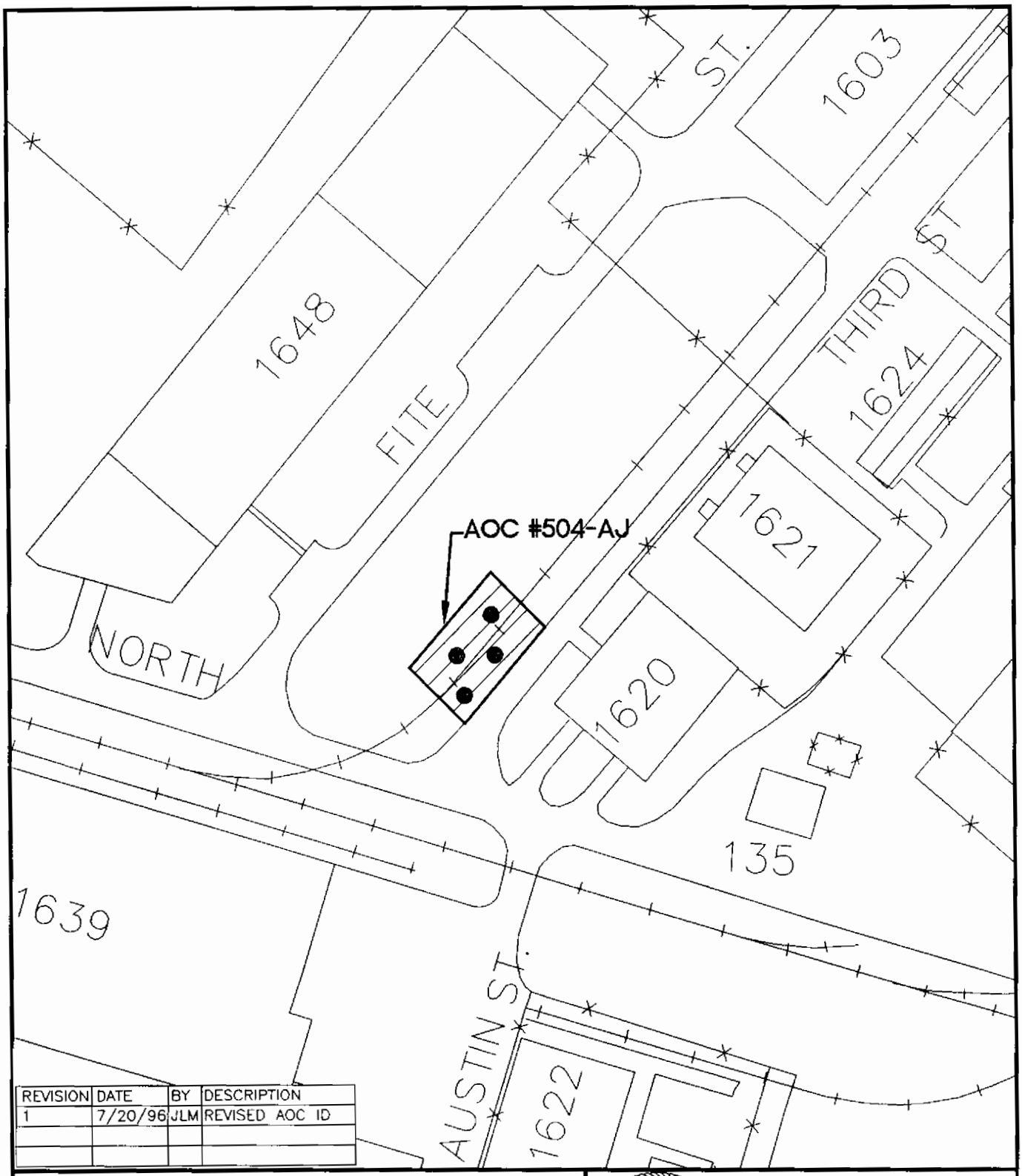
- ● – PROPOSED SOIL BORINGS – ZONE L
- ▲ – PROPOSED SHALLOW MONITORING WELLS – ZONE L
- OC – EXISTING SOIL BORINGS – ZONE C

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-19
AOC 504-AH: RAILROAD SYSTEM
CONTAINER CAR STORAGE AREA
PROPOSED SAMPLE LOCATIONS

DWG DATE: 7/20/96 | DWG NAME: FIG2-19



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	REVISED AOC ID

LEGEND

- ● – PROPOSED SOIL BORINGS – ZONE L
- ◬ – PROPOSED SHALLOW MONITORING WELLS – ZONE L

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-20
AOC 504-AJ: RAILROAD SYSTEM
RAIL SPUR TO BUILDING 1603
PROPOSED SAMPLE LOCATIONS

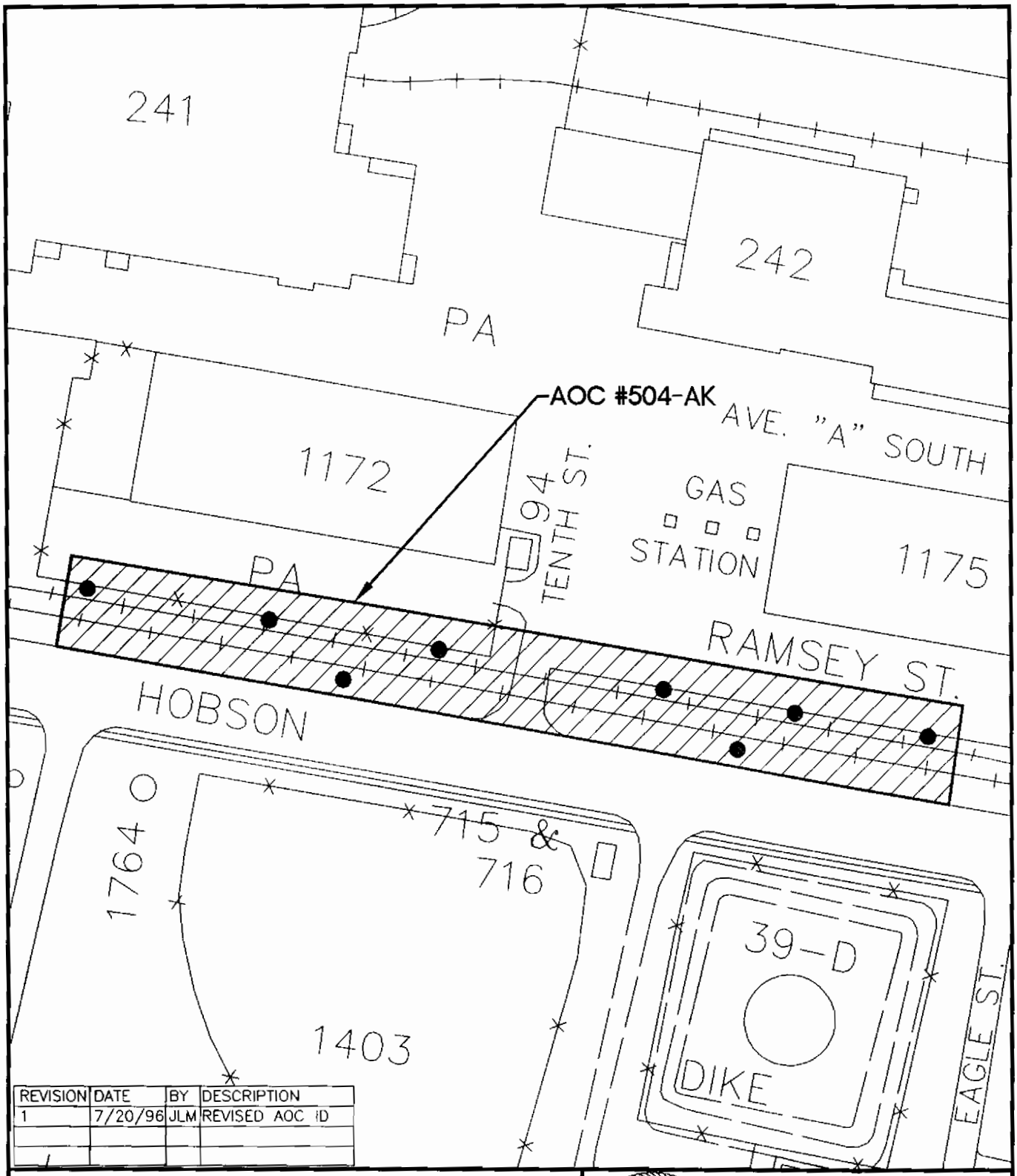
DWG DATE: 7/20/96 | DWG NAME: FIG2-20

- AOC 504-AK is an area where, reportedly, rail cars containing lead-contaminated equipment were stored. Rain water may have entered the rail car and rinsed lead from the equipment and onto the soil (Figure 2-21). This area will be investigated in Zone L. This area was identified by Mr. Rhodes as a potential release "spot."

- AOC 504-BA is a section of rail line used to deliver blast media to a series of sand hoppers identified as SWMU 109 (Figure 2-22) and is being investigated under Zone F. During the visual inspection, it was noted that the ground surface in the area of the tracks and hoppers was covered with a blast media that appeared to be "Black Beauty." For reasons mentioned, no samples are proposed in this work plan. AOC 504-BA is within the boundary of SWMU 109; therefore, no samples are proposed in this work plan. In addition, this is currently planned for interim measure activities to remove the grit on the ground surface. This area was identified by Mr. Rhodes as a potential release "spot" as well as by stains observed during the visual inspection performed by E/A&H.

- AOC 504-BB is an area located on Pier D associated with pumping bilge water from ships (Figure 2-23). Although the information available indicates this area suspect to be contaminated, no samples have been proposed in this work plan due to the location of the site. The area is on a concrete pier, and any releases that may have occurred to the underlying Cooper River will be addressed in the Zone J RFI. This area was identified by Mr. Rhodes as a potential release "spot."

- AOC 504-BC is an area associated with coal storage areas (Figure 2-24). Some data was collected in the Zone C RFI, but additional samples will be collected in Zone L. This area was identified by Mr. Rhodes as a potential release "spot," as well as by stains observed during the visual inspection performed by E/A&H.



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	REVISED AOC ID

LEGEND

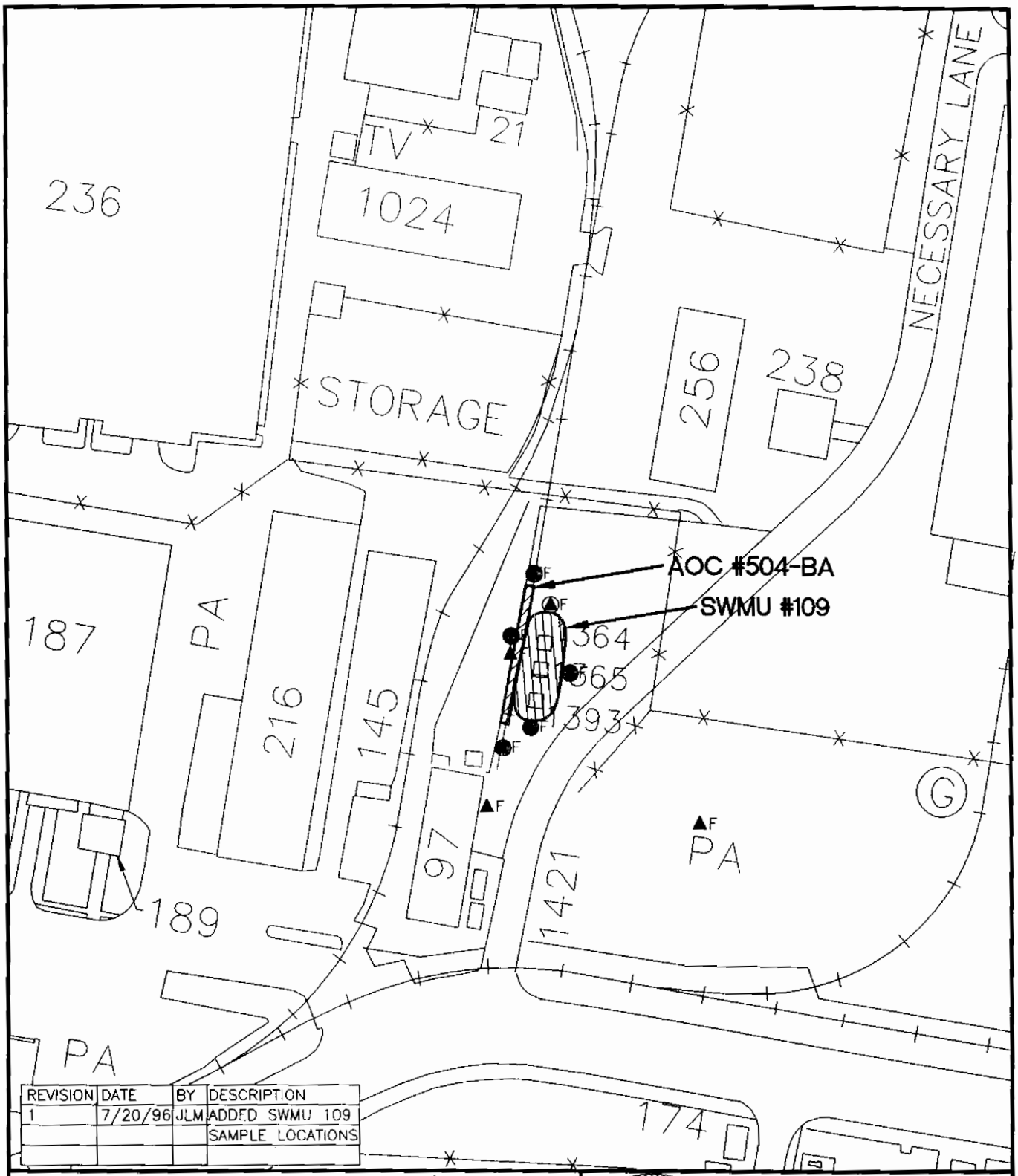
- ● – PROPOSED SOIL BORINGS – ZONE L
- ▲ – PROPOSED SHALLOW MONITORING WELLS – ZONE L

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-21
AOC 504-AK: RAILROAD SYSTEM
STORAGE AREA FOR CONTAINER CARS
PROPOSED SAMPLE LOCATIONS

DWG DATE: 7/20/96 | DWG NAME: FIG2-21



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	ADDED SWMU 109 SAMPLE LOCATIONS

LEGEND

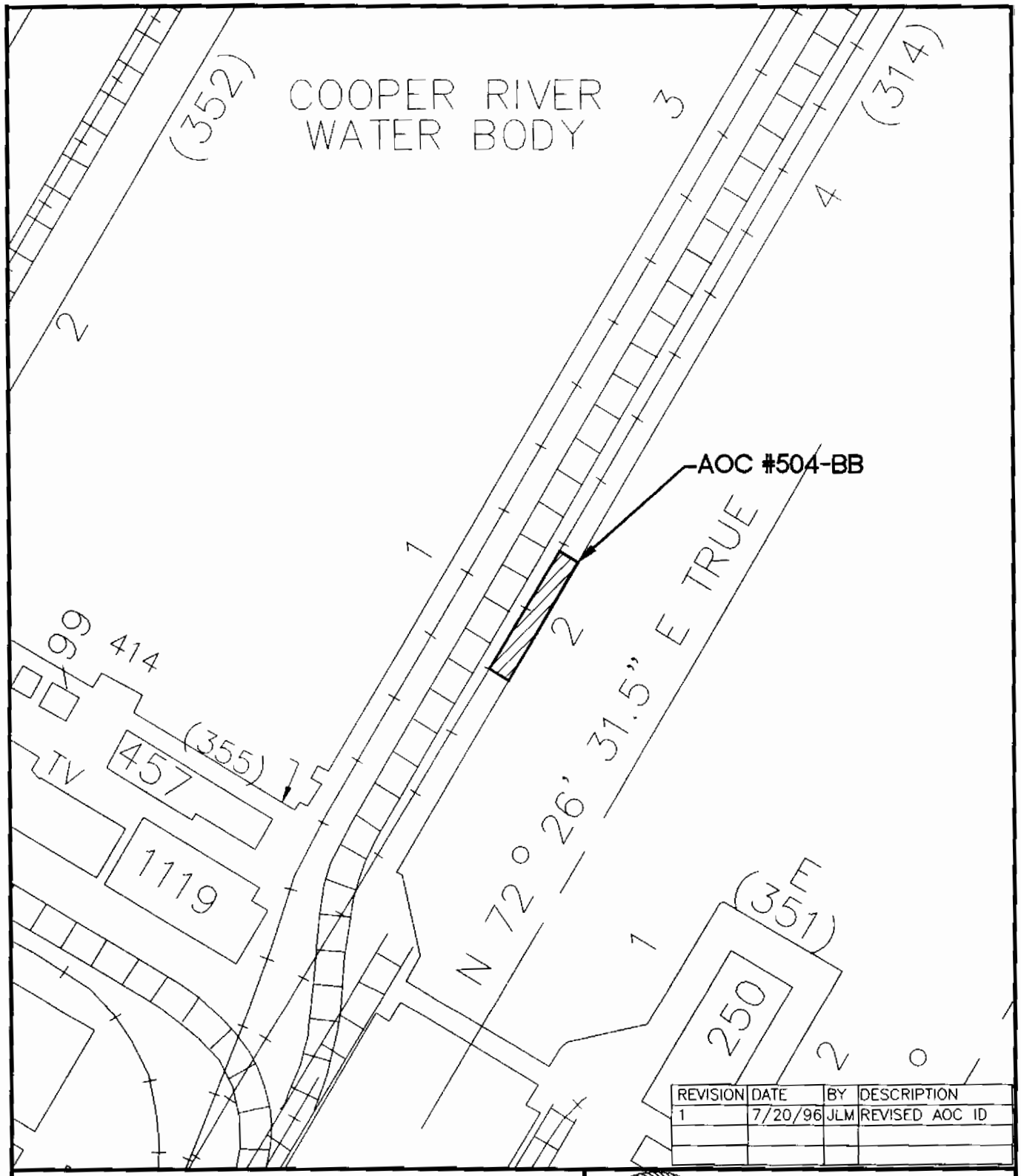
- ● – PROPOSED SOIL BORINGS – ZONE L
- ◬ – PROPOSED SHALLOW MONITORING WELLS – ZONE L
- ●F – PROPOSED SOIL BORINGS – ZONE F
- ◬F – PROPOSED SHALLOW MONITORING WELLS – ZONE F
- ▲F – PROPOSED SEDIMENT SAMPLE – ZONE F

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-22
AOC 504-BA: RAILROAD SYSTEM
SAND BLAST GRIT STORAGE HOPPERS
PROPOSED SAMPLE LOCATIONS

DWG DATE: 7/20/96 | DWG NAME: FIG2-22



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	REVISED AOC ID

LEGEND

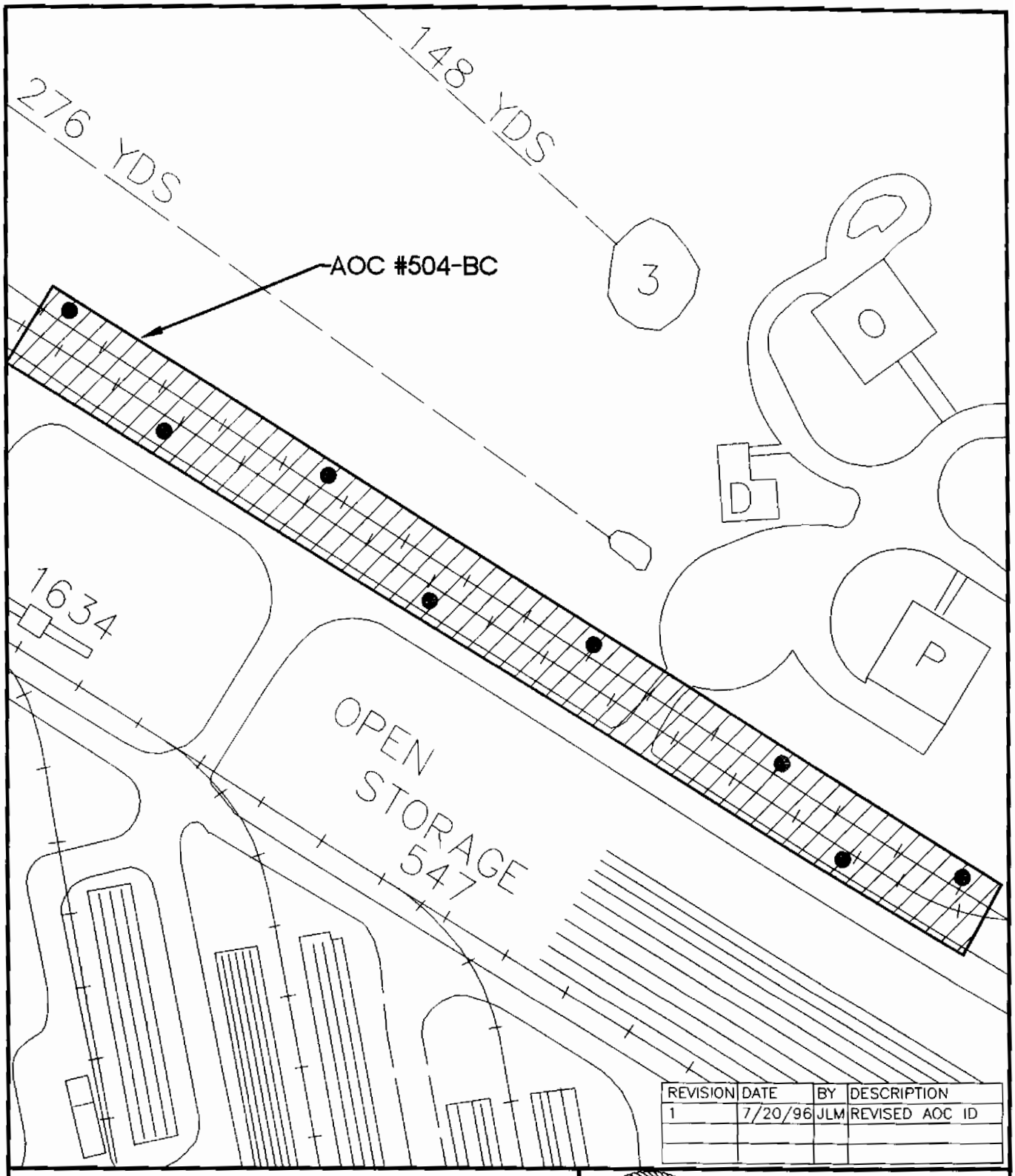
▨ – STAINED AREA

GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-23
AOC 504--BB: RAILROAD SYSTEM
VESSEL BILGE WATER UNLOADING
PROPOSED SAMPLE LOCATIONS

DWG DATE: 7/20/96 | DWG NAME: FIG2-23



REVISION	DATE	BY	DESCRIPTION
1	7/20/96	JLM	REVISED AOC ID

LEGEND

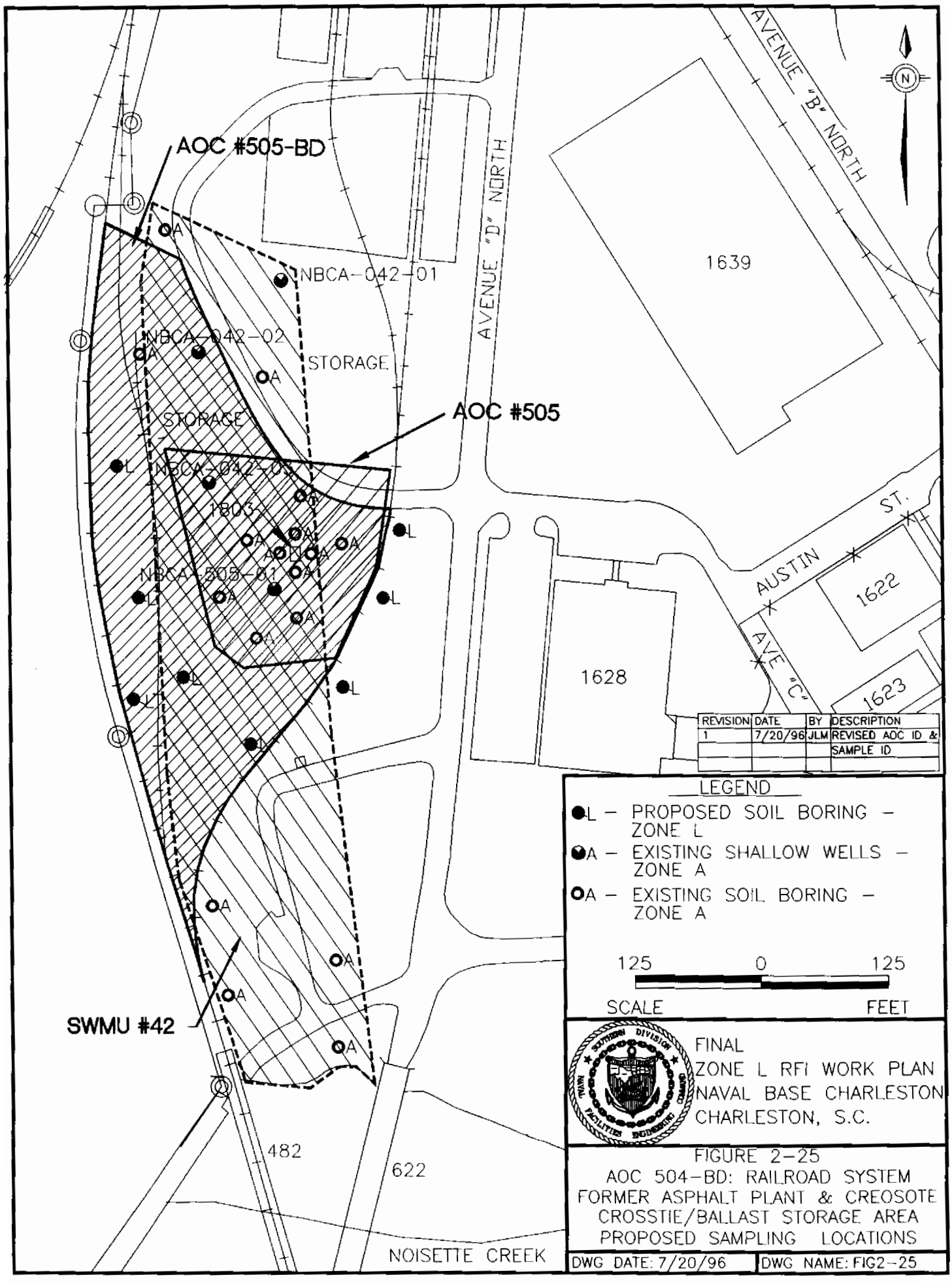
- ● – PROPOSED SOIL BORINGS – ZONE L
- ▲ – PROPOSED SHALLOW MONITORING WELLS – ZONE L

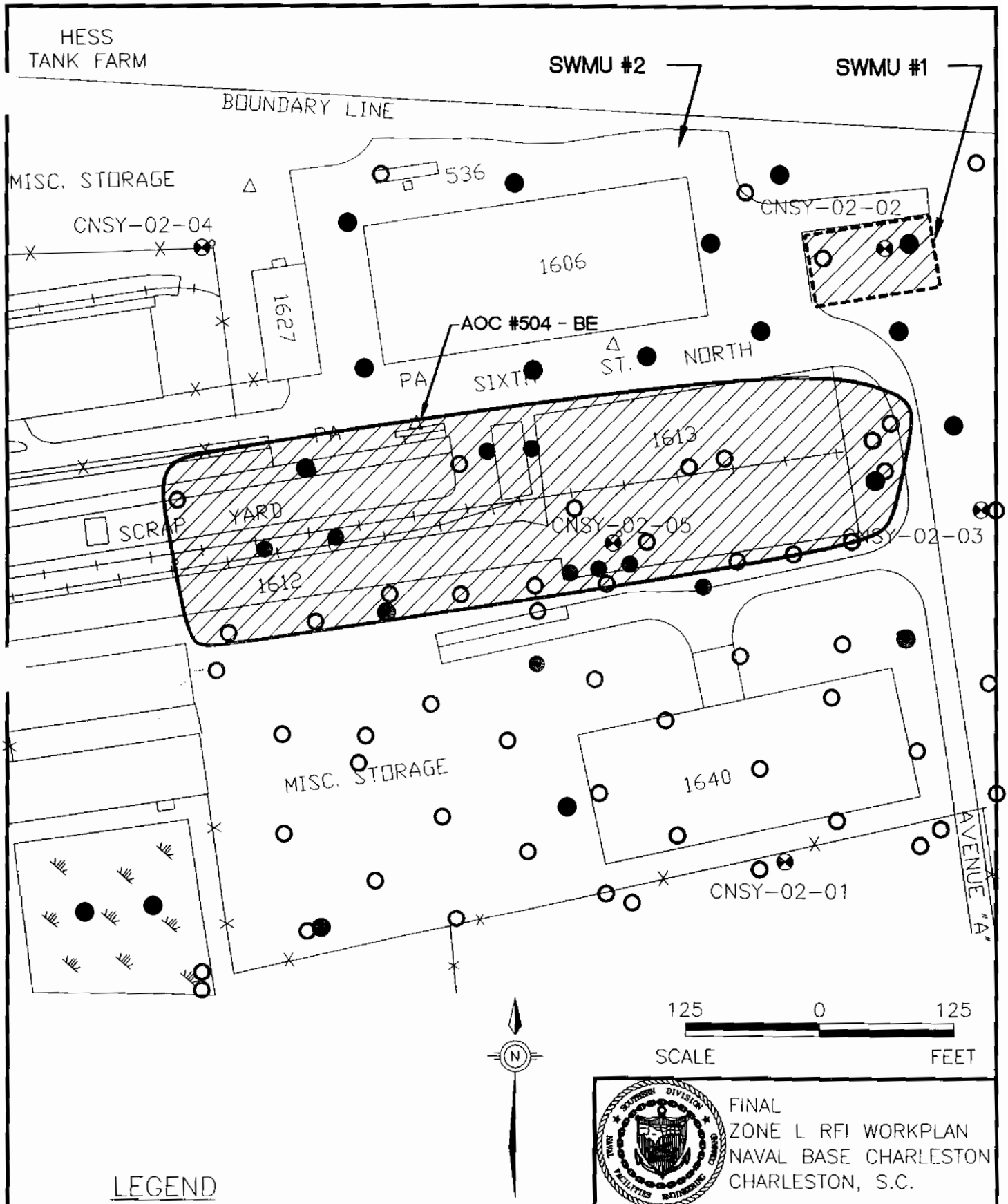
GRAPHIC SCALE 100 0 100 200

FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-24
AOC 504-BC: RFI RAILROAD SYSTEM
COAL/CONTAINER CAR STORAGE AREA
PROPOSED SAMPLE LOCATIONS

DWG DATE: 7/20/96 | DWG NAME: FIG2-24


AOC #505-BD
AOC #505
SWMU #42
NBCA-042-01
NBCA-042-02
NBCA-042-03
NBCA-505-01
STORAGE
STORAGE
1803
AVENUE "D" NORTH
AVENUE "B" NORTH
AUSTIN ST.
AVE "C"
1639
1622
1628
1623
482
622
NOISETTE CREEK
N
REVISION | DATE | BY | DESCRIPTION
1 | 7/20/96 | JLM | REVISED AOC ID & SAMPLE ID
LEGEND
L – PROPOSED SOIL BORING – ZONE L
A – EXISTING SHALLOW WELLS – ZONE A
A – EXISTING SOIL BORING – ZONE A
125 0 125
SCALE FEET
FINAL
ZONE L RFI WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.
FIGURE 2-25
AOC 504-BD: RAILROAD SYSTEM
FORMER ASPHALT PLANT & CREOSOTE
CROSSTIE/BALLAST STORAGE AREA
PROPOSED SAMPLING LOCATIONS
DWG DATE: 7/20/96
DWG NAME: FIG2-25


HESS
TANK FARM
SWMU #2
SWMU #1
BOUNDARY LINE
MISC. STORAGE
536
CNSY-02-02
CNSY-02-04
1606
1627
AOC #504 - BE
PA
SIXTH
ST.
NORTH
1613
SCRAP YARD
CNSY-02-05
CNSY-02-03
1612
MISC. STORAGE
1640
AVENUE "A"
CNSY-02-01
125
0
125
SCALE
FEET
N
LEGEND
● – PROPOSED SOIL BORING – ZONE A
○/△ – PREVIOUS SOIL BORING/SEDIMENT SAMPLE LOCATION.
⊗ – EXISTING MONITORING WELL
FINAL
ZONE L RFI WORKPLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.
FIGURE 2-26
AOC 504-BE: RAILROAD SYSTEM
DRMO SCRAP YARD
PROPOSED SAMPLE LOCATIONS
DWG DATE: 7/20/96
DWG NAME: FIG2-26

- AOC 504-BD is an area associated with a former asphalt plant and creosote crosstie/ballast storage area (Figure 2-25). The former asphalt plant and crosstie/ballast storage areas have been identified as SWMU 42 and AOC 505, respectively, and are being investigated under Zone A. However, in order to fully define the area of potential contamination associated with this site, additional samples will be collected in Zone L. This area was identified by Mr. Rhodes as a potential release "spot."

- AOC 504-BE is a section of rail spur within the Defense Reutilization and Marketing Office (DRMO) storage area (Figure 2-26), where rail cars were stored for unknown periods of time with unknown or suspect materials, prior to unloading or removal from the NAVBASE boundaries. The DRMO storage area is identified as SWMU 2 and is being investigated under Zone A. Sampling locations proposed for SWMU 2 considered both the location of SWMU 2 and AOC 504-BE so that data could be used to characterize the sites with one sampling effort. The investigation of SWMU 2 is currently underway. This area was identified by Mr. Rhodes as a potential release "spot."

- A review of the historical base maps indicated abandoned sections of rail line are present in Zones A, B, C, D, and E. AOC 504-BF is the abandoned rail lines within Zones A and B. AOC 504-BG is the abandoned rail lines within Zones C and D. AOC 504-BH is the abandoned rail lines in Zone E. The locations of these lines and the proposed soil sampling locations are illustrated on Figures 2-27, 2-28, and 2-29 respectively.

2.3.1 Previous Investigations

Previous investigative work has been completed in the vicinity of AOCs 504-AG, 504-AH, 504-BB, and 504-BE. The first three areas mentioned are all close to SWMU 44, which is the

coal pile investigated in the Zone C RFI. At the time this work plan was prepared, the data for SWMU 44 had not been validated in accordance with the guidelines set forth in the *Final Comprehensive RFI Work Plan*; however, a preliminary review of the data indicates that various metals and semi-volatile organic compounds were detected at levels which exceeded risk-based screening concentrations. Numerous samples have been collected at SWMU 2, which encompasses AOC 504-BE. Elevated concentrations of lead have been detected at SWMU 2.

A summary of the SWMU 2 sample data collected to date can be found in the *Final Zone A and B RFI Work Plan*. No environmental data are known to exist for the remaining sites listed.

2.3.2 Data Gaps

Currently, insufficient environmental media data have been collected to characterize all of the sites associated with the railroad system. To ensure data collection efforts are sufficient to meet the stated investigative objectives, the following data gaps have been identified and will be resolved:

- Analytical data is either insufficient or non-existent to establish whether a release has occurred and COPCs are present for some of the identified potential migration pathways.

- The nature and extent of impact to the environmental media have not been determined.

- No data exist to support a detailed evaluation of treatment alternatives, where necessary.

2.3.3 Objectives

The objective of the proposed field investigation is to fill the identified data gaps by establishing whether COPCs are present for the identified migration pathways. To fill these gaps, soil and groundwater samples will be collected. If COPCs are detected, the horizontal and vertical extent

and rate of any soil and/or groundwater contamination will be delineated concurrently. Data collection efforts proposed in this work plan will be supplemented by those efforts proposed in other zone specific work plans to support a baseline risk assessment and the technical evaluation of treatment alternatives.

2.3.4 Sampling and Analysis Plan

To fulfill the RFI objectives, site-specific sampling and analysis requirements are proposed. The sampling strategy is intended to assess areas possibly impacted by AOC 504. These areas of potential contamination were identified from spill/release reports, visual site inspections, railroad personnel interviews, and a review of historical maps. The proposed sampling locations for AOC 504-AB through AOC 504-BE have been biased to characterize the areas where releases are reported to have occurred or obvious staining exists. Initially sampling efforts will be limited to soil, as a confirmatory type of sampling approach. If soil data indicate a release has occurred, the investigation will be expanded to include sampling of all appropriate media. The collection of groundwater samples to assess impacts from sites described within this work plan will be coordinated with groundwater monitoring efforts underway or proposed for other zone investigations. The proposed investigative strategy for AOC 504-BF through AOC 504-BH, the abandoned sections of rail line, differs from the approach described above since the primary concern is the potential for residual soil contamination left when cross ties containing polynuclear aromatic hydrocarbons were removed. It is highly possible that the types of constituents detected will be found ubiquitously along the entire length of these areas. Therefore, for each abandoned section of line that is 500 feet or less, one sample will be collected at each end and one sample will be collected in the middle resulting in a total of three samples at a maximum spacing of 250 feet. For each section of line that is greater than 500 feet in length, samples will be collected beginning at one end and every 250 feet thereafter until the other end of the line is reached where an additional sample will be collected. Sample location maps from other zone investigations have been reviewed in an effort to use existing or soon to

be collected data points to complete the site characterization. Samples are not proposed to be collected underneath asphaltic roadbeds or parking lots since it is highly improbable that a distinction could be made between constituents associated with the rail line and those associated with the asphalt components. Because of the confirmatory nature of these samples, collection procedures and subsequent laboratory analysis will be performed in accordance with DQO Level III or IV guidelines.

Table 2-5 summarizes the types of samples and analytical parameters. All sampling will follow the NAVBASE Charleston *Final Comprehensive RFI Work Plan.* Interpretation of the data, with respect to wood preservatives expected to be found in soil in the immediate vicinity of the treated cross-ties, will be closely coordinated with the BCT. Positive results for wood preservatives may represent COPCs, under some circumstances, but may not be indicative of "contamination" in the vicinity of active rail lines.

Table 2-5
Railroad System
Site-Specific Sampling Plan

Matrix	Quantity	Analysis
Soil (0-1' bgs) Soil (3'-5' bgs)	55 55	VOA & SVOA w/ TICs, Metals, Cyanide, Herbicides, PCBs, and Pesticides.
Soil Screening (0-1' bgs)	37	VOA, Metals, and Cyanide

Notes:

The quantities presented are estimated numbers of samples believed to be needed to fulfill the objectives of the investigation. Expansion of the investigation may be necessary to meet the stated objectives.

All analyses will be performed per SW-846, except where other methods are specified. DQO Level III analysis as specified in the sampling plan will be used, with a minimum of 10% duplicates analyzed for all Appendix IX constituents at DQO Level IV. Duplicates will be collected at the locations where contaminants are most likely to be found. The sample quantities presented do not include QA/QC samples.

2.4.2 Data Gaps

Currently no environmental media data have been collected to characterize the storm sewer system or to support a detailed evaluation of treatment alternatives, where necessary. To ensure data collection efforts are sufficient and meet the stated investigative objectives, the following data gaps have been identified and will be resolved:

- There are limited data to evaluate the storm sewer lines' integrity.
- There are no chemical data to determine whether releases of hazardous materials from the sewer systems have occurred.
- There are no data to identify potentially contaminated areas.
- There are no environmental data to establish whether COPCs are present for any of the potential migration pathways.
- No data exist to support a detailed evaluation of treatment alternatives, where necessary.

2.4.3 Objectives

The objective of the proposed field investigation for the storm sewer system is to fill the identified data gaps by establishing whether contaminants are present for the identified migration pathways, or have been released into the storm sewer system via cross-connects with the sanitary sewer system. For the purpose of this work plan, cross-connects are defined as improper connections of the sanitary sewer to the storm sewer system. To fill these data gaps, soil and groundwater samples will be collected. If contaminants are detected, the horizontal and vertical extent and rate of any contamination will be delineated concurrently. Data collection efforts will also support the technical evaluation of treatment alternatives.

2.4.4 Sampling and Analysis Plan

Storm Sewer System

The sampling plan for the storm sewer system will focus on identifying which pipelines have released COPCs by performing interval-based sampling using DPT. Sampling will be performed only on abandoned, former, and existing storm sewer lines which have been, or are, downgradient of industrial sources. Based on the results of the interval-based sampling and field investigations, a decision will be made concerning the need for additional sampling if a contaminant associated with the storm sewer system is located, or a sanitary to storm sewer cross-connect was located in SWMU 37 sanitary sewer system. Field sampling will consist of collecting a predetermined number of soil and groundwater samples at locations throughout NAVBASE by using DPT. This type of sampling will provide DQO Level II analysis and serve as a screening mechanism to determine the presence of contaminants. Additional DPT samples will be obtained as necessary to adequately define the nature and extent of contamination. Confirmation sampling using DQO Level IV samples will be performed at a minimum frequency of 10%. If the screening results vary from the confirmation results by more than 2 orders of magnitude, additional confirmation samples will be collected.

The primary pathway of contamination from the storm sewer system is exfiltration of COPCs into the surrounding soil, and subsequently into the groundwater, from damaged pipelines or manholes. COPC exfiltration occurs along structurally defective pipelines and when pipelines and manholes are surcharged. For the purpose of this document, surcharged periods are defined as times when manholes and pipelines have been filled beyond their capacity.

Should the DPT equipment be unable to access a particular soil boring location, standard sampling equipment such as hand augers may be used to obtain the sample. If DPT equipment is unable to access a groundwater sample location, it may be relocated to an accessible area as close as possible to the original location. The DPT subcontractor will be required to analyze

samples in the field. Each sample shall be taken as close to the pipe as possible, and below the bottom of the pipe. If a pipeline is below the groundwater table, a groundwater sample shall be taken; however, if the pipeline is above the groundwater table, a soil sample shall be taken. The reason for taking the sample at this location is due to the standard construction practice of installing underground utility lines. When constructing a sanitary or storm sewer line, a trench is dug into the native ground and the pipe is placed on a granular bedding material such as gravel. The trench is then filled with this same granular material to a certain height above the pipe, then native backfill material is used to bring the top of the trench to the ground surface. The cross-sectional area which contains the granular material may then act as a "conduit," or pathway, for fluids released from the pipeline. It can be expected that this fluid will travel along this "conduit" to the next downgradient manhole. Here, the fluid may continue past the manhole or be trapped in the granular bedding material below the base of the manhole. Therefore, when sampling at a manhole, two samples shall be taken. One groundwater sample will be taken near the bottom of the manhole on the inlet side to determine the presence of contaminants in the bedding material; one soil sample shall be taken near each manhole frame and cover to provide data concerning the possibility of surcharge at the manholes.

The sampling scheme proposed for the storm sewer system will only investigate pipelines downgradient of industrial sources. These segments will be sampled at 200 foot intervals, with the first sample collected 200 feet from the intersection of the pipeline with the building's face. Additional samples will be taken on alternating sides of the pipeline at 200 foot intervals, with one soil and groundwater sample at each manhole. The type of sample taken along the pipeline is dependent upon the location of the pipeline in reference to the groundwater table. This work plan proposes a sampling interval of 200 feet. However, if the distance between manholes is less than 300 feet, samples will be taken only at each manhole. If the distance between manholes is 300 to 500 feet, one sample will be taken at the midway point, with one sample at each manhole. For lines greater than 500 feet, the interval spacing will be 200 feet, with one

sample at each manhole. The interval-based sampling will terminate at the outfall of the storm sewer pipeline. If the outfall discharges directly into the Cooper River, one sediment sample will be taken near the pipe's end, at a depth of 0 to 6 inches. Interpretation of the results of the sediment sample's analytical data will be deferred to the Zone J investigation. Should further evaluation of the outfalls be required, it will be performed under the Zone J field work.

Where the contaminant concentrations along a section of pipe are ubiquitous, it may be difficult to pinpoint the area of release. This may indicate either the industrial waste discharged into the system has corroded or disintegrated the pipeline, a break in the line exists, or contaminants from nearby sites have migrated into the bedding material. If the sampling does not conclusively identify the point of release, the pipeline will be internally investigated by remote television cameras. This task will be performed by a subcontractor, with E/A&H providing oversight. Prior to video taping the pipeline segment's interior, it shall be cleaned of all sediment and debris to ensure the cameras provide an adequate visual representation. This waste material will be removed, drummed, analyzed, and properly disposed. The remote television inspection is designed to locate segments of pipelines where hazardous materials released into the pipeline have corroded or disintegrated the pipeline, or where hazardous materials have been released from the pipeline into the environment due to integrity problems of the pipeline (i.e. collapse, breaks, etc.). E/A&H personnel will view all videotapes of the television inspection to locate potential defects. If defects are detected, their locations will be measured from the upgradient manhole and labeled. If no defects are apparent, no further evaluation of the pipe's interior will be conducted. However, further assessment will be required to identify the source of contamination. A revised site-specific sampling plan, along with the video tape showing the defect, will be developed and submitted to the BCT for approval. All tapes will be made available to the Project Team during the 30%, 60%, and 90% progress meetings.

Once the areas to be investigated have been defined, the proposed sampling locations will be compared to the other zones' investigations to ensure duplicate sampling efforts are prevented. When information concerning subsurface conditions along pipelines of interest supplied by sampling in the other zones adequately characterizes the pipeline, sampling under the Zone L RFI Work Plan for that particular segment of pipeline will be eliminated. Therefore, the analytical data from the other zones' samples will be used to evaluate the pipeline segment. Should the results from the other zones' sampling indicate a contaminant is present, further evaluation to define the nature and extent of contamination will be performed under the direction of that particular zone. For areas where there are no samples from the other zones in the general vicinity of pipelines in question, sampling will be performed under the Zone L RFI Work Plan. Figures 2-30, 2-31, and 2-32 represent the proposed sample location selected based on the strategy, research, and justification outlined in this work plan.

The layout of sample locations was determined based on the best information available. However, due to the limited accuracy of available information, some of the actual locations may have changed slightly based on field conditions. If a suitable sampling location cannot be found, the field crew will notify USEPA and SCDHEC to discuss an alternative sampling strategy before continuing. All sampling will adhere to the NAVBASE *Final Comprehensive RFI Work Plan*. Table 2-7 summarizes the type of samples and analytical parameters.

As previously discussed in Section 2.2.4 (Sampling and Analysis Plan), an objective of the proposed field investigation for the sanitary sewer lines is to establish whether contaminants have been released from an industrial source into the storm sewer system via cross-connects. If a sanitary to storm sewer cross-connect is located during the dye testing investigation proposed under Section 2.2.4, further sampling along the downstream storm lines will be performed under AOC 699 - Storm Sewer System.

Table 2-7
Storm Sewer System
Site-Specific Sampling Plan

Matrix	Quantity	Analysis
Soil Screening (pipe invert)	20	VOA, Metals, and Cyanide.
Groundwater Screening	103	
Sediment Screening	10	
Soil Confirmation (pipe invert) *	2 **	VOA, SVOA w/ TICs, Metals,
Groundwater Confirmation *	11**	Cyanide, Pesticides, and PCB.

Notes:

The quantities presented are estimated numbers of samples believed to be needed to fulfill the objectives of the investigation. Expansion of the investigation may be necessary to meet the stated objectives.

All analyses will be performed per SW-846, except where other methods are specified. Duplicates will be collected at the location where contaminants are most likely to be found. The sample quantities presented do not include Quality Assurance/Quality Control (QA/QC) samples.

* Confirmation samples shall taken for DQO Level IV type analysis.
** The quantities of soil and groundwater confirmation samples are estimates only. Per this work plan, the quantity of confirmation samples shall, at a minimum, equal to 10% of the total screening samples obtained by DPT equipment. An exact quantity will not be available until all DPT samples are obtained at each investigative location.

2.4 AOC 699, Storm Sewer System

The storm sewer system at NAVBASE has been identified as AOC 699 and is designated for an RFI as described in the *Final RFA* (Volume V, June 1995). In this investigation, the storm sewers — including gravity pipelines and manholes — will be addressed. The site is described in Table 2-6 and shown on Figures 2-1 and 2-2.

Table 2-6
AOC 699
Site Information

Number	Description	Material Generated or Stored	Potential Pathways
AOC 699[A] **Storm Sewer System**	See Description in Text Following This Table	Acids Solvents Surfactants Heavy Metals Caustic Solutions Petroleum Hydrocarbons (VOA, SVOA, Metals and Cyanide)	Air **Soil** **Soil Gas** Sediment **Groundwater** Surface Water

Notes:

[A] Described in the *Final RCRA Facility Assessment*, Vol. V, June 1995.
Pathways bolded will be sampled.

Storm Sewer System

The storm sewer system collects rainfall from 1,325 acres; 8.3 million gallons are collected and discharged in a typical storm of 0.5 inches over 2 hours. Water is ultimately discharged to the Cooper River via approximately 55 discharge outfalls. Lines consist of vitrified clay, ductile iron, PVC, corrugated metal, and reinforced concrete. Pipes range in size from 4-inch diameter downspouts to 72-inch diameter trunk lines.

As discussed in Section 1.2, an investigative strategy was developed to assist in the preparation of this document. Section 2.2 further defines the tasks involved in the strategy. Due to the

similarities of the two sewer systems, this section will not repeat the general items of the strategic outline; however, we will only discuss the specific items relating the storm sewer system.

Special concerns for the sewer systems are cross-connects and run-off of contaminated sediments from SWMUs and AOCs into catch basins during storm events. As previously discussed in Section 1.2, cross-connects where the storm sewer discharges to the sanitary sewer were identified in the *Wastewater Facilities Evaluation* and listed in Table F-1 of Appendix F. However, it is not known whether all cross-connects were identified. Therefore, further investigation to determine if any cross-connects of the sanitary sewer to the storm sewer down gradient of industrial sources and potential sources of contaminants is required. This will be accomplished by performing dye traces and will be performed under SWMU 37 - Sanitary Sewer System. If sanitary to storm sewer cross-connects are located, further sampling along the association storm sewer pipes may be required. Contaminated sediment run-off collected in storm sewer catch basins has been considered during the development of SWMU and AOC specific investigations in other zone work plans. Interim measures have been proposed that will entail cleaning sediment from catch basins in the vicinity of several sites in Zone E to mitigate the possibility of those sediments being transported to the Cooper River.

2.4.1 Previous Investigations

Previous reports and/or records pertinent to this investigation are the *Wastewater Facilities Evaluation,* September 1990; *Final Report for Storm Water Discharges Studies*, Phase II, October 1994; and the CNSY OSHE office spill reports. The *Wastewater Facilities Evaluation* and *Final Report for Storm Water Discharges Studies* identify specific problems in the sewer system. No environmental data have been found regarding the storm sewer system.

3.0 HEALTH AND SAFETY PLAN

3.1 Introduction

The following Health and Safety Plan is designed to ensure the safety and health of site workers throughout the completion of field activities to the Zone L RFI at NAVBASE.

This Zone L-Specific Health and Safety Plan (ZLHASP) has been developed for tasks related to the SWMU 37, AOC 504, and AOC 699 investigations.

This ZLHASP is intended to complement the E/A&H NAVBASE Comprehensive Health and Safety Plan (CHASP) by providing site- and activity-specific details which are not addressed in the CHASP.

This document is organized to provide site workers concise discussions of site conditions and expected hazards. Section 3.2, Employee Protection, identifies zone-wide hazards expected to be encountered throughout the investigation and specifies the procedures and controls to abate them. Section 3.4, Site-Specific Information and Requirements, concisely describes Zone L sites and expected chemical and physical hazards, analyzes site hazards with respect to the site activities, and specifies hazard abatement procedures and controls to be implemented. Copies of both this plan and the CHASP must be onsite during all field operations.

3.1.1 Applicability

The provisions of this plan are mandatory for E/A&H personnel, who must read it and sign the acceptance form (Appendix G) before starting site activities. In addition, personnel will adhere to the most current requirements of Title 29 Code of Federal Regulations (CFR) 1910.120, Standards for Hazardous Waste Operations and Emergency Response (HAZWOPER), as specified for workers involved in corrective actions under RCRA.

All non-E/A&H personnel present in E/A&H work areas shall either adopt and abide by this ZLHASP and the corresponding CHASP, or shall have their own safety plan which, at a minimum, meets the requirements of E/A&H's plans. Subcontractors who adopt the provisions of these plans are wholly responsible for enforcing the requirements with their employees and shall provide each employee with personal protective equipment (PPE) and implement controls as specified in the ZLHASP and the CHASP.

This ZLHASP applies to specific planned activities and procedures such as integrity testing sewer lines; boring, installing, and developing groundwater monitoring wells; surveying; and collecting soil, groundwater, surface water, and sediment samples. To the extent feasible, DPT will be used to collect subsurface samples. Confined space entry may occur in this zone. Confined space entry procedures are discussed in Section 3.2.2.1 and a copy of the E/A&H Confined Space Entry Program is provided in the CHASP.

Nonroutine procedures and tasks involving nonroutine hazards are not adequately addressed in this plan. Examples of such procedures are:

- Waterborne activities
- Trenching
- Sampling, handling, or removing unidentified drums

Should it be necessary to conduct these or other high-risk tasks, specific health and safety procedures must be developed, approved, and implemented before proceeding.

3.1.2 Work Zones

Section 2.1 of the CHASP describes the function and interrelation of the three work zones which, in combination, constitute the work area. The three work zones are:

- Exclusion Zone (EZ)
- Contamination Reduction Zone (CRZ)
- Support Zone (SZ)

These work zones will be established and used during fieldwork covered under this ZLHASP.

3.1.3 Work Area Access

Authorized personnel will be allowed access to work areas as long as they follow the requirements of this ZLHASP and the CHASP (see also Work Area Access, Section 2.2 of the CHASP).

3.1.4 Zone Research

Section 3.4 will provide a specific site description including chemical and physical hazards, appropriate controls, and PPE. The EZ, CRZ, and SZ for each site will be established in the field. The locations of these zones depend on the work task, site layout, weather, and logistical factors.

E/A&H has performed substantial effort in an attempt to research the location of underground utilities associated with each work area. Sample locations are situated with respect to that information. However, because few of the underground utility locations are actually surveyed, the sample locations essentially are based on schematic engineering diagrams. Therefore, great care will be taken during any intrusive work within Zone L. Precautions required to prevent drilling into underground utilities are stated in Section 3.2.2.2.

3.2 Employee Protection

Employee protection for the work to be completed under the Zone L RFI Work Plan was determined by researching site conditions, reviewing planned activities, and identifying site-specific physical and chemical hazards. This section of the ZLHASP identifies zone-wide potential physical and chemical hazards as follows:

- Section 3.2.1 Work Limitations
- Section 3.2.2 Physical Hazards
- Section 3.2.3 Chemical Hazards
- Section 3.2.4 Selection of PPE
- Section 3.2.5 Air Monitoring

Physical or chemical hazards that are unique to a SWMU or AOC are discussed in the appropriate subsection of Section 3.4, Site-Specific Information and Requirements.

3.2.1 Work Limitations

All site activities will be conducted during daylight only. E/A&H is also assuming that shipyard activities will continue during completion of the work specified in the Zone L RFI. Therefore, as needed, all work activities, and locations will be coordinated with Code 106 at least 10 working days before they begin. Some field activities associated with AOC 504, the Railroad System, will require coordination with the Public Works Division (PWD), Division of Planning and Estimating. These requirements are explained in detail in Section 3.4.2.2.

3.2.2 Zone L Physical Hazards

Field personnel should be aware of, and act in a manner to minimize, the dangers associated with physical hazards typically encountered during environmental investigations. These hazards include confined space entry, aboveground and underground utilities, heat- and cold-related

illnesses, severe weather, working with and around drill rigs and heavy equipment, uneven terrain, slippery surfaces, and improper lifting.

3.2.2.1 Confined Space Entry

E/A&H is concerned about employee safety when working in or around confined spaces. Therefore, E/A&H personnel are required to characterize the potential hazards associated with entering any confined space. Refer to the following definitions for space characterization information.

Confined Space — A space that is: (1) large enough and so configured that an employee can bodily enter and perform assigned work; (2) has limited or restricted means for entry or exit; and (3) is not designed for human occupancy. Confined spaces may include, but are not limited to, storage tanks, manholes, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, trenches, vats, and open-top spaces more than 4 feet deep such as pits, tubs, vaults, or any place with limited ventilation.

Permit-Required Confined Space (permit space) — A confined space with one or more of the following characteristics: (1) contains or has the potential to contain a hazardous atmosphere; (2) contains a material that can engulf an entrant; (3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; or (4) contains any other recognized serious safety or health hazard.

Nonpermit Confined Space — A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

NOTE: E/A&H PERSONNEL SHALL OBTAIN WRITTEN APPROVAL FROM A COMPANY PRINCIPAL AND THE PROJECT HEALTH AND SAFETY MANAGER (PHSM) BEFORE BEGINNING EITHER A PERMIT- OR NON-PERMIT-REQUIRED CONFINED SPACE ENTRY. ALL CONFINED SPACE ENTRY WILL BE SUPERVISED BY THE PHSM, AND WILL BE CONDUCTED WITH RESPECT TO THE E/A&H CORPORATE CONFINED SPACE ENTRY PROGRAM (AS INCLUDED IN THE CHASP) AND 29 CODE OF FEDERAL REGULATIONS (CFR) 1910.146.

No subcontractors may enter a permit-required or non-permit-required confined space without first submitting a copy of their Confined Space Entry Program to E/A&H. This program must be submitted to the project health and safety manager (PHSM) at least 10 working days prior to confined space entry and at a minimum, comply with the Occupational Safety and Health Administration (OSHA) standard. In addition to having a compliant program, the subcontractor must demonstrate compliance with its Confined Space Entry Program prior to entering by showing the PHSM (or PHSM designee) a completed entry permit and all necessary monitoring, ventilation and rescue equipment.

Some fieldwork in Zone L, in particular the field survey of SWMU 37, the sanitary sewer system, and AOC 699, the storm sewer system, is likely to require permit-required confined space entries. E/A&H personnel will be involved in contractor oversight only and are not expected to enter any confined space. If E/A&H personnel must enter a confined space, they will demonstrate compliance with the Corporate Confined Space Entry Program and 29 CFR 1910.146 before entry procedures begin.

Prior to E/A&H personnel or one of its subcontractors entering a confined space, the following requirements must be met:

- Compliance with 29 CFR 1910.146, in particular compliance with provisions on ventilation, atmospheric testing, and rescue personnel and equipment must be demonstrated and documented.

- Oxygen concentrations must be 19.5% or higher. If oxygen concentrations cannot be maintained above this level, entry procedures will need to be substantially upgraded.

- Hydrogen sulfide concentrations must be less than 5 parts per million (ppm). If concentrations exceed 5 ppm and ventilation efforts cannot further reduce airborne concentrations of hydrogen sulfide, then entry will require the use of self-contained breathing apparatus (SCBA) with escape bottles or pressure-demand airline respirators with escape bottles.

- Combustible gases shall not exceed 10% of the lower explosive limit (LEL).

- The concentration of airborne chemicals shall not exceed 5 ppm as determined using a PID with a 10.2 electron volt lamp. If specific gases are known to be present, then they shall not be present at greater than 50% of their Permissible Exposure Limits (PELs) or Threshold Limit Value (TLV), whichever is lower. If any of these conditions are met, and ventilation efforts cannot further reduce airborne concentrations, entry will require the use of SCBAs with escape bottles or pressure-demand airline respirators with escape bottles.

3.2.2.2 Underground Utilities

The Public Works Engineering Department has stressed that the utility maps are highly subjective and only approximate the subsurface utility locations. Very few, if any, utility lines were surveyed upon installation, repair, or modification. The problems associated with subsurface obstructions predominantly relate to the health and safety of field personnel, but may also alter proposed subsurface sampling points. However, to prevent penetrating utility lines, considerable research was dedicated to locating subsurface utilities in preparing this work plan.

Proposed subsurface sampling locations shown in this work plan have been chosen based on a number of variables including: the suspected direction of groundwater and surface water flow, proximity to the investigated unit, suspected location of subsurface utilities and piling support structures, and aboveground improvements such as buildings, facilities, railways, and portal crane rails.

Borings near underground utility lines that are not part of this investigation (i.e., those other than storm water and sanitary sewers) will be offset 5 feet from the utility line. If this offset cannot be achieved, the borings will be advanced with a posthole digger or hand auger to 5 feet bgs to ensure that the subsurface utility is not penetrated. Personnel shall use electrical insulating gloves and boots when performing these operations. If a subsurface obstruction is encountered, the boring will be terminated. When a boring is terminated, the borehole will be pressure-grouted to the soil/asphalt or concrete interface, and the asphalt or concrete plug will be cemented back in place flush with the existing surface grade.

3.2.2.3 Procedures and Equipment for Hot or Cold Weather

The Site Supervisor and the Site Health and Safety Officer (SHSO) shall be aware of the potential for heat stress and other environmental illnesses. When environmental or work conditions dictate, work regimens shall be implemented to minimize the potential for employee

illness. Field staff will be responsible for monitoring coworkers for signs or symptoms of heat- or cold-induced illness. For a discussion of the more common heat- and cold-related illnesses and their associated symptoms, see CHASP Section 6.5.1.

Due to the ambient environmental conditions typical for Charleston, South Carolina, the heat index and/or core body temperature (area and/or personal) will be monitored during hot weather and/or when elevated levels of PPE are used. In addition to using various work-rest regimens, employees also will use cool vests to help regulate core body temperature when conditions dictate.

3.2.2.4 Severe Weather

Fieldwork shall not be conducted when lightning can be seen or thunder heard from the work area. When lightning and/or thunder occur, cease work, perform emergency personal and equipment decontamination (see Section 3.3) as needed, then seek shelter.

During extreme weather conditions, the Site Supervisor shall use his/her best judgment and has the authority to stop fieldwork or dismiss workers for the day. Examples of conditions that (may) warrant work stoppage include: tornado warnings, hurricane warnings, high winds, hail, flooding, and ice storms.

3.2.2.5 Working Around DPT, Drill Rigs, and Other Heavy Equipment

When working around heavy equipment and drill rigs, personnel will adhere to the procedures outlined in the CHASP, Appendix B, Drilling Safety Guide.

When working with or near DPT equipment, the use of hearing protection is required.

3.2.2.6 Radiation Protection

Radioactive materials/hazards are potentially present within Zone L as a result of past operational activities at CNSY. As part of the CNSY and the NAVBASE closure process, the Navy is required to conduct radiological surveys to verify that all naval material has been removed.

Before E/A&H and contractors begin fieldwork, the CNSY General Survey Project Superintendent of Zone L shall be contacted to determine if the CNSY radiological verification surveys have been completed there. Once completion of the surveys has been verified, work may commence in these areas with no radiological precautions required. This applies to all E/A&H employees and their contractors while conducting fieldwork in Zone L, including but not limited to walkover investigations, drilling, well development, soil sampling, water sampling, and trenching.

3.2.2.7 Standard Safe Work Practices

- When conducting fieldwork, personnel should walk. Running greatly increases the probability of slipping, tripping, or falling.

- Eating, drinking, chewing gum or tobacco, smoking, or any activity that increases the probability of hand-to-mouth transfer of contaminated material is prohibited in the EZ and CRZ.

- Hands and face should be thoroughly washed upon leaving the EZ when personnel may have come into contact with contaminated soil, water, or sediment.

- No contact lenses will be worn in work areas during invasive activities.

- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as practical after leaving the CRZ.

- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, or discolored surfaces, or lean, sit, or place equipment on drums, containers, or on soil suspected of being contaminated.

- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on cleanup or response operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Consumption of alcoholic beverages is prohibited.

- Adequate side and overhead clearance must be maintained to ensure that the drill rig boom does not touch or pass close to any overhead power lines or other overhead obstacles or obstructions.

- Utility lines should be marked using characteristic spray paint or labeled stakes. A buffer zone, 3 yards to either side of a utility line, should be maintained during all subsurface investigations.

- Due to the flammable properties of the potential chemical hazards, all spark or ignition sources should be bonded and/or grounded or mitigated before soil boring advancement or other site activities begin.

3.2.2.8 General Rules of Conduct

- Liquor, firearms, narcotics, tape recorders, and other contraband items are not permitted on the premises.

- Any violation of local, state, or federal laws, or conduct which is outside the generally accepted moral standards of the community is prohibited.

- Violation of the Espionage Act, willfully hindering or limiting production, or sabotage is not permitted.

- Willfully damaging or destroying property, or removing government records is forbidden.

- Misappropriation or unauthorized alteration of any government records is forbidden.

- Securing government tools in a personal or contractor's tool box is forbidden.

- Gambling in any form, selling tickets or articles, taking orders, soliciting subscriptions, taking collections, etc. is forbidden.

- Doing personal work in government shop or office, using government property or material for unauthorized purposes, or using government telephones for unnecessary or unauthorized local or long-distance telephone calls is forbidden.

- Compliance with posted signs and notices is required.

- Boisterousness and noisy or offensive work habits, abusive language, or any verbal, written, symbolic, or other communicative expression which tends to disrupt the work or morale of others is forbidden.

- Fighting or threatening bodily harm to another is forbidden.

- Defacing any government property is forbidden.

- Wearing shorts of any type and/or offensive logos, pictures, or phrases on clothing is forbidden. Shirts, shoes, and pants, slacks, or coverall-type garments will be worn at all times on government property.

- All persons operating motor vehicles will obey all NAVBASE traffic regulations.

3.2.2.9 Medical Monitoring Program

See CHASP Section 7.

3.2.3 Chemical Hazards

Identifying Materials Generated or Stored

The list of materials generated or stored for each investigative site are based on review of the RFA. Where the RFA identifies specific chemicals, those chemicals are listed. However, where historical information does not identify the use or disposal of specific chemicals, the work plan specifies only chemical classes. To measure, evaluate, and prevent worker exposures, the procedures outlined in this document will account for all available information and will base control procedures and PPE on worst-case scenario assumptions. Section 3.4, Site-Specific Information, will identify the specific chemical hazard, if known, and will base exposure monitoring, controls, and PPE on that information. If only the chemical class is known,

exposure monitoring, control procedures, and PPE will be designed to accommodate a wide range of chemicals within that class or classes. Due to the lack of reliable historical data for some sites within Zone L and the documented use of solvents, heavy metals, and polychlorinated biphenyls (PCBs) throughout the site, E/A&H will approach each site investigation with appropriate caution and with site workers trained and equipped to measure and identify chemical hazards potentially generated during each intrusive procedure. Chemical hazards are selected to represent the range of acute and chronic health (toxicological) hazards that are, or may foreseeably be, present onsite. Not every chemical known or suspected of being present is listed as a chemical hazard. Rather, one or two of the most toxic or most prevalent contaminants within a class of chemicals are listed below.

Based on the information in the RFA, chemicals in Table 3-1 have been used at NAVBASE Charleston. Therefore, they have the potential to be present at Zone L. Table 3-1 lists the specific chemical hazards as identified in the RFA.

3.2.4 Selection of PPE

Specified PPE must protect against known and suspected site hazards. Protective equipment is selected based on the types, concentrations, and routes of personal exposure that may be encountered. When the types of materials and possibilities of contact are unknown or the hazards are not clearly identifiable, a more subjective determination must be made of the PPE required, and greater emphasis is placed on experience and sound safety practices. As discussed above, PPE for site workers will be based on site history and the activities to be performed there. Section 3.4 Site-Specific Information, will describe the site, discuss the work planned there, and specify the level of PPE to be used based on the site chemical and physical hazards.

Table 3-1
Zone L Chemical Hazards — Exposure Information

Compound	Ionization Potential (ev)[a]	Odor Threshold (ppm)	OSHA PEL[a]	ACGIH TLV[b]	NIOSH REL[c]	Action Level
Solvents/Degreasers						
Perchloroethylene	9.3	5	25 ppm	25 ppm 100 ppm — STEL	Potential Occupational Carcinogen	12 ppm
Chloroform	11.4	205	2 ppm	10 ppm Suspected Human Carcinogen	2 ppm Potential Occupational Carcinogen	1 ppm
Trichloroethylene	9.5	50	50 ppm 200 ppm — STEL	50 ppm 100 ppm — STEL	25 ppm Potential Occupational Carcinogen	12 ppm
Vinyl Chloride	7.6	260	1 ppm 5 ppm — Ceiling Confirmed Carcinogen	5 ppm Confirmed Human Carcinogen	Potential Occupational Carcinogen	0.5 ppm
Methylene Chloride	11.4	214	500 ppm 1,000 ppm — Ceiling	50 ppm Suspected Human Carcinogen	Potential Occupational Carcinogen	25 ppm
1,1,1-Trichloroethane	Not Listed	100	350 ppm 450 ppm — STEL	350 ppm 450 ppm — STEL	350 ppm — Ceiling	175 ppm
Benzene	9.25	4.7	1 ppm 5 ppm — STEL	10 ppm Suspected Human Carcinogen	0.1 ppm 1 ppm Ceiling Potential Occupational Carcinogen	0.5 ppm
Toluene	8.8	40	100 ppm 150 ppm	50 ppm Skin	100 ppm 200 ppm — Ceiling	25 ppm

Table 3-1
Zone L Chemical Hazards — Exposure Information

Compound	Ionization Potential (ev)[c]	Odor Threshold (ppm)	OSHA PEL[a]	ACGIH TLV[b]	NIOSH REL[c]	Action Level
Solvents/Degreasers						
Ethylbenzene	8.8	140	100 ppm 125 ppm — STEL	100 ppm 125 ppm — STEL	Not Listed	50 ppm
Xylene	8.6	0.05	100 ppm 150 ppm — STEL	100 ppm 150 ppm — STEL	100 ppm 200 ppm — Ceiling	50 ppm
2-Butanone (MEK)	6.7	10	200 ppm 300 ppm — STEL	200 ppm 300 ppm — STEL	200 ppm	100 ppm
Hexane	10.2	130 ppm	500 ppm 1,000 ppm — STEL	50 ppm	100 ppm	25 ppm
PCBs	Not Listed	Not Listed	0.5 mg/m³ Skin	0.5 mg/m³ 1 mg/m³ Skin	Not Listed	0.25 mg/m³
Ethylene Glycol	9.3	Not Listed	50 ppm — Ceiling	50 ppm — Ceiling	Not Listed	25 ppm
Metals						
Lead	N/A	N/A	0.05 mg/m³	0.15 mg/m³	<0.1 mg/m³	0.025 mg/m³
Cadmium	N/A	N/A	0.05 mg/m³	0.002 mg/m³ — Respirable Fraction 0.01 mg/m³ — Total Dust	Lowest Feasible Concentration	0.01 mg/m³
Chromium	N/A	N/A	1 mg/m³	1 mg/m³	0.5 mg/m³	0.25 mg/m³
Mercury	N/A	N/A	0.05 mg/m³ — Skin	0.025 mg/m³ — Skin	0.05 mg/m³	0.012 mg/m³
Silver	N/A	N/A	0.01 mg/m³	0.1 mg/m³	Not Listed	0.005 mg/m³

Table 3-1
Zone L Chemical Hazards — Exposure Information

Compound	Ionization Potential (ev)[c]	Odor Threshold (ppm)	OSHA PEL[a]	ACGIH TLV[b]	NIOSH REL[c]	Action Level
Metals						
Copper	N/A	N/A	0.1 mg/m³ — Fume 1 mg/m³ — Dust	0.2 mg/m³ — Fume 1 mg/m³ — Dust	Not Listed	0.05 mg/m³ — Fume 0.5 mg/m³ — Dust
Potassium Cyanide	N/A	N/A	5 mg/m³	5 mg/m³ — Ceiling Skin	5 mg/m³ — Ceiling	2.5 mg/m³
Sodium Cyanide	N/A	N/A	5 mg/m³	5 mg/m³ — Ceiling Skin	5 mg/m³ — Ceiling	2.5 mg/m³
Nickel	Not Listed	Not Listed	1 mg/m³	1 mg/m³	0.015 mg/m³ Potential Occupational Carcinogen	0.007 mg/m³
Fuels						
Benzene	9.25	4.7	1 ppm 5 ppm — STEL	10 ppm Suspected Human Carcinogen	0.1 ppm 1 ppm — Ceiling Potential Occupational Carcinogen	0.5 ppm
Toluene	8.8	40	100 ppm 150 STEL	500 ppm -- Skin	100 ppm 200 ppm — Ceiling	225 ppm
Ethyl Benzene	8.8	140	100 ppm 125 ppm - STEL	100 ppm 125 ppm - STEL	Not Listed	50 ppm
Xylene	8.6	0.05	100 ppm 150 ppm — STEL	100 ppm 150 — STEL	100 ppm 200 ppm — Ceiling	50 ppm

Table 3-1
Zone L Chemical Hazards — Exposure Information

Compound	Ionization Potential (ev)[c]	Odor Threshold (ppm)	OSHA PEL[a]	ACGIH TLV[b]	NIOSH REL[c]	Action Level
Fuels						
Tetraethyl Lead	11.1	Not Listed	0.075 mg/m³ — Skin	0.1 mg/m³ — Skin	<0.1 mg/m³	0.037 mg/m³
Kerosene	6.8	1	Not Listed	Not Listed	100 mg/m³	50 mg/m³
Acids						
Nitric Acid	N/A	N/A	2 ppm 4 ppm — STEL	2 ppm 4 ppm — STEL	2 ppm	1 ppm
Sulfuric Acid	N/A	N/A	1 mg/m³	1 mg/m³ 3 mg/m³ — STEL	1 mg/m³	0.5 mg/m³
Hydrochloric Acid	N/A	N/A	7 mg/m³ — Ceiling	7 mg/m³ — Ceiling	Not Listed	3.5 mg/m³
Chromic Acid	N/A	N/A	0.1 mg/m³ — Ceiling	0.05 mg/m³ — Confirmed Human Carcinogen	0.001 mg/m³	0.0005 mg/m³
Pesticides						
DDT	Not Listed	Not Listed	1 mg/m³ — Skin	1 mg/m³	0.5 mg/m³	0.25 mg/m³
DDE	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	—
Chlordane	13.4	Not Listed	0.5 mg/m³ — Skin	0.5 mg/m³ — Skin	Potential Occupational Carcinogen	0.25 mg/m³
Dieldrin	Not Listed	0.041	0.25 mg/m³ — Skin	0.25 mg/m³ — Skin	Potential Occupational Carcinogen	0.12 mg/m³

Table 3-1
Zone L Chemical Hazards — Exposure Information

Compound	Ionization Potential (ev)[d]	Odor Threshold (ppm)	OSHA PEL[a]	ACGIH TLV[b]	NIOSH REL[c]	Action Level
Pesticides						
Endrin	Not Listed	Not Listed	0.1 mg/m³ — Skin	0.1 mg/m³ — Skin	Not Listed	0.05 mg/m³
Malathion	Not Listed	Not Listed	10 mg/m³	10 mg/m³ — Skin	15 mg/m³	5 mg/m³
Parathion	Not Listed	Not Listed	0.1 mg/m³ — Skin	0.1 mg/m³ — Skin	0.05 mg/m³	0.025 mg/m³
Additional Site Contaminants						
Freon (Chlorodifluoro-methane)	Not Listed	Not Listed	1,000 ppm	1000 ppm	Not Listed	500 ppm
Benzo(a)pyrene	NA	NA	0.2 mg/m³	0.2 mg/m³ Confirmed Human Carcinogen	0.1 mg/m³ Potential Occupational Carcinogen	0.1 mg/m³
Benzo(b)fluoranthene	NA	NA	0.2 mg/m³	0.2 mg/m³ Confirmed Human Carcinogen	0.1 mg/m³ Potential Occupational Carcinogen	0.1 mg/m³

Notes:

[a] OSHA Permissible Exposure Limit (PEL) 29 CFR 1910.1000, Table Z-1-A. Limits For Air Contaminants.
[b] 1994-1995 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists (ACGIH).
[c] National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) Pocket Guide to Chemical Hazards, June 1990.
[d] Odor Thresholds for Chemicals with Established Occupational Health Standards, American Industrial Hygiene Association, 1989, Range of All Reference Values.
mg/m³ Milligrams per cubic meter

PPE requirements are subject to change as site information is updated or changes. A decision to deviate from specified levels of PPE as contained in this ZLHASP must be made or reviewed by the PHSM. Table 3-2 presents the levels of PPE which may be employed at Zone L, and the criteria for upgrading PPE.

3.2.5 Air Monitoring

Air will be monitored for VOCs, respirable dust, oxygen, and combustible gases during intrusive investigative activities. Personnel may also be monitored to determine mean exposure concentrations they received while performing fieldwork. Personnel samples will be collected and analyzed with respect to National Institute for Occupational Safety and Health (NIOSH) *Manual of Analytical Methods*. At each site where Level C PPE is used, personnel samples will be collected to evaluate employee exposures. Additional personnel samples will be collected during site activities anticipated to represent worst-case exposure situations.

When possible, real-time monitoring instruments will be used to measure airborne contaminant concentrations. The PID for monitoring air will be field calibrated to measure VOCs relative to a 100 ppm isobutylene standard. If VOCs are detected downhole, colorimetric detector tubes and/or other sampling media may be used to identify these compounds and estimate their concentrations.

The PHSM reserves the right to require personal exposure monitoring or other types of air sample collection and analysis. These samples may be required for a variety of reasons such as: to identify a chemical odor, PID readings exceed or approach the Action Level (AL), or to determine if personal exposures are below OSHA PELs.

Table 3-2
Level of Protection and Criteria

Level of Protection	Criteria for Use	Equipment
Level A	• When atmospheres are immediately dangerous to life and health (IDLH in the *NIOSH/OSHA Pocket Guide to Chemical Hazards* or other guides.) • When known atmospheres or potential situations exist that could affect the skin or eyes or be absorbed into the body through these surfaces. Consult standard references to obtain concentrations hazardous to skin, eyes, or mucous membranes. • Potential situations include those where immersion may occur, vapors may be generated, or splashing may occur through site activities. • Where atmospheres are oxygen-deficient. • When the type(s) and or potential concentration of toxic substances are not known.	• Positive-pressure, full facepiece, (SCBA) or positive-pressure supplied air respirator (SAR) with escape SCBA. • Fully encapsulating chemical protective suit. • Chemical-resistant inner and outer gloves. • Steel toe and steel shank chemical-resistant boots. • Hard hat under suit. • Two-way radios worn inside suit. • Optional: coveralls, long cotton underwear, disposable protective suit, gloves and boots, over fully encapsulating suit.
Level B	• When respiratory protection is warranted and cartridge respirators are not appropriate. Examples of these conditions are: — When work area may contain less than 19.5% oxygen, — When expected contaminants do not have appropriate warning properties, e.g., vinyl chloride, or — When cartridges are not available to protect against all COPCs. • Hazards associated with limited dermal exposure are not significant.	• Chemical-resistant clothes, coveralls. • Positive-pressure, full face SCBA or SAR with escape bottle. • Hard hat. • Chemical-resistant outer and inner gloves. • Steel toe and steel shank boots. • Chemical-resistant outer boots.
Level C	• When respiratory protection is warranted and cartridge respirators are appropriate. • When PID readings exceed the Action Level (AL). • When air monitoring indicates airborne concentration of a chemical is 50% or more of the PEL or TLV. • And the work area contains at least 19.5% oxygen.	• Chemical-resistant coveralls. • Full face, air-purifying respirator equipped with cartridges suitable for the hazard. • Hard hat. • Chemical-resistant outer and inner gloves. • Steel toe and steel shank boots. • Disposable outer boots.

Table 3-2
Level of Protection and Criteria

Level of Protection	Criteria for Use	Equipment
Modified Level D	• When chemical contamination is known or expected to be present, yet inhalation risk is low and respiratory protection is not required. • Site contaminants may be absorbed through the skin. • The "default level" of PPE required when the ZLHASP does not specify another level of PPE. • When minimal or no chemical contamination is expected. • When ZLHASP specifies Level D protection is adequate. • And the work area has at least 19.5% oxygen.	• Chemical-resistant coveralls. • Chemical-resistant outer gloves; inner gloves or glove liners, optional. • Steel toe and steel shank boots. • Hard hat. • Safety glasses with side shields or safety goggles. • Optional: chemical-resistant outer boots. • Inner gloves or chemical-resistant gloves needed to handle soil or water samples. • Optional: coveralls and disposable outer boots. • Work clothes.

Air will be monitored for total (inspirable) dust using a real-time aerosol monitor to measure airborne dust concentrations. These data may be used by the PHSM and SHSO to determine if personnel exposures exceeded site ALs.

A combustible gas indicator (CGI) will be used during soil borings and well installations. The CGI will be field-calibrated to measure flammable gases relative to a methane standard. Downhole CGI readings will be collected periodically during soil-disturbing operations. Field activities will immediately cease if downhole readings meet or exceed 20% of the LEL. If CGI readings do not subside, the area will be immediately evacuated and the situation re-evaluated to determine how to proceed. Operations may not proceed until downhole readings are below 20% LEL.

Action Level and Ceiling Concentration

Each site at NAVBASE has a designated AL and ceiling concentration. For this project the AL is defined as the PID reading in the breathing zone above which respiratory protection must be upgraded; chemical-protective clothing may also be upgraded. The AL is determined on a

site-by-site basis. In some cases dust concentrations may be established as an AL. To exceed the AL, PID readings should be sustainable. Readings should remain above the AL for at least one or two minutes at a time. Readings that are elevated for only a few seconds every 15 or 20 minutes do not exceed the AL and do not require workers to upgrade their level of PPE.

The general AL for this zone, as determined on a properly calibrated PID, is 5 PID units above background. PPE shall be upgraded to Level C (assuming that cartridge respirators are appropriate, otherwise Level B) if airborne VOC concentrations in the breathing zone exceed the AL, or if the concentration of any contaminant exceeds 50% of the OSHA PEL. This baseline AL and general PPE requirement may be superseded by more stringent site-specific levels, as identified in Section 3.4.

If breathing zone levels exceed the AL, or site conditions indicate that additional health and safety precautions are needed, field activities in the area shall stop. Field staff shall notify the Site Supervisor of the situation and he/she shall contact the Project Manager and/or the PHSM. The PHSM will be responsible for reassessing the hazards and prescribing revised health and safety requirements as necessary, including upgraded PPE requirements, revised work schedules, and revised decontamination procedures. See Table 3-2 for specific criteria for each protection level.

If PID readings exceed 10 units, the SHSO shall contact the PHSM and discuss the need to identify and quantify airborne contaminants. Work shall not proceed until breathing zone concentrations return to background levels and it is reasonably anticipated that breathing zone readings will stay approximately at background levels, or the chemical constituent(s) are identified and appropriate PPE is donned.

The ceiling concentration is the maximum allowable PID reading in the breathing zone regardless of PPE. A ceiling concentration of 50 PID units has been established. Should VOC concentrations exceed 50 ppm in the breathing zone, field workers should secure their equipment and back off the site. Work shall not resume until the Site Supervisor and PHSM understand why VOC concentrations became elevated, know the major constituents of the VOCs being generated, and the VOCs in the breathing zone are less than 5 ppm or workers have upgraded to Level C or B. The proper PPE upgrade shall be determined by the PHSM based on site-specific chemical information, i.e., is there enough information to determine that air-purifying respirators will provide sufficient protection.

Field monitoring values will be recorded in a field logbook and copies will be posted for field personnel review.

Equipment Maintenance

Before being used daily, PIDs, CGIs, and other monitoring equipment shall be calibrated or their proper function verified. Throughout the day this equipment shall be periodically checked to ensure it is working properly. A final calibration shall be conducted at the end of the workday, at which time each instrument will be checked to ensure that it is free from surface contamination. Air monitoring equipment shall detect the calibration standard within a range of plus or minus 10%, otherwise the instrument shall be considered malfunctioning. Field staff shall note in their field notebooks that they conducted these calibrations and equipment checks.

When equipment is not functioning properly, it should be brought to the attention of the Site Supervisor or SHSO, who will arrange to repair or replace that equipment as needed.

3.3 Decontamination

3.3.1 Personnel and Equipment Decontamination

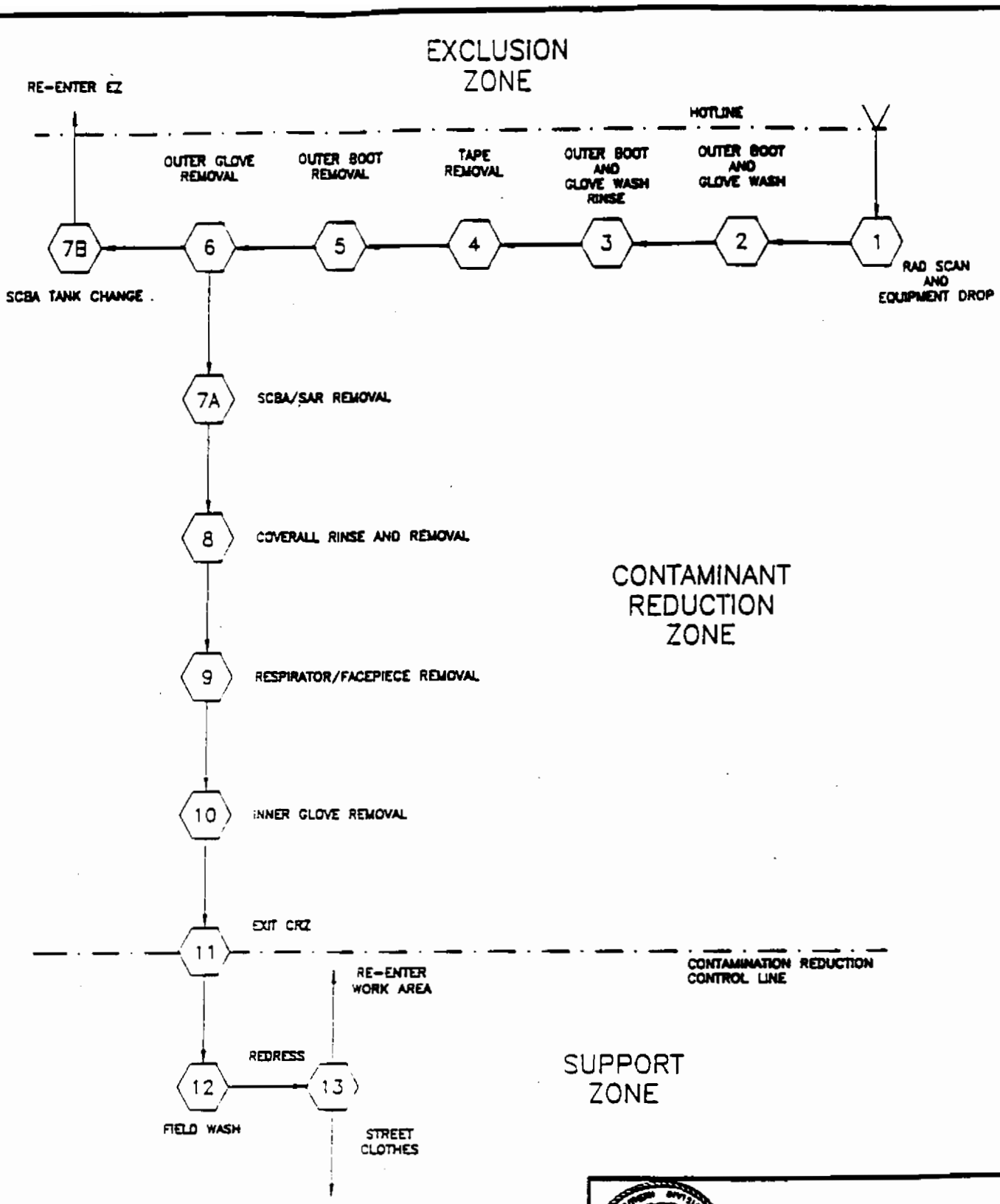
As needed, CRZs will be established adjacent to EZs and will include stations for decontaminating personnel, PPE, and hand tools. Typically, a portion of the CRZ will be covered with sheets of 6-mil polyethylene (generally, an area 20 feet by 20 feet is sufficient) with specific stations to accommodate the removal and disposal of the protective clothing, boot covers, gloves, and respiratory protection.

Heavy equipment and field equipment that cannot adequately be decontaminated in the CRZ may be decontaminated on a more centrally located decontamination pad. Table 3-3 lists equipment that may be convenient to have onsite to decontaminate heavy equipment and vehicles; this table also explains how equipment may be used.

Table 3-3
Equipment Recommended for Decontaminating Heavy Equipment and Vehicles

- **Tanks** or **drums** to be store collected wash and rinse solutions; alternatively, equipment to treat collected wash and rinse solutions may be substituted.
- **Pumps** and **filters** as needed to collect wash and rinsate solutions.
- Pressurized **steam sprayers** for steam-cleaning equipment.
- Long-handled **brushes** for general cleaning of exterior surfaces. Also **shovels** and other equipment may be used to dislodge caked-on contaminated mud on the undercarriage or in the tires.
- **Wash solutions**, selected for their ability to remove (dissolve, etc.) contaminants.
- **Rinse solutions**, selected for their ability to remove contaminants and wash solutions.
- **Pressurized sprayers** for washing and rinsing, particularly hard-to-reach areas.
- Clean **buckets** that can hold cleaning and rinsing solutions.
- **Brooms** and **brushes** that can be used to clean the interior, operator areas of vehicles and equipment.

The full contamination layout provided on Figure 3-1 shows one method of setting up an acceptable decontamination area for Level B PPE. There are numerous ways to lay out



ZONE L HASP
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 3-01
FULL DECONTAMINATION LAYOUT
LEVEL B PROTECTION

DWG DATE: 10/19/94 | DWG NAME: 29FDLLP

decontamination areas. Decontamination areas for Level C and Modified D PPE should be based on this concept of decontamination, but can be scaled back in accordance with the decontamination needs of the specific site and level of PPE. As a general rule, people working in the CRZ, assisting in the decontamination of workers leaving the EZ, shall be outfitted in PPE that is one protection level below what the exiting workers are using. For example, if workers leave the EZ in Level C, personnel in the CRZ should be in Modified D.

Often equipment may be adequately decontaminated using a soapy wash solution and following specified rinsing procedures. Normally hand-held equipment can be decontaminated in Level D with gloves or Modified Level D PPE. When steam-cleaning equipment, personnel shall wear Modified Level D PPE and a splash guard.

In inclement weather (e.g., lightning) or an emergency requiring immediate evacuation, contaminated equipment will be bagged or wrapped and taped in 6-mil polyethylene sheeting and tagged as "contaminated" for later decontamination.

Respirators not only need to be decontaminated and cleaned between uses, but also need to be sanitized. Alcohol swabs are generally sufficient.

3.3.2 Full Decontamination Procedures

Workers shall use the following cleaning and decontamination procedures when exiting the EZ for lunch, at the end of their shift, or when work is completed. Procedures for rest breaks and changing SCBA tanks and cartridges are described in Section 3.3.3. Not all steps apply to every situation; follow applicable procedures. Decontamination procedures shall start at the EZ/CRZ interface and continue away from the EZ toward the SZ. Figure 3-1 shows the steps involved in a formal decontamination of Level B workers.

Full Decontamination

1. ***Equipment drop***. Deposit equipment used onto plastic drop cloths or into a plastic-lined tub. All gross contamination should be removed here, fine cleaning and decontamination of equipment may be completed here or elsewhere. Before moving equipment that is still contaminated, it must be wrapped and taped.

2. ***Outer boot and glove wash***. Wash/remove gross contamination from outer boots, outer gloves, SCBA, and/or (SAR).

3. ***Tape removal***. Remove tape from ankles and wrists and discard in plastic-lined drum.

4. ***Outer boot removal***. Remove outer boots; disposable outer boots may be discarded in the same waste container used in Step 3. Nondisposable boots need a thorough cleaning before they can be removed from the site. (If nondisposable boots are used, it is preferable to have them dedicated to the project.)

5. ***Outer glove removal***. Remove and dispose of outer gloves. Gloves may be disposed in the same waste container as used in Step 3.

6. ***SCBA and SAR removal***. For Level B*.

   SCBA — With buddy or other site worker, remove backpack, remove facepiece, and shut off air flow.

   SAR — With buddy or other site worker, remove harness and escape bottle, remove face piece, and shut off air flow.

* If coveralls are significantly contaminated, leave the respirator facepiece on, disconnect the air hose just downstream of the regulator, turn off the air flow, remove the backpack or equipment harness, and leave the facepiece in place. Remove the facepiece in Step 8.

7. ***Coverall removal***. Rinse coveralls, if needed; remove coveralls and dispose of them. The same drum may be used as in Step 3. Nondisposable coveralls shall be double-bagged with the outer bag clearly labeled "contaminated."

8. ***Respirator removal***. Remove respirator (or facepiece of Level B equipment, if it is still being worn). Dispose of spent cartridges, clean, disinfect, dry, and properly store respirator or facepiece.

9. ***Inner glove removal***. Remove and dispose of inner gloves.

10. ***Exit area***. Exit the CRZ via the SZ.

11. ***Field wash***. Wash and rinse hands and face.

12. ***Re-dress***. Re-dress into appropriate PPE for re-entry or change into street clothes.

Notes

- All wastes (soil and water) generated during personal decontamination will be collected in 55-gallon drums. The drums will be labeled by E/A&H personnel; final disposal will be by the Navy.

- Hard hats and eye protection should be washed at the end of each workday with soap and water solution.

3.3.3 Partial Decontamination Procedures

To change a respirator cartridge or SCBA tank:

1. ***Outer boot and glove wash.*** Wash outer boots and gloves. Wash/remove gross contamination from SCBA and/or SAR.

2. ***Tape removal.*** Remove tape from ankles and wrists and discard it in a plastic-lined drum.

3. ***Facepiece removal.*** Disconnect facepiece and air hose just downstream of regulator. The facepiece may remain in place, or be removed and cleaned. Remove the spent tank from the backpack and replace it with a full tank. Connect air hose and turn on air.

4. ***Respirator removal.*** Remove respirator, remove used cartridges, clean and disinfect respirator, install new cartridges, and don respirator.

5. ***Respirator check.*** Check to make sure that respirator still seals properly to your face.

6. ***Don clean PPE.*** Put on clean outer gloves, tape wrists (as applicable), and re-enter EZ.

When taking a rest break:

1. ***Outer boot and glove wash.*** Wash outer boots and gloves. Wash/remove gross contamination from SCBA and/or SAR.

2. ***Tape removal.*** Remove tape from ankles and wrists and discard in a plastic-lined drum.

3. ***Respirator removal***. Remove SCBA unit, SAR harness, or respirator, and place in a clean area; plastic sheeting may be needed.

4. ***Coverall removal***. Remove outer wear if it is ripped or significantly contaminated. In hot weather, at least unzip and pull down upper half of coveralls.

5. ***Inner glove removal***. Remove and discard inner gloves.

6. ***Wash***. Wash and rinse hands and face at the field wash station.

7. ***Rest break***. Take rest break. Remember to drink plenty of water, Gatorade, or other similar beverage.

8. ***Don inner gloves***. Put on inner gloves.

9. ***Don PPE***. Don coveralls, outer boots, and outer gloves. Tape wrists and ankles (as needed), and re-enter the EZ.

Decontamination procedures, based on Level D protection:

- Brush heavily soiled boots and rinse outer gloves and boots with soap and water.
- Remove gloves and discard in a trash container.
- Discard gloves and other disposable PPE in a trash container.
- Wash hands and face, and preferably shower as soon as practical.

3.3.4 Closure of the Decontamination Station

All disposable clothing and plastic sheeting used during activities at sites with Level D through Level C will be double-bagged and discarded in a refuse container. Decontamination and rinse solutions and disposable PPE from Level B sites will be placed in a labeled 55-gallon drum (separate solids and liquids) for later analysis and disposal. All washtubs, pails, buckets, etc., will be washed and rinsed at the end of each workday.

3.4 Site-Specific Information and Requirements

Overview

Due to the enormous size and the limited information currently available for the sites in Zone L, a phased investigative strategy is presented in Section 2. The first phase will consist of:

- Interval-based sampling to ascertain where unknown, significant releases have occurred.
- Planned site-specific sampling at locations where known to have had significant releases of contaminants.
- Inspection of sewer lines with video equipment to evaluate line integrity.

Phase two consists of additional sampling based on the data gathered in phase one.

This ZLHASP is written to include proposed site activities. Should the type or location of field activities change, then this ZLHASP shall be modified before these additional or revised field activities begin. Sites in Zone L to be investigated are:

- SWMU 37, Sanitary Sewer System, including gravity pipelines, manholes, lift and pumping stations, force mains, septic tanks, OWS, and latrines.
- AOC 504, Railroad System, including current and abandoned rail yards, rail lines, and loading and unloading areas.
- AOC 699, Storm Water Sewer System, including gravity pipelines, manholes, and lift and pumping stations.

3.4.1 SWMU 37, Sanitary Sewer System

Site information for SWMU 37 is briefly summarized in Table 3-4. Details on sample sites and locations and an overview of the design and layout of the sanitary sewer system are provided in Section 2.2.

Table 3-4
SWMU 37 — Site Information

Number	Description	Material Generated or Stored
SWMU 37 **Sanitary Sewer System** (Including oil/water separators, septic tanks, and latrines)	Refer to Section 2.2	Acids Organotin Tributyltin Surfactants Heavy Metals Caustic Solutions Chlorinated Solvents Petroleum Hydrocarbons

Note:

Described in the *Final RCRA Facility Assessment*, Vol. 1, June 6, 1995.
Biohazards may also be associated with the sanitary sewer system.

Previous reports and records pertinent to this investigation are the *Wastewater Facilities Evaluation,* (September 1990), and the CNSY OSHE office spill reports. The *Wastewater Facilities Evaluation* identifies specific problems in the sewer system. The spill reports document material spilled, quantity, location, and remedial efforts taken. No environmental data have been found regarding the sanitary sewer system, OWS, septic tanks, and latrines.

3.4.1.1 Site Activities

The purpose of the field investigation is to identify potentially contaminated areas and cross-connects of the sanitary sewer to the storm sewer. The sanitary sewer lines, force mains, and surcharged areas with the potential to transport COPCs have been identified and a proposed sampling scheme consisting of strategically placed DPT sample points has been developed for each. Site information and proposed sampling locations for sewer lines, OWS, septic tanks, and

latrines are depicted in Figures 2-4 to 2-9. Sanitary sewer lines with no potential to transport COPCs will not be investigated further.

An important element of the RFI will be to determine if cross-connects of the sanitary sewer to the storm sewer exist. The preferred method for performing this evaluation will be dye tracing. The dye trace will involve flushing a visible dye through the sanitary sewer lines and monitoring open manhole locations for both the sanitary and storm sewer systems around the exterior of the building. If necessary, smoke testing will use an air blower to force smoke from a smoke candle through the storm sewer line. If smoke leaking from the sewer is observed, the presence of a defect is established. Television inspection may be conducted to determine the type and location of structural defects. Sewer lines need to be cleaned before inserting the television camera. Smoke testing, line cleaning and camera work and recording will be conducted by a subcontractor(s) with E/A&H personnel providing oversight.

3.4.1.2 Hazard Analysis and Employee Protection — Survey of Sanitary Sewer System Confined Space Entry

In inspecting the sanitary sewer system, it is likely subcontractor and possibly E/A&H personnel will have to enter confined spaces. Specific hazards potentially encountered in confined space entries into a sewer system include: reduced concentrations of oxygen, combustible concentrations of methane and other gases, hydrogen sulfide, and direct contact, inhalation, and/or ingestion of biohazards (infectious sanitary waste) or chemical contamination.

Prior to E/A&H personnel entering a confined space, they must comply with E/A&H Confined Space Entry Program and the OSHA Permit-Required Confined Space standard (29 CFR 1910.146). For subcontractor requirements pertaining to confined space entry, also see Section 3.2.2.1.

Personal Protective Equipment

The sanitary sewer system has not previously had an environmental investigation. A review of available site information provides insufficient information for E/A&H to narrow the list of potential chemical hazards. The site-specific potential chemical hazards are specified in Table 3-1. If chemical hazards identified during the investigation are not included in Table 3-1 (other than methane or hydrogen sulfide), an AL will be determined and a Material Safety Data Sheet (MSDS) will be obtained and incorporated into the set of MSDSs maintained at the E/A&H Field Trailer.

Due to the potential dermal hazards associated with handling soil and groundwater potentially contaminated with biohazardous material (infectious waste), the initial PPE level specified for invasive field activities is modified Level D with a surgical mask. Nitrile inner and outer gloves (see Table 3-2 for Level of Protection and Criteria) will be used and outer gloves should be replaced immediately if they become damaged. The AL for this site is a continuous PID reading of 5 ppm or greater in the breathing zone. If 5 ppm above background is measured continuously for a substantial time (greater than 2 to 3 minutes), the required PPE shall be upgraded to Level C.

Zone L physical hazards and hazard abatement procedures are discussed in Section 3.2.2. In addition to the AL listed above, during confined space entries all ALs specified in Section 3.2.2.1 are applicable.

3.4.1.3 Hazard Analysis and Employee Protection — Sampling Sewer Lines, Oil/Water Separators, Septic Tanks, and Latrines

The proposed sampling scheme presented in Section 2.2 is a general schematic consisting of soil borings and groundwater sample locations (using DPT) for sites with an OWS or a septic tank. Due to the limited accuracy of available information, the general schematic of subsurface sample

locations is preliminary. Actual locations must be determined by field conditions. Also, sample locations associated with the sanitary sewer lines will be determined after the field survey of the system is completed.

In addition to the hazards associated with typical of environmental investigations (addressed in Section 3.2), site-specific hazards potentially present include buildup of methane and other combustible gases and presence of biohazardous (infectious) and chemical contaminants.

Personal Protective Equipment

The OWS and septic tanks have not previously had an environmental investigation. Available site information is insufficient for E/A&H to narrow the list of potential chemical hazards. The site-specific potential chemical hazards are listed in Table 3-1. If additional chemical hazards identified during the investigation are not included in Table 3-1, an AL will be determined and an MSDS will be obtained and incorporated into the set maintained at the E/A&H Field Trailer.

Due to the potential dermal hazards associated with handling soil and groundwater potentially contaminated with biohazardous materials (infectious wastes) at this SWMU, the initial PPE level specified for invasive field activities onsite is modified Level D with a surgical mask. Nitrile inner and outer gloves (see Table 3-2 for Level of Protection and Criteria) will be used and outer gloves should be replaced immediately if they become damaged. Modified Level D is justified because chemicals that may have entered the sanitary sewer system would have been quickly diluted by sewage. The AL for this site is a continuous PID reading of 5 ppm or greater in the breathing zone. If 5 ppm above background is measured continuously for a substantial time (greater than 2 to 3 minutes), the required of PPE shall be upgraded to Level C.

Zone L physical hazards and hazard abatement procedures are discussed in Section 3.2.2. In addition to the AL listed above during confined space entries, all ALs specified in Section 3.2.2.1 are applicable.

3.4.2 AOC 504, Railroad System

The railroad system investigation will address all current and abandoned rail yards, rail lines, loading/unloading areas and other points of interest. Site information concerning the railroad system is summarized below in Table 3-5, Figures 2-13 through 2-26 indicate possible contaminated areas associated with the railroad.

Table 3-5
AOC 504 — Site Information

Number	Description	Material Generated or Stored
AOC 504 Railroad System	Refer to Section 2.3	Acids Metals Fuels Solvents Coal and Coal Derivatives

Note:

Described in the *Final RCRA Facility Assessment*, Vol. II, June 6, 1995.

No environmental data have been found regarding the railroad system. However, spill reports, including those associated with or near the railroad system, are available from the Department of the Navy Occupational Safety, Health, and Environmental Office and the *Final Report for Storm Water Discharge Studies — Phase I,* February 1993.

3.4.2.1 Site Activities

Sampling sites in AOC 504 were selected as a result of known or suspected releases of chemicals or fuels. Information on potential releases came from spill reports, interviews, and stains observed when E/A&H personnel walked the rail lines. Presently, 12 sites have been identified for sampling. Virtually no information is available on these sites, and the information gathered has been primarily hearsay.

What is known or suspected about these sites is:

- AOC 504-AB is a former fuel off-loading facility that is associated with AOC 619 being investigated in Zone F (Figure 2-13). A section of rail line which ran parallel to the existing tracks has been abandoned by removing the rail and cross ties; however, the ballast material remains. Because the investigation being proposed for AOC 619 encompasses a much larger area that includes AOC 504-AB no sampling is proposed in this work plan.

- AOC 504-AC is a section of rail line that services a reclaimed oil facility that has been identified as AOC 629 covered under the Zone G RFI (Figure 2-14). Due to the nature of the operations in the vicinity of the rail line and obvious staining, this area was identified for further investigation. However, because it is only a small area within a larger site proposed to be investigated no sampling is proposed in this work plan.

- AOC 504-AD is an abandoned section of rail line that formerly served as an off-loading point for materials used in the Building 36 battery shop which is identified as SWMU 36 to be investigated under Zone F (Figure 2-15). For reasons similar to those mentioned above, no sampling is proposed in this work plan.

- Five surficial stains of unknown origin or composition were observed at the locations designated as AOC 504-AE through AOC 504-AJ (Figures 2-16, 2-17, 2-18, 2-19 and 2-20).

- AOC 504-AK is an area where reportedly, rail cars containing lead-contaminated equipment were stored. Rain water may have entered the rail car, and rinsed lead from the equipment and onto the soil (Figure 2-21).

- AOC 504-BA is a section of rail line used to deliver blast media to a series of sand hoppers that have been identified as SWMU 109 (Figure 2-22). During the visual inspection it was noted that the ground surface in the area of the tracks and hoppers was covered with a blast media that appeared to be "Black Beauty." Once again for reasons mentioned above, no samples are proposed in this work plan. AOC 504-AK is within the boundary of SWMU 109; therefore, no samples are proposed in this work plan. In addition, this is currently planned for interim measure activities to remove the grit on the ground surface.

- AOC 504-BB is an area located on Pier D that was associated with pumping bilge water from ships (Figure 2-23). Even though the information available indicates this area to be suspect, no samples have been proposed in this work plan due to the location of the site. The area is on a concrete pier and any releases which may have occurred to the underlying Cooper River will be covered under the Zone J RFI.

- AOC 504-BC is an area associated with coal storage areas (Figure 2-24).

- AOC 504-BD is an area associated with a former asphalt plant and creosote crosstie/ballast storage area (Figure 2-25). The former asphalt plant and crosstie/ballast

storage areas have been identified as SWMU 42 and AOC 505 respectively which are being investigated under Zone A. However, in order to fully define the area of potential contamination associated with this site, additional samples will be collected in Zone L.

- AOC 504-BE is a section of rail spur within the Defense Reutilization and Marketing Office (DRMO) storage area (Figure 2-26), where rail cars were stored for unknown periods of time with unknown or suspect materials, prior to unloading or removal from the NAVBASE boundaries. The DRMO storage area is identified as SWMU 2 and is being investigated under Zone A. AOC 504-BE is within the boundary of SWMU 2; therefore, no samples are proposed in this work plan.

- AOC 504-BF is the abandoned rail lines within Zones A and B. AOC 504-BG is the abandoned rail lines within Zones C and D. AOC 504-BH is the abandoned rail lines in Zone E. The locations of these lines and the proposed soil sampling locations are illustrated on Figures 2-27, 2-28, and 2-29 respectively.

Soil sampling is the primary field activity for this AOC.

3.4.2.2 Hazard Analysis and Employee Protection

Trackbed Integrity

Working around rail lines poses more subtle hazards, which are equally as dangerous as the obvious safety hazards. For example, drilling can affect trackbed integrity and support, which could contribute to a derailment. Vibrations from a passing train could damage drilling equipment even though workers and equipment appear to be out of harm's way. Therefore, when field activities will be conducted within 15 feet of the centerline of a rail track, rail traffic must be stopped. The type of work to be conducted and the schedule of field activities must be

explained to and coordinated with the Supervisor of Code 451.3 (803-743-3720) — CNSY PWD, Facilities Management, Planning, and Estimating Division.

Before starting work, E/A&H shall meet with Code 451.3 to provide a written agenda that contains work locations, an explanation the of work activities, and an approximate schedule. With this information CODE 451.3 will coordinate track outages. In addition, before working at any sites associated with NAVBASE railroad tracks or crane rails, a minimum advance notice of 10 working days shall be provided. The services of a Certified Railroad Inspector may be required to certify the integrity of the trackbed after sampling, well installation, etc. are completed.

Personal Protective Equipment

All sites within this SWMU have not been investigated previously. A review of available site information indicates that for eight of the 14 sites listed herein, the COPCs are fuel oils, bilge water, and/or polynuclear aromatic hydrocarbons (PAHs) associated with either the asphalt plants or fuels. In addition, herbicides used along track beds and wood preservatives (possibly creosote or pentachlorophenol) applied to railroad track ties may be in soil onsite. Due to the potential dermal hazards associated with handling soil and groundwater at this site, the initial PPE level specified for invasive field activities is modified Level D with nitrile inner and outer gloves (see Table 3-2 for Level of Protection and Criteria). The AL for these sites is a continuous PID reading of 5 ppm or greater in the breathing zone. If 5 ppm above background is measured continuously for a substantial time (greater than 2 to 3 minutes), the required level of PPE shall be upgraded to Level C.

Available information for five of the remaining six sites is insufficient for E/A&H to narrow the list of potential chemical hazards. Lead is the primary COPC for the remaining site. As in the other eight sites, herbicides and wood preservatives used for their intended purposes could be

present in soil at these six sites. COPCs are specified in Table 3-1. Due to the lack of knowledge about COPCs and their concentrations, invasive activities at these six sites shall be conducted in Level C PPE.

If additional chemical contaminants identified during the investigation are not included in Table 3-1, an AL will be determined and an MSDS will be obtained and incorporated into the set maintained at the E/A&H Field Trailer.

Zone L physical hazards and hazard abatement procedures including confined space entry requirements are discussed in Section 3.2.2.

3.4.3 AOC 699, Storm Sewer System

The site is described below in Table 3-6 and shown on Figures 2-1 and 2-2. Previous reports and records pertinent to this investigation are the *Wastewater Facilities Evaluation* (September 1990); *Final Report for Storm Water Discharges Studies*, Phase II (October 1994); and the CNSY OSHE office spill reports. The *Wastewater Facilities Evaluation* and *Final Report for Storm Water Discharges Studies* identify specific problems in the storm sewer system. The spill reports document material spilled, quantity, location, and remedial efforts taken. No environmental data have been found regarding the storm sewer system.

Table 3-6
AOC 699 — Site Information

Number	Description	Material Generated or Stored
AOC 699 **Storm Sewer System**	Refer to Section 2.4	Acids Solvents Surfactants Heavy Metals Caustic Solutions Petroleum Hydrocarbons

Note:
Described in the *Final RCRA Facility Assessment*, Vol. V, June 6, 1995.

3.4.3.1 Site Activities

The purpose of the field investigation is to identify potentially contaminated areas. The storm sewer lines, manholes, and surcharged areas with the potential to transport COPCs have been identified and a proposed sampling scheme consisting of strategically placed soil borings has been developed for each. Site information and proposed sampling locations for storm sewer lines are depicted in Figures 2-30 to 2-32. Storm sewer lines with no potential to transport COPCs will not be investigated further.

An important element of the RFI will be to determine if cross-connects of the sanitary sewer to the storm sewer exist. The preferred method for performing this evaluation will be dye tracing. The dye trace will involve flushing a visible dye through the sanitary sewer lines and monitoring open manhole locations for both the sanitary and storm sewer systems around the exterior of the building. If necessary, smoke testing will use an air blower to force smoke from a smoke candle through the storm sewer line. If smoke leaking from the sewer is observed, the presence of a defect is established. Television inspection may be conducted to determine the type and location of structural defects. Sewer lines need to be cleaned before inserting the television camera. Smoke testing, line cleaning and camera work and recording will be conducted by a subcontractor(s) with E/A&H personnel providing oversight.

3.4.3.2 Hazard Analysis and Employee Protection — Survey of Storm System Confined Space Entry

In conducting the field survey of the storm sewer system, (i.e., smoke testing, cleaning, and inspection via TV cameras), it is likely that subcontractor personnel and possibly E/A&H personnel will have to enter confined spaces. Specific hazards potentially encountered in confined space entries into a sewer system include: reduced concentrations of oxygen, combustible concentrations of methane and other gases, hydrogen sulfide, and chemical contamination.

Before E/A&H personnel enter a confined space, they must comply with E/A&H Confined Space Entry Program and the OSHA Permit-Required Confined Space standard (29 CFR 1910.146). For subcontractor requirements pertaining to confined space entry, see Section 3.2.2.1.

Personal Protective Equipment

The storm sewer system has not previously undergone an environmental investigation. Available site information is insufficient for E/A&H to narrow the list of potential chemical hazards. The site-specific potential chemical hazards are specified in Table 3-1. If additional chemical hazards identified during the investigation are not included in Table 3-1, an AL will be determined and an MSDS will be obtained and incorporated into the set maintained at the E/A&H Field Trailer.

Due to the potential dermal hazards associated with handling soil and groundwater potentially contaminated with chemicals and biohazardous materials (infectious wastes) at this AOC, the initial PPE level specified for invasive field activities is modified Level D. Nitrile inner and outer gloves (see Table 3-2 for Level of Protection and Criteria) will be used. The AL for this site is a continuous PID reading of 5 ppm or greater in the breathing zone. If 5 ppm above background is measured continuously for a substantial time (greater than 2 to 3 minutes), the required PPE shall be upgraded to Level C.

Zone L physical hazards and hazard abatement procedures, including confined space entry requirements, are discussed in Section 3.2.2. In addition to the AL listed above, during confined space entries all ALs specified in Section 3.2.2.1 are applicable.

3.4.3.3 Hazard Analysis and Employee Protection — Sampling Storm Sewer Lines

The proposed sampling scheme presented in Section 2.2 is a general schematic consisting of interval sampling, soil borings, and installation of monitoring wells for sites with an OWS or

a septic tank. Due to the limited accuracy of available information, the general schematic of subsurface sample locations is preliminary. Actual locations must be determined by field conditions.

In addition to the hazards associated with typical environmental investigations (addressed in Section 3.2), site-specific hazards potentially present include: chemical contamination, buildup of methane and other combustible gases, and buildup of hydrogen sulfide.

Personal Protective Equipment

The storm sewer system has not previously undergone an environmental investigation. Available site information is insufficient for E/A&H to narrow the list of potential chemical hazards. The site-specific potential chemical hazards are specified in Table 3-1. If additional chemical hazards discovered during the investigation are not included in Table 3-1, an AL will be determined and an MSDS will be obtained and incorporated into the set maintained at the E/A&H Field Trailer.

Due to the potential dermal hazards associated with handling soil and groundwater potentially contaminated with chemical biohazardous materials (infectious wastes) at this AOC, the initial PPE level specified for invasive field activities is modified Level D. Nitrile inner and outer gloves (see Table 3-2 for Level of Protection and Criteria) will be used and outer gloves should be replaced immediately if they become damaged. Modified Level D is justified because chemicals that may have entered the storm sewer system would have been quickly diluted by storm water runoff. The AL for this site is a continuous PID reading of 5 ppm or greater in the breathing zone. If 5 ppm above background is measured continuously for a substantial time (greater than 2 to 3 minutes), the required level of PPE shall be upgraded to Level C.

Zone L physical hazards and hazard abatement procedures including confined space entry requirements are discussed in Section 3.2.2. In addition to the AL listed above, during confined space entries all AL specified in Section 3.2.2.1 are applicable.

3.5 Authorized Personnel

Only those individuals identified as necessary to the investigative operations at each work site will be considered authorized. The Navy and E/A&H will determine which personnel are necessary and authorized. E/A&H personnel working in an E/A&H-controlled area shall have current HAZWOPER training certificates on file onsite, shall be under appropriate medical surveillance, and shall be equipped and willing to don all PPE specified by the health and safety plan. Individuals whose current documentation is not on file, or those with more recent documentation (have attended a refresher course), will provide copies of their documentation to the Site Supervisor before entering any work area.

Subcontractors, Department of Defense oversight personnel, and other site visitors shall also demonstrate compliance with the requirements specified above before being designated "authorized personnel."

Personnel anticipated to be onsite at various times during site activities include:

- Engineers-in-Charge — Matthew A. Hunt, Brian Stockmaster, Southern Division, Naval Facilities Engineering Command (SOUTHDIV)
- Site Contact — Bo Camp (Caretaker Site Office)
- Principal-In-Charge — James Speakman (E/A&H)
- Task Order Manager/Project Manager — Todd Haverkost (E/A&H)
- Project Health and Safety Managers — David Isenberg and John Borowski (E/A&H)

- Site Supervisor — Jack Mayfield (E/A&H)

- Site Health and Safety Officer — Tim McCord (E/A&H)

Responsibilities of Key Field Staff

Key field staff for this project, in terms of health and safety, are:

- Site Supervisor
- Site Health and Safety Officer
- All Field Staff

The primary health and safety responsibilities associated with each of these positions are delineated in CHASP, Sections 8.1, 8.2, and 8.3, respectively.

3.6 Emergency Information

All hazardous waste site activities present a risk to onsite personnel. During routine operations, risk is minimized by establishing good work practices, staying alert, and using proper PPE. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated.

Examples of an emergency include:

- A fire, explosion or similar event at or near the site, whether related to this project or not.

- A member of the field crew sustains a significant injury, or experiences symptoms of a chemical exposure.

- The identification of a condition which suggests that site conditions are imminently more dangerous or hazardous than anticipated.

Site Resources

A cellular telephone will be available in the SZ for routine and emergency communication/ coordination with Caretaker Site Office, SOUTHDIV, and the E/A&H field office. Fire extinguishers, first-aid supplies, and eye wash equipment will be available at the work area, in field vehicles, and at the field trailer.

Emergency Action Plan

If a situation requiring evacuation occurs, all E/A&H personnel shall seek a safe place. The primary refuge shall be the E/A&H Field Trailer in Zone H. If unable or imprudent to reach this location, alternate refuges will be identified in site safety briefings. Employees shall remain

at their selected refuge until they receive further instructions, or the refuge is no longer safe. It is imperative that persons remain at the refuge so that E/A&H can account for all personnel who were onsite at the time of the incident.

Use the Charleston office of EnSafe as the command center. Use cellular phones to contact the office and apprise them of the situation, to locate E/A&H personnel, to request assistance, and to coordinate other appropriate actions.

Emergency Actions

E/A&H personnel shall evacuate the work area and proceed directly to a refuge. They do not operate heavy equipment as part of their employment and they do not provide functions or services critical to NAVBASE's operations.

All emergency response operations and actions that may be necessary at NAVBASE Charleston shall be directed by the Navy using Naval personnel and **properly trained civilians.** E/A&H personnel are not to take/effect emergency response actions unless they have received specific training in emergency response actions and their training is current. For example, several E/A&H employees presently hold Emergency Medical Technician (EMT) certification by the American Red Cross. It is appropriate for these persons to provide EMT services as needed until additional medically qualified people arrive. Furthermore, if the Navy requests assistance and that assistance can be provided without personal risk, employees should cooperate as much as possible. If possible let E/A&H know you are safe first, then assist.

Additional procedures that should be followed include:

- If a member of the field team experiences effects or symptoms of exposure while on the scene, the field crew will immediately halt work and act according to the instructions provided by the Site Supervisor or, in his absence, the SHSO.

- For applicable site activities, including all Level B activities, use wind indicators to continuously indicate downwind, preferred escape routes, from upwind routes.

- Investigate condition(s) suggesting that site conditions may be more hazardous than anticipated. The condition observed and the decisions made shall be recorded in the safety logbook, or in the field logbook if a safety logbook is not being maintained. If there are doubts about how to proceed, suspend work and leave the work area until the PHSM has evaluated the situation and appropriately instructed the field team.

- If an accident occurs, the Site Supervisor is to complete an Accident Report Form (Appendix G) for submittal to the managing Principal-in-Charge of the project.

- If a member of the field crew suffers a personal injury, the SHSO will call **NAVBASE Fire Department 743-4458 or 5444** if an ambulance is needed. Next alert appropriate emergency response agencies as the situation dictates. Complete an Accident Report Form for any such incident.

- If a member of the field crew suffers chemical exposure, flush the affected areas immediately with copious amounts of clean water, and if the situation dictates, the SHSO should alert appropriate emergency response agencies, or personally ensure that the

exposed individual is transported to the nearest medical treatment facility for prompt treatment. An Accident Report Form will be completed for any such incident.

Directions to the nearest emergency medical facility capable of providing general emergency medical assistance and treating chemical burns are provided in Appendix H of this ZLHASP.

Emergency Contacts

If any situation or unplanned occurrence requires outside emergency assistance, immediately call the appropriate contact from the following list:

Contact	Agency or Organization	Telephone
Bo Camp	Caretaker Site Office, Site Contact	(803) 743-9985
Matthew A. Hunt	SOUTHDIV	(803) 820-5525
Brian Stockmaster	SOUTHDIV	(803) 820-7481
Law Enforcement	NAVBASE Security N. Charleston Police Department	(803) 745-1095
Fire Department	N. Charleston Fire Department	(803) 743-4458
Ambulance Service	Charleston County EMS	(803) 743-5444 (803) 743-9180 (803) 743-3779
Hospital	Charleston Naval Hospital* Roper Hospital	(803) 743-7132 (803) 745-2787
Southern Poison Control Center	—	1-800-922-1117
Todd Haverkost	EnSafe/Allen & Hoshall, Manager, Charleston Operations	(803) 884-0029

Contact	Agency or Organization	Telephone
David Isenberg	EnSafe/Allen & Hoshall, PHSM	(615) 399-8800
Timothy McCord	EnSafe/Allen & Hoshall, SHSO	(803) 821-7520

* Use Charleston Naval Hospital for (potentially) life-threatening situations. For medical needs that are less urgent, the naval hospital will not provide service to civilians; Roper Hospital is the next closest appropriate medical facility.

Should an emergency occur or a potential emergency becomes a possibility, the following people shall be fully apprised of the situation a soon as practical: Bo Camp, Caretaker Site Office Contact; Matthew Hunt and Brian Stockmaster, SOUTHDIV Engineers-in-Charge; Todd Haverkost, E/A&H Manager of Charleston Operations and Project Manager; and David Isenberg, E/A&H PHSM. Other persons, as appropriate may also need to be contacted.

3.7 Forms

The following forms will be used in implementing this ZLHASP:

- Plan Acceptance Form
- Plan Feedback Form
- Exposure History Form
- Accident Report Form

A ZLHASP Plan Acceptance Form will be completed by all employees working onsite before site activities begin. The Plan Feedback Form will be filled out by the SHSO and any other onsite employee who wishes to do so. The Exposure History Form will be completed by both the Field Project Manager and the individual(s) for whom the form is intended. Examples of each form are provided in Appendix G of this plan.

All completed forms must be returned to the Task Order Manager at EnSafe/Allen & Hoshall, Memphis, Tennessee.

4.0 SIGNATORY REQUIREMENT

Condition I.E. of the HSWA portion of RCA Part B Permit (EPA SAO 170 022 560) states that "All applications, reports, or information submitted to the Regional Administrator shall be signed and certified in accordance with 40 CFR §270.11." The certification reads as follows:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

P. H. Daly
Commander
Caretaker Site Office

7-25-96
Date:

4.0 SIGNATORY REQUIREMENT

Condition I.E. of the HSWA portion of RCA Part B Permit (EPA SAO 170 022 560) states that "All applications, reports, or information submitted to the Regional Administrator shall be signed and certified in accordance with 40 CFR §270.11." The certification reads as follows:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

P. H. Daly
Commander
Caretaker Site Office

7-25-96
Date:

5.0 REFERENCE LIST

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APPENDIX A
ZONE L RFA SUMMARY

Table A-1 Zone L SWMU Summary				
SWMU Number	**SWMU Name**	**Investigative Approach**	**NAVABASE Location**	**Work Plan Reference**
37	Sanitary Sewer System	RFI	Basewide	Section 2.2

Table A-2 Zone L AOC Summary				
AOC Number	**AOC Name**	**Investigative Approach**	**NAVBASE Location**	**Work Plan Reference**
504	Railroad	RFI	Basewide	Section 2.3
699	Storm Sewer System	RFI	Basewide	Section 2.4

APPENDIX B
TREATMENT ALTERNATIVES

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of controls for contaminated groundwater	Groundwater Collection	Vertical Extraction Wells	Vertical wells are used to extract contaminated groundwater.	Use of aquifer Depth to water table Direction of flow Rate of flow Hydraulic conductivity (vertical and horizontal) Effective porosity Aquifer type Hydraulic gradient Identification of recharge and discharge areas Identification of aquifer boundaries Aquitard characteristics (Pilot - slug test)
To evaluate the feasibility and implementability of treatments for contaminated groundwater	Chemical Treatment	Ion Exchange	Ion exchange is the process of exchanging selected dissolved ionic contaminants with a set of substitute ions. Ion exchangers are primarily used for recovery of dilute solutions of metals or to soften water by removing calcium and manganese.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Bicarbonate Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Copper Iron Magnesium Manganese Nickel Oil and grease pH Potassium Sodium Sulfate Total Organic Carbon (TOC) Total Suspended Solids Zinc

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater	Chemical Treatment	Oxidation	Oxidation is a chemical reaction in which one or more electrons are transferred from the chemical being oxidized to an oxidizing agent. Chemical oxidation include destruction of cyanide; transformation of organics to biodegradable forms, or detoxification of organics and inorganics.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Bicarbonate Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Copper Iron Magnesium Manganese Nickel Oil and grease pH Potassium Sodium Sulfate Total Organic Carbon Total Suspended Solids Zinc (Pilot - reagent consumption, optimal pH, and reaction time)

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater	Chemical Treatment	Metal Precipitation	Precipitation is a chemical unit process in which soluble metallic ions are removed from solution by conversion to an insoluble form. Precipitation is commonly used to treat heavy metals, phosphorus, and hardness.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Bicarbonate Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Copper Iron Magnesium Manganese Nickel Oil and grease pH Potassium Sodium Sulfate Total Organic Carbon Total Suspended Solids Zinc (Pilot - chemical dosage, contact time, mixing rate, optimal pH, and sludge handling)
		pH Adjustment	Neutralizing agents are added to adjust pH.	Indicator Parameters Bicarbonate Calcium Chloride Iron Magnesium Manganese pH Potassium Sodium Sulfate Total Suspended Solids (Pilot - titration curve)

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater	Biological Treatment	Aerobic	Aerobic is the use of oxygen-utilizing microorganisms to biodegrade contaminants.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Acidity-alkalinity Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Dissolved oxygen Hardness Metals, dissolved Nitrogen, ammonia Nitrogen, Kjeldahl Nitrogen, Nitrate-nitrite Oil and grease Organic carbon pH Phosphorus Total solids Specific conductance Sulfate Sulfide Suspended solids Temperature Volatile suspended solids

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater		Anaerobic	Anaerobic is the use of non-oxygen-utilizing micro-organisms to biodegrade contaminants.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Acidity-alkalinity Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Dissolved oxygen Hardness Metals, dissolved Nitrogen, ammonia Nitrogen, Kjeldahl Nitrogen, Nitrate-nitrite Oil and grease Organic carbon pH Phosphorus Total solids Specific conductance Sulfate Sulfide Suspended solids Volatile suspended solids

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater	Physical Treatment	Adsorption (Granular Activated Carbon)	Adsorption is a physical separation process in which organic and inorganic materials are removed by sorption or the attraction and accumulation of one substance on the surface of another.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Acidity-alkalinity Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Dissolved oxygen Hardness Iron Metals, dissolved Manganese Nitrogen, ammonia Nitrogen, Kjeldahl Nitrogen, Nitrate-nitrite Oil and grease Organic carbon pH Phosphorus Sulfate Sulfide Suspended solids
		Air Stripping	Stripping refers to the removal of relatively volatile components from wastewater by passage of air, steam, or other gas through the contaminated liquid. Stripping is effective in removing ammonia, chlorinated solvents, monoaromatics, and other VOCs.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Acidity-alkalinity Biochemical oxygen demand Chemical oxygen demand Hardness Iron Manganese Metals, dissolved Oil and grease pH

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater	Physical Treatment	Sedimentation	Sedimentation is a physical process that removes suspended solids from a liquid matrix by gravitational settling.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Acidity-alkalinity Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Dissolved oxygen Hardness Iron Metals, dissolved Manganese Nitrogen, ammonia Nitrogen, Kjeldahl Nitrogen, Nitrate-nitrite Oil and grease Organic carbon pH Phosphorus Sulfate Sulfide Suspended solids

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater		Filtration	Filtration is a physical process used to remove suspended solids from wastewater and is generally proceeded by chemical precipitation and neutralization.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Acidity-alkalinity Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Dissolved oxygen Hardness Iron Metals, dissolved Manganese Nitrogen, ammonia Nitrogen, Kjeldahl Nitrogen, Nitrate-nitrite Oil and grease Organic carbon pH Phosphorus Sulfate Sulfide Suspended solids

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater	Disposal	Publicly Owned Treatment Works (POTW)	A chemical, physical, or biological wastewater treatment plant designed and constructed to treat municipal domestic wastewater.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Acidity-alkalinity Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Dissolved oxygen Hardness Iron Metals, dissolved Manganese Nitrogen, ammonia Nitrogen, Kjeldahl Nitrogen, Nitrate-nitrite Oil and grease Organic carbon pH Phosphorus Sulfate Sulfide Suspended solids

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater		RCRA Treatment Storage, and Disposal Facility (TSDF)	The process of chemical, physically, or biologically treating the wastewater in an offsite permitted commercial hazardous waste facility.	Organic/Inorganic Water Chemistry[d] Indicator Parameters Acidity-alkalinity Biochemical oxygen demand Calcium Chemical oxygen demand Chloride Dissolved oxygen Hardness Iron Metals, dissolved Manganese Nitrogen, ammonia Nitrogen, Kjeldahl Nitrogen, Nitrate-nitrite Oil and grease Organic carbon pH Phosphorus Sulfate Sulfide Suspended solids
	Disposal	Land Application	The process of applying wastewater directly on the land to infiltrate into the soil.	Depth to water table Total phosphorus Chloride Ammonia Nitrate Alkalinity pH Sodium Total dissolved solids Soil type Hydraulic conductivity Application rate

Table B-1
Treatment Alternatives For Groundwater and Surface Runoff

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated groundwater		Injection	The process of hydraulicly placing wastewater into the aquifer using either vertical or horizontal wells.	Depth to water table Total phosphorus Chloride Ammonia Nitrate Alkalinity pH Sodium Total dissolved solids TOC Soil type Hydraulic conductivity Application rate (2.5 Gallons/ft^2/day or 5/square root of slowest percolation rate.

Notes:

[a] USEPA *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfills Sites*, EPA/540/P-91/001, Office of Solid Waste and Emergency Response Directive 9355.3-11, February 1991

[b] 40 Code of Federal Regulations (CFR) 268 Land Disposal Restriction

[c] USEPA *CERCLA Site Discharges to POTWs Treatability Manual*, EPA/540/2-90/007, Office of Solid Waste and Emergency Response, August 1990.

[d] VOA & SVOA w/TICs, Metals, Cyanide, Pesticides, and PCBs

Table B-2
Treatment Alternatives for Soil and Sediment

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of controls to prevent contact	Cap	Native Soil Single Barrier Double Barrier	This is the process of placing a physical horizontal barrier across the site.	Moisture Content Permeability In-Situ Density Atterberg Limits Grain Size Analysis Porosity Depth
	Excavation	Dig up	This is the process of physically removing the hot spot, soil, or waste from the site.	Organic/Inorganic Water Chemistry[d] Moisture Content Permeability In-Situ Density Atterberg Limits Grain Size Analysis Porosity Depth
To evaluate the feasibility and implementability of treatments for contaminated soil	Thermal Treatment	Thermal Destruction	Thermal destruction is the process of oxidizing organic and inorganics using high temperature.	Organic/Inorganic Water Chemistry[d] Moisture Content Particle size Btu content TCLP
		Thermal Desorption	Thermal desorption is the process of using low temperature to volatilize organics and inorganics from a solid matrix.	Organic/Inorganic Water Chemistry[d] Moisture Content Particle size TCLP
	Biological Treatment	Aerobic	Aerobic is the use of oxygen-utilizing microorganisms to biodegrade contaminants.	Organic/Inorganic Water Chemistry[d] Moisture Content Soil Texture Temperature pH Soil Microorganisms Total Nitrogen Total Phosphorus Depth to groundwater Dissolved oxygen Methane Chemical oxygen demand

Table B-2
Treatment Alternatives for Soil and Sediment

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated soil	Biological Treatment	Anaerobic	Anaerobic is the use of non-oxygen utilizing micro-organisms to biodegrade contaminants.	Organic/Inorganic Water Chemistry[d] Moisture Content Soil Texture Temperature pH Soil Microorganisms Total Nitrogen Total Phosphorus Depth to groundwater Methane Chemical Oxygen Demand
	Physical Treatment	Solidification/ fixation	Solidification is a physical process in which organic and inorganic materials are bound to the surface of another.	Organic/Inorganic Water Chemistry[d] Moisture Content Soil Texture Suspended Solids Bulk Density Grain Size Analysis Atterberg Limits Cone Index Unconfined Compressive Strength Temperature pH
		Solvent Extraction	Solvent extraction is a physical separation process in which organic and inorganic materials are removed from the surface of a solid matrix to a liquid matrix.	Organic/Inorganic Water Chemistry[d] Total Organic Carbon Total Recoverable Hydrocarbons Moisture Content Soil Texture Permeability Bulk Density Grain Size Analysis Clay Content Temperature pH Chemical Oxygen Demand Cation Exchange Capacity Depth to groundwater TCLP

Table B-2
Treatment Alternatives for Soil and Sediment

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated soil	Disposal	Consolidation	This is the process of consolidating the waste, soil, and other debris in a properly designed and constructed landfill.	Organic/Inorganic Water Chemistry[d] Moisture Content Permeability In Situ Density Atterberg Limits Grain Size Analysis Depth to Groundwater TCLP
		RCRA TSDF	The process of chemical, physically, or biologically treating the contaminant, soil, and other debris in an offsite permitted commercial hazardous waste facility.	Organic/Inorganic Water Chemistry[d] Moisture Content Soil Texture Temperature pH Soil Microorganisms Total Nitrogen Total Phosphorus Depth to groundwater Dissolved oxygen TCLP

Notes:

[a] USEPA *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfills Sites*, EPA/540/P-91/001, Office of Solid Waste and Emergency Response Directive 9355.3-11, February 1991

[b] 40 CFR 268 Land Disposal Restriction

[c] USEPA *CERCLA Site Discharges to POTWs Treatability Manual*, EPA/540/2-90/007, Office of Solid Waste and Emergency Response, August 1990.

[d] VOA & SVOA w/TICs, Metals, Cyanide, Pesticides, and PCBs

Table B-3
Treatment Alternatives For the Presence of Soil Gas

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of controls for subsurface gas	Cap	Native Soil Single Barrier Double Barrier	This is the process of placing a physical horizontal barrier across the site.	Moisture Content Permeability In-Situ Density Atterberg Limits Grain Size Analysis Porosity Depth
	Vent	Vertical Horizontal	Vertical or horizontal wells are used to vent gases.	Moisture Content Air Permeability Atterberg Limits Grain Size Analysis Porosity Depth
To evaluate the feasibility and implementability of treatments for contaminated soil gas and soil	Thermal Treatment	Thermal Destruction	Thermal destruction is the process of oxidizing organic and inorganics using high temperature.	Organic/Inorganic Water Chemistry[d] Moisture Content Particle size Btu content TCLP
		Thermal Desorption	Thermal desorption is the process of using low temperature to volatilize organics and inorganics from a solid matrix.	Organic/Inorganic Water Chemistry[d] Moisture Content Particle size Btu content TCLP
	Physical Treatment	Carbon Absorption	Adsorption is a physical separation process in which organic and inorganic materials are removed by sorption or the attraction and accumulation of one substance on the surface of another.	Organic/Inorganic Water Chemistry (VOA & SVOA w/TICs, Pesticides, and PCBs) Moisture Content Temperature TOC

Table B-3
Treatment Alternatives For the Presence of Soil Gas

Data Quality Objective Elements	Remedial Technology[a]	Process Option[b,c]	Description	Data Quality Needs
To evaluate the feasibility and implementability of treatments for contaminated soil gas and soil	Physical Treatment	Vacuum Extraction	Vacuum extraction refers to the removal of relatively volatile components from soil or waste by passage of air, steam, or other gas through the contaminated matrix. Stripping is effective in removing chlorinated solvents, monoaromatics, and other VOCs.	Organic/Inorganic Water Chemistry[d] Moisture Content Air Permeability Temperature pH Depth to groundwater
	Disposal	RCRA TSDF	The process of chemical, physically, or biologically treating the contaminant in an offsite permitted commercial hazardous waste facility.	Organic/Inorganic Water Chemistry[d] Moisture Content Soil Texture Temperature pH Soil Microorganisms Total Nitrogen Total Phosphorus Depth to groundwater Dissolved oxygen TCLP

Notes:

[a] USEPA *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfills Sites*, EPA/540/P-91/001, Office of Solid Waste and Emergency Response Directive 9355.3-11, February 1991

[b] 40 Code of Federal Regulations (CFR) 268 Land Disposal Restriction

[c] USEPA *CERCLA Site Discharges to POTWs Treatability Manual*, EPA/540/2-90/007, Office of Solid Waste and Emergency Response, August 1990.

[d] VOA & SVOA w/TICs, Metals, Cyanide, Pesticides, and PCBs

APPENDIX C
FACILITY MATRIX FOR INDUSTRIAL SOURCES

Table C-1
Facility Matrix for Industrial Sources

Building Number	Building Name	Date	HW	PP	OWS	Spill Release	PCBs	USTs	ASTs	SWMU	AOC	SA	ST	CR
3	Inside Machine Shop	1906	X			X				67	545			
5	Woodworking Shop	1904	X							68/69/70	547/548			
6	Forge Shop and Propeller Repair Shop	1967	X	X				X	X		538/539			
9	Temporary Service Shop	1906	X	X		X	X			83/84/85/86	574			
13	QA Office and Supply Administration	1906	X	X		X	X	X		30/89/90/91/929 3/94/95				
44	Old Plating Shop	1941	X	X						25/71/72				
68	Battery Shop (Electric Shop)	1942	X	X		X			X	36	620/621			
69	Storehouse, Receiving and Shipping Former Location of Galvanizing Shop, Bldg. 1176	1942				X		X						
177	Electric and Electronics Shop	1955	X			X	X			82	563/571/572/573			
187	Module Maintenance Facility, Operations	1962	X							108	606			
218	Missile Ordnance System Shop	1969	X			X	X			100	588			
221	Lead Storage Building	1970	X							65	544			
226	Plating Plant and Pump, Valve & Hydraulics	1976	X	X	X	X			X	23/62	540/543	X	X	
236	Operations Center and Pipefitting Office	1982	X	X		X		?		96/97	583	X	X	
1025	Galvanizing/Pickling Plant Former Bldg. 1025	1920	X								546			
1030	Former Galvanizing Shop Bldg. 1030	1922	X								552			
1797	Acid Waste Treatment Facility	1975	X							5				

Table C-1
Facility Matrix for Industrial Sources

Building Number	Building Name	Date	HW	PP	OWS	Spill Release	PCBs	USTs	ASTs	SWMU	AOC	SA	ST	CR

Notes:

HW	—	Hazardous Material
PP	—	Petroleum Products
OWS	—	Oil/Water Separator
PCBs	—	Polychlorinated Biphenyls
USTs	—	Underground Storage Tanks
ASTs	—	Aboveground Storage Tanks
SWMU	—	Solid Waste Management Unit
AOC	—	Area of Concern
SA	—	Direct Discharge to Sanitary Sewer System
ST	—	Direct Discharge to Storm Sewer System
CR	—	Direct Discharge to Cooper River

* Industrial Sources are facilities where routine discharges of wastewater containing potentially hazards materials have occurred.

APPENDIX D
FACILITY MATRIX FOR POTENTIAL SOURCES OF CONTAMINANTS

Table D-1
Facility Matrix for Potential Sources of Contaminants

Building Number			Building Name	Date	HW	PP	OWS	Spill Release	PCBs	USTs	ASTs	SWMU	AOC	SA	ST	CR
NS	1		Administrative Building	1958	X			X	X							
	2		Ship Fitter Shop, Structural and Pipe Group	1906	X	X						60	516/532		X	
	2	A	Shipfitter Shop and Sail Loft	1937	X	X						56/168	529			
NS	2		Utility Building	1958	X	X	X			X			677	X		X
RTC	4		Paint Storage	1950s	X			X								
	7		Comptroller Department and IRM	1908	X	?				X				X		
	9		Temporary Service Shop	1906	X	X		X	X			83/84/85/ 86	574			
	11		Miscellaneous Shop and Test Equipment Storage	1918	X			X			X					
X	12		Carpentry Shop	1943	X	X		X				35				
	14		Small Craft Ready Fuel Storage	1958		X					X					
	25		Transportation Shop & Garage	1940		X						88	577/578 119			
	30		Public Works Building Trades	1919		X		X								
	31		Storage for Power Plant	1919	X											
	32		Central Power Plant	1909	X	X	X	X	X		X	76	559			
	35		Welding School	1913	X							57/58/59	530			
	39	D	Ballast/Sludge Storage Tank	1939		X	X	X			X	24	631			
	39	L	Diesel Tank, 6,500 Gallons	1942		X		X			x		631			
	39	M	Diesel Pumphouse	1942		X		X					631			
NSC	39		Diesel Oil Pumphouse	1941	X	X										
	42		Motor Pool Dispatch Office	1937	X	X		X		X		3/24	117		X	
	43		Central Tool Shop and Service Group Office	1941	X	X		X	X			73				
NS	44		Heating Plant	1969		X	X	X		X						
NH	51		Photo Lab	1941	X							45				
NH	53		Administrative Office (Naval Investigative Service)	1941	X	X			X			178				
NS	54		Billeting Office	1958		X		X					662			

Table D-1
Facility Matrix for Potential Sources of Contaminants

Building Number	Building Name	Date	HW	PP	OWS	Spill Release	PCBs	USTs	ASTs	SWMU	AOC	SA	ST	CR
56	Electrical/Mechanical Group Shops	1937	X	X				X		64				
57	Rigger Shop (Shop 72)	1940	X	X		X				74/169				
58	Dispensary	1940	X			X								
59	Resource Department, Structural Group	1940	X	X		X	X		X	55	164528			
FBM 61	Fleet Ballistic Missile Submarine Training Facility	1962	X	X	X	X	X	X	X	74/132/133/134/135		X	?	
62	Operations Project Office	1942	X			X	X							
NH 62	Family Service Center	1945				X		X	X					
NSC 66	Storage Warehouse	1942		X										
NH 68	Medical Storehouse	1943		X		X		X	X					
NS 69	Boiler House	1984		X		X			X	131				
77	Substation, Restroom, Ship Superintendent Office	1942	X	X		X					558			
79	Nuclear Repair Facility	1943	X	X		X		X		102	590			
NS 79	Dispensary	1963	X	X				X	X			X		
80	Outside Machine Shop	1943	X	X						87/172	576			
84	Substation, Drydock No. 2	1942		X		X	X				562			
88	Salt Water Pumphouse No. 2	1942	X	X		X								
96	Substation and Storage	1943		X		X	X				604/623			
97	Air Compressor House	1943	X	X	X	X	X			174				
98	Fuel Oil Booster Pumphouse and 3 Fuel Transfer Pipelines	1944		X		X		X			631			
101	Material and Tool Storehouse	1919	X							155	596			
122	Transportation Motor Pool	1945		X		X			X					
123	Boiler House	1947		X		X			X					
125	Substation	1956	X				X				643			
135	Operational Storage	1945	X	X				X						
148	Stripper - Concrete Tank	1948		X					X		631			

Table D-1
Facility Matrix for Potential Sources of Contaminants

Building Number	Building Name	Date	HW	PP	OWS	Spill Release	PCBs	USTs	ASTs	SWMU	AOC	SA	ST	CR
172	Operational Storage	1952	X	X		X					631			
190	Radiological Control Training and Offices Building	1963	X	X					X		594			
191	Controlled Humidity Warehouse	1961	X	X		X		X	X					
194	Paint Shop Storage	1964	X							80	566			
195	Rigger Shop Services	1964	X			X				32				
198	Supply Receiving, Shipping and Administration Building	1964	X	X		X								
208	5000-Gallon Underground Fuel Oil Tank	1956		X										
212	Abrasive Blasting Facility	1966	X			X				53	526			X
217	Neutron Generator House	1968	X				X							
222	Drydock Support Repair Facility	1971	X			X				143/144/ 179/192/ 180				
223	Paint Shop	1973	X			X				54	525		X	
224	Ships Outfitting, Clothing Storage	1972	X	X		X		X						
228	Pipe Insulation Facility	1976	X				X			61				
234	Engineering Management Building	1974	X			X				48				
240	Carwash	1984			X			X						
241	Crane Maintenance	1987	X	X	X	X		X		111/112/113/114	610			
242	Automobile Maintenance Building	1987	X	X	X			X	X	115	613/614			
246	Mixed Waste Storage	1986	X			X				10			X	
255	Industrial Logistics	1993	X	X				X						
256	Shipwork Staging Storage Building	1992												
321	Supply Pier A	1943	X	X		X						X		
419	Recreational Storage	1985	X						X					
420	Maintenance Shed	1991		X										
451 B	Substation	1944		X		X	X				633			

Table D-1
Facility Matrix for Potential Sources of Contaminants

Building Number	Building Name	Date	HW	PP	OWS	Spill Release	PCBs	USTs	ASTs	SWMU	AOC	SA	ST	CR
451 D	Switching Station	1983				X	X							
451 H	Substation	1983		X		X	X				584			
451 L	Switching Station	1983					X							
451 M	Switching Station	1987					X							
454	Substation	1964		X			X				575			
459	Switching Station	1974	X	X			X							
460	Switching Substation	1974	X			X	X				533			
466	Switching Substation	1987	X			X	X				618			
600	30,000-Gallon Fuel Oil Tank	1961		X		X	X		X					
601	Fuel Oil 12,000-Gallon Tank	1963		X		X			X					
602	8,000-Gallon Fuel Oil Tank	1963		X		X			X					
641	Warehouse/Administrative (SUBRON 4)	1978		X		X		X						
645	Engine Overhaul Facility	1969	X	X					X					
656	Navy Exchange, Retail Warehouse, & Service Outlets	1968		X		X		X						
657	America's Original Sports Bar/James E. Williams Complex	1969	X	X		X	X	X		137				
660	Instrument Building (Degaussing)	1964	X	X		X	X		X					
675	Dental Clinic	1977	X	X										
680	Fleet Maintenance Building (SIMA)	1975	X	X	X				X					
851	Gas/Diesel Pumping Station	1980	X	X		X		X						
1035	Paint Shop 71	1919	X								579			
M 1067	Store House	1918	X	X								X		
M 1116	General Warehouse	1919												
1141	Shipyard Security Office	1981		X				X			701			
1167	Exchange Warehouse	1942		X										
1171	Material and Equipment Storage	1972	X											
1173	Storage and Office Area	1972	X							101				

Table D-1
Facility Matrix for Potential Sources of Contaminants

Building Number	Building Name	Date	HW	PP	OWS	Spill Release	PCBs	USTs	ASTs	SWMU	AOC	SA	ST	CR
1174	Training and Administrative Offices	1942	X	X		X		X						
1175	Shop Stores and Grounds Maintenance	1972	X	X				X		116				
1189	Fire Prevention and Inspection Division and MWR Laundry	1942	X								607			
1193	Office	1942	X	X		X			X					
1241	Electric Repair Shop	1946				X								
1245	Woodworking Shop (Field)	1942	X							81				
1275	Abrasive Blast Slab	1942	X			X				54/21				
1278	Battery Processing Slab	1942	X	X		X	X			18/157	605			
1298	Brick Storage (Shop 41)	1944	X	X		X			X					
1346	Service Station/Minimart	1962	X	X		X		X		110	609			
1426	Contaminated Waste Storage	1964	X	X		X	X							
1448	Filter House for Structure No. NS-59	1959	X			X								
1508	Car Wash and Hobby Shop	1972	X	X		X		X		124	653			
1612	Open Storage Yard/Scrap Yard	N/A	X			X								
1628	Publications and Printing Plant	1979	X									X		
1646	Golf Course Warehouse (Pesticide Storage/Mixing Warehouse)	1975	X	X		X					700			
1653	Fuel Testing Laboratory	1991	X	X	X	X								
1654	Accounting Building	1991									631			
1708	Generator Building	1968		X					X					
1711	Incinerator	1969	X											
1717	Flushing Equipment Storage	1968	X				X			75/77/78/33				
1718	Septic Tank and Drain Field	1968	X	X		X								
1719	Special Service Equipment Storage Building-Old Gear Locker	1968		X		X								
1723	Boiler Tube and Firebrick Storage Shed	1970	X			X	X							
1760	Contaminated Storage	1968	X											

Table D-1
Facility Matrix for Potential Sources of Contaminants

Building Number	Building Name	Date	HW	PP	OWS	Spill Release	PCBs	USTs	ASTs	SWMU	AOC	SA	ST	CR
1776	Mechanics Shop	1971	X	X	X					138				
1786	A/C Equipment & Cooling Tower	1973		X				X	X					
1816	Storage and Engine Shop	1984	X	X					X					
1819	Maintenance Shed/Mechanical Equipment Storage	1970	X	X		X								
1824	Hazardous/Flammable Storage Facility	1990	X			X								
1888	Indoor Pistol Range	1981	X								669	X		
3900	Diesel Oil Tank, 2,350,000 Gallons	1942		X		X			X					
3900 F	Diesel Industrial Supply Center	1942			X	X								
3900 I	Diesel Oil Pumphouse/Laboratory	1943	X											
3901 A	Ballast/Sludge Storage Tank	1945		X		X			X					
3915	Lubricant Storage Tank, 1,008,000 Gallons	1991		X		X			X					
3916	Diesel Oil Tank, 4,200,000 Gallons	1990		X	X	X			X					
3917	Diesel Oil Tank, 4,200,000 Gallons	1991		X	X	X			X					

Notes:

HW — Hazardous Material
PP — Petroleum Products
OWS — Oil/Water Separator
PCBs — Polychlorinated Biphenyls
USTs — Underground Storage Tanks
ASTs — Aboveground Storage Tanks
SWMU — Solid Waste Management Unit
AOC — Area of Concern
SA — Direct Discharge to Sanitary Sewer System
ST — Direct Discharge to Storm Sewer System
CR — Direct Discharge to Cooper River

* A Potential Source of contaminants is defined as facilities where the potential for a "one-time" release of hazardous materials may have occurred.

APPENDIX E
SEPTIC TANK AND OIL/WATER SEPARATOR TABLES AND MAPS

Table E-1 Septic Tanks				
Building Number	**Map Location**	**Building Name**	**Description**	**Investigative Zone**
661	C-18	Communication Center	One septic tank is at this facility.	Zone H AOC 654
665	E-16	Consolidated Package Store	One septic tank is at this facility.	Zone L
1226	K-49	Shop Repair Storage	Two septic tanks are at this facility.	Zone L
1888	J-12	Indoor Pistol Range	An operating septic tank is at this facility.	Zone I AOC 669
1984	H-13	Pistol Range Classroom	One septic tank is north of this facility.	Zone L
Traffic Island	M-51	Avenue D North and Second Street North	One septic tank is reportedly under the traffic island.	Zone L

APPENDIX F
SEWER CROSS-CONNECTS

Table F-1
Sewer Cross-Connects

Item	Description	Location
1	Drop Inlet	10' Upstream of MH 6
2	Roof Drains	Connection into MH 31A at Residential Areas
3	Drop Inlet	8' from MH 135D
4	Drop Inlet	Outside Residence 746 on Manley Ave. near MH 135B
5	Roof Drains	MH 78A at Bldg 1137.
6	Roof Drains	Old Naval Hospital; Bldgs NH-46, NH-48, NH-52 and NH-54.
7	Drop Inlet	South Side of Second Ave West Adjacent to MH 156A.
8	Drop Inlet	North Side of Second Ave West Adjacent to MH 156A.
9	Drop Inlet	In Parking Lot Between Bldg M-82 and MH 156A.
10	Floor Drain	Bldg M-17 Basement
11	Drop Inlet	Corner of Bldg 46, Near MH 200
12	Drop Inlet	Rear of Bldg 63
13	Drop Inlet	18' From MH 193A
14	Drop Inlet	20' From MH 212
15	Drop Inlet	Between Bldgs 25 and 1199.
16	Drop Inlet	Rear of Bldg 31
17	Roof Drains	Building 57
18	Roof Drains	Building 43
19	Storm Sewer MH	East Corner of Bldg 57
20	Floor Drain	Bottom of Indoor Pool Steps
21	Drop Inlet	15' From MH 282
22	Drop Inlet	36' From MH 296B
23	8" Storm Line	Connected to MH 350A or MH 350
24	Drop Inlet	Connected to MH 364
25	Curb Inlet (2)	Located on Magpie Ave. near MH 397F
26	Drop Inlet	Connected to MH 377A, Adjacent to Bldg FBM-61.

Notes:

This information was obtained from the *Wastewater Facilities Evaluation, Charleston Naval Base, Charleston, S.C.*, by Davis & Floyd, Inc. dated September 1990. The status of each cross-connect was obtained by interviewing Mr. Cletewood Droze of Public Works Department on September 15, 1995.

APPENDIX G

HEALTH AND SAFETY FORMS

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project site and returned to: EnSafe/Allen & Hoshall, Memphis, Tennessee.

Job No: 0029 - 00104

Contract No: N62467-89-D-0318

Project: Zone J - Naval Base Charleston

I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

_____

Signed

_____

Print Name

_____

Company

_____

Date

EMPLOYEE EXPOSURE HISTORY FORM

Employee: _____

Job Name: _____

Date(s) From/To: _____

Hours Onsite: _____

Contaminants (Suspected/Reported):

_____

_____

_____

_____

_____

_____

_____

(See Attached Laboratory Analysis)

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for revisions:

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT	DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (Include area code)
NAME OF INJURED OR ILL WORKER AND COMPANY	
WORKER'S SOCIAL SECURITY NUMBER	

DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT

NARRATIVE DESCRIPTION OF ACCIDENT

NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED	LOST TIME YES ☐ NO ☐

PROBABLE DISABILITY (Check one)

FATAL ☐ | LOST WORK DAY WITH ____DAYS AWAY FROM WORK | LOST WORK DAY WITH ____DAYS OF RESTRICTED ACTIVITY | NO LOST WORK DAY ☐ | FIRST-AID ONLY ☐

CORRECTIVE ACTION RECOMMENDED (By whom and by when)

NAME OF SUPERVISOR	TITLE
SIGNATURE	DATE

APPENDIX H

DIRECTIONS TO MEDICAL FACILITY
GENERAL EMERGENCY MEDICAL ASSISTANCE

DIRECTIONS TO THE NEAREST MEDICAL FACILITY

Roper Hospital
Baker Hospital Blvd.
Charleston, South Carolina

General Telephone Number — (803) 744-2110
Emergency Room Telephone Number — (803) 744-2110

Directions to Roper Hospital from the Main Gate of the Charleston Naval Shipyard:

(1) After exiting the Main Gate (McMillan Gate) continue west on McMillan to US Highway 52.

(2) Turn left (east) on US Highway 52 and proceed to State Route 7.

(3) Turn right (south) on State Route 7 and proceed to Interstate 26.

(4) Turn left (east) on Interstate 26 and proceed to Baker Hospital Boulevard.

(5) Turn right (south) on Baker Hospital Boulevard and proceed approximately 0.2 miles to Roper Hospital Emergency Room.

HEALTH AND SAFETY PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

HEALTH AND SAFETY
ZONE L
HOSPITAL DIRECTIONS

DWG DATE: 10/18/95 | DWG NAME: BOARD