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U.S. Army
Environmental
Center

LANDFILL REMEDIATION FEASIBILITY STUDY

DEVENS, MASSACHUSETTS

VOLUME I OF II

TEXT, FIGURES AND TABLES

CONTRACT DACA31-94-D-0061
TASK ORDER 0002

U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND,
MARYLAND

~~JANUARY~~ 1997
March

PRINTED ON RECYCLED PAPER

LFC 97011 ABBP VI

AEC Form 45, 1 Feb 93 replaces THAMA Form 45 which is obsolete.

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JANUARY 1997

to go with LFC 97011ADBP

RESPONSE TO COMMENTS ON DRAFT CONSOLIDATION LANDFILL FEASIBILITY STUDY

DEVENS, MASSACHUSETTS

U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MARYLAND

JANUARY 1997

USEPA NEW ENGLAND COMMENTS ON THE DRAFT CONSOLIDATION LANDFILL FEASIBILITY STUDY

Comment #	Comment/Response

GENERAL COMMENTS

1. Comments: Waste volume calculation (i.e., length x width x depth or average-end areas) for each of the debris areas should be provided to form the basis for future documents. The feasibility study (FS) should state that the actual volumes may vary considerably from these estimates because of the uncertainties associated with the estimating techniques (i.e., actual conditions may vary from the test pit observations made at limited locations, actual volumes of recoverable materials may vary from the test pit observations made at limited locations, actual volumes of recoverable materials may vary also, etc.) For the purposes of cost estimation and this FS, the volume estimated provided are adequate for alternative comparisons.

   Response: Waste volume calculations for each of the debris areas are included in Appendix B of the Landfill Remediation FS (LRFS) Report. A statement that actual waste volumes may vary has been added to Subsection 2.1.

2. Comment: The cost estimates for alternatives involving mining to recover recyclable materials appear to be slightly inflated because: **a.** The estimates do not include any cost reductions based on salvage value of the recyclable materials. As pointed out in the vendor information provided in Appendix E, scrap metal and aggregate (from crushed concrete, bricks, and asphalt) currently have a market value of approximately $25 per cubic yard (cy) or $50 per ton) and $6 to 8 per cy, respectively. Base don the waste volumes provided in Table 4-1, a net savings of over $1,000,000 may be achieved making the mining alternatives less costly. The FS should indicate that the mining alternatives have potential lower costs rather than assuming that the recyclable materials have no market value. A range of costs based on best- and worst-case scenarios of the recyclables volume recovered should also be considered. **b.** The consolidation landfill could be built on a smaller footprint thereby reducing the construction costs. Based on a comparison of the footprints and cross-sections for Alternatives C and D in Figures 5-9 through 5-12, it appears that waste materials could be placed within a smaller footprint than currently proposed for Alternative D, which includes mining and less waste volume. Alternative D requires a landfill capacity of approximately 33 percent the volume of Alternative C (76,400 cy vs. 232,000 cy). Therefore, Alternative D could have a smaller land area than 250,000 square feet as proposed (a reduction of only 17 percent from Alternative C at 300,000 square feet). Even if a larger capacity is needed (to account for an unexpected volume increase because less recyclable material is encountered during debris excavation), a more optimal, smaller landfill area appears to be appropriate for Alternative D. Lower site work, liner, and cap costs would result from a smaller footprint. The optimal size of the Alternative D landfill should be evaluated further and the cost estimate should be revised.

Comment #	Comment/Response

Response: Comment 2a is not relevant to the LRFS Report. The FS report does not evaluate alternatives involving recovery of recyclable materials. In response to Comment 2b, a consolidation landfill containing various waste volumes is being evaluated in the LRFS report, although the varying sizes are due to the alternative-specific grouping of landfills to be consolidated, not a result of lower volume through recycling. One footprint size, optimizing use of the available space at the Shepley's Hill expansion area, is being considered for all of the consolidation landfill volumes in order to simplify the conceptual FS design. This approach is adequate for the purposes of the FS. The footprint size can be adjusted, if necessary, during final design.

3. Comment: No sampling to characterize soils a hazardous is proposed in the FS. Although the wastes at the debris areas are mostly construction-type debris (the debris areas contain only non-hazardous debris "based on available information"), reports of drums, cans, and "unknown quantities of oil" at some of the sites leaves open the possibility of contaminant sources being discovered during excavation. In addition, contaminants in soil posing unacceptable human health ecological risks are present at some of the sites. A determination should be made as to whether any RCRA-listed or characteristic hazardous wastes are present at the sites. If so, the Land Disposal Restrictions (LDRs) must be complied with and would be considered an ARAR. It is recommended that some limited sampling of soils at the debris areas be conducted to ensure compliance with the LDRs and to confirm the full extent of contaminants are removed. We have previously developed these types of sampling plans at other Landfill consolidation projects on Federal Facilities in the Region. I will forward copies of these plans to you at the appropriate time. Please refer to page-specific comment 18 also.

Response: Since the production of the Draft Landfill Consolidation FS Report, more has been learned regarding the types of wastes at the two largest landfills being evaluated. Test excavations by SEA Consultants in 1996 confirms the presence of demolition-type debris at AOCs 9 and 40. However, it is possible that small amounts of hazardous wastes could be encountered during excavations. As part of final design of the selected alternative, limited sampling evaluations to determine existence of hazardous wastes can be planned. For now, the cost to perform the sampling is included in the LRFS Report cost estimate contingency.

4. Comment: In regard to the above, cost calculations do not seem to have a contingency for the discovery and subsequent handling and removal of hazardous substances from these landfills. Please include estimates in the FS Report. Additionally, no reference is made on this issue in the text of the Report. Please include a discussion on this issue in the final version of the FS.

Comment #	Comment/Response
	Response: As mentioned in the response to the previous comment, costs for limited hazardous waste sampling is covered in the LRFS Report cost estimate contingency. A reference is included in Subsection 8.2.2.7 of the report.
5.	Comment: Overall, EPA feels that capping AOCs 9, 11, & 40 in place and off-site disposal of SAs 6, 12, 13 & 41 (option 1 in the plan of action) needs to be included in the screening process to make this a more complete FS. If Landfill Consolidation is not approved, capping one or more of these Landfills in place may be a viable option.
	Response: The LRFS Report evaluates in detail two alternatives (Nos. 3 and 7) that include capping AOCs 9, 11, and 40 in place.
6.	Comment: The cost savings associated with not having to dispose of contaminated soils now on the soils storage facility as well as those administrative costs associated with the production of less documents needs to be more clearly accounted for.
	Response: This comment is not relevant to the LRFS Report. The FS report does not evaluate disposal of the contaminated soils now on the soil storage facility into the consolidation landfill.

Comment #	Comment/Response

SPECIFIC COMMENTS:

1. Comment: **Section 1.6.2, page 1-14, lines 30-32.** The text states that organic contaminants were detected in soil. Please describe the nature and extent of soil contamination.

   Response: The nature and extent of organic contaminants in soil at AOC 9 is described in Subsection 2.2 of the LRFS Report.

2. Comment: **Section 1.6.6.** An estimate of the waste volume should be provided for AOC 40 (volumes are estimated for all other areas).

   Response: An estimate of the AOC 40 waste volume is included in Subsection 2.6 of the LRFS Report.

3. Comment: **Section 2.2, page 2-5, lines 35**: Why will "filling" of wetlands occur at AOC 40.

   Response: Reference to filling of wetlands at AOC 40 has been deleted in the ARARs presentation Section of the LRFS Report.

4. Comment: **Section 4.1.2, page 4-3, line 22**: The waste volume should be changed to 76,400 cubic yards to be consistent with Table 4-1 (other sections also). Also, please clarify how the waste volumes for each debris area were calculated to arrive at the volume to be consolidated (see general comment 1).

   Response: Waste volume calculation summaries are presented in Appendix B of the LRFS Report.

5. Comment: **Section 4.1.2, page 4-3, lines 38**: In Sections 1.7 and 1.8, soils were found to pose unacceptable risks at some of the debris areas. Per Table 4-1, it appears that some of the soil from the debris areas will be recovered for reuse. Please add "soil" to all lists of recoverable materials. Please describe the soil segregation process to ensure only non-hazardous soils will be reused. Where would the soil be reused?

   Response: This comment is not relevant to the LRFS Report. The FS report does not include evaluation of alternatives that recover soil from the debris areas for reuse.

Comment #	**Comment/Response**
6.	Comment: **Section 4.2.4, page 4-9, line 36**: Rather than indicating that this alternative is similar to the other mining alternatives by eliminating the need for a large on-site landfill, the text should be revised to indicate that this alternative is different because no on-site landfill would be constructed. Response: This comment is not relevant to the LRFS Report. The FS report does not evaluate alternatives that include waste mining.
7.	Comment: **Section 4.2.4, page 4-9, lines 36**: Mining should be added to the list of capital costs. Response: This comment is not relevant to the LRFS Report. The FS report does not evaluate alternatives that include waste mining.
8.	Comment: **Table 4-4**: Please discuss the significance of the large land area needed for the surface water drainage ditch under Implementability Disadvantages. Also, under Cost Disadvantages, the fact that hauling costs for mined debris will be offset by its salvage value should be considered an advantage because the cost estimate is based on no salvage value for the recyclable materials. Refer to general comment 2.a also. Response: The proposed footprint for the consolidation landfill is changed from that proposed in the Draft Landfill Consolidation FS Report. Consequently, the area of land needed for the surface drainage ditch is no longer considered an Implementability Disadvantage. The remainder of this comment is not relevant to the LRFS Report. The FS report does not evaluate alternatives that include waste mining.
9.	Comment: **Section 5.2.1, page 5-5, paragraph 2**: Because some of these drums are partially submerged within the pond and may otherwise contain liquids with solvents and metals, a more immediate removal action appears to be warranted to prevent further potential releases of these contaminants. The drum removal as proposed in the FS is already a separate activity. Response: The proposed drum removal remains a component of remedial alternatives evaluated for AOC 40 in the LRFS Report.
10.	Comment: **Figure 5-3**: The limits of the 100-foot buffer zone should be shown.

Comment # **Comment/Response**

Response: The requested information was not presented in the AOC 11 RI report, the source of the referenced figure.

11. Comment: **Section 5.2.1, page 5-7, lines 2-3**: A determination should be made as to whether or not the "basin" at AOC 41 (a potential isolated land subject to flooding [ILSF] per the assessment in Appendix C) is in fact ILSF and a vernal pool under the Massachusetts Wetland Regulations. If determined to be a vernal pool, then debris excavation will impact a wetland resource area (the area considered vernal pool habitat includes the area within 100 feet of the boundary of the vernal pool itself) and mitigating measures to restore the area must be implemented.

Response: The basin at AOC 41 has been determined not to meet the definition of an ILSF. Calculations for this determination appear in Appendix C of the LRFS Report.

12. Comment: **Section 5.2.1, page 5-11, line 19**: Figure 5-15 (and 5-14) is missing.

Response: A complete set of figures is included in the LRFS Report.

13. Comment: **Table 5-5**: Under Operating & Maintenance (O&M) Costs, what is the "Old Landfill"?

Response: References to the "Old Landfill" have been changed to "Cold Spring Brook (CSB) Landfill" in the LRFS Report.

14. Comment: **Sections 5.2.2 and 5.3.2**: Per general comment 3, confirmational sampling costs should be added.

Response: As mentioned in the response to general comment 3, limited sampling costs are included in the LRFS Report cost estimate contingency.

15. Comment: **Section 5.3.1, page 5-20, paragraph 5**: Refer to general comment 2.b. regarding the optional size of the consolidation landfill.

Response: See response to general comment 2b.

Comment #	**Comment/Response**
16.	Comment: **Sections 5.3.2, page 5-22, lines 4-5**: Per general comment 2.a., assigning a salvage value to the recyclable materials will reduce the cost by over $1,000,000. Response: This comment is not relevant to the LRFS Report. The FS report does not evaluate alternatives that include waste mining.
17.	Comment: **Section 5.3.1.1**: Per general comment 2.b., a smaller, optimally sized landfill will reduce the gap in this sensitivity analysis, making the mining option more attractive (although still more costly). Response: See response to general comment 2b.
18.	Comment: **Table 5-6**: The bottom of the location-specific ARARs is not complete. Under Action-specific, the Massachusetts Reuse and Disposal of Contaminated Soils policy sets specific allowable contaminant levels in soil for reuse at lined landfills. To comply with this requirement, some limited sampling must be conducted (no sampling is currently proposed) {Note: this applies to Table 5-9 also}. Also, please explain why the 250-foot separation from Plow Shop Pond cannot be met. Response: This comment is not relevant to the LRFS Report. The FS report does not evaluate alternatives that recover soil from the debris areas for reuse.

MADEP COMMENTS ON THE
DRAFT CONSOLIDATION LANDFILL FEASIBILITY STUDY
(October 16, 1995)

Comment #	**Comment/Response**
1.	Comment: MADEP believes that the elimination of Alternative B (Debris Excavation/Mining/Consolidation on Top of Shepleys Hill Landfill) is premature. Although we agree that compression generation of some additional leachate is possible, it would be a one-time event and not a source of continuing contamination. Additionally, the utilization of the existing landfill and the addition of fill to Shepley's Hill Landfill will serve to increase top slope grades to 5% as required by current solid waste regulations. Therefore, the MADEP recommends that Alternative B be considered for detailed analysis in the final FS. Response: In a supplemental comment dated November 7, 1995 MADEP stated that it had conducted an additional review of consolidating wastes on top of Shepley's Hill Landfill. As a result of the review, MADEP recommended no further evaluation of this alternative due to its higher costs as compared to consolidating in the expansion area.
2.	Comment: MADEP continues to be concerned with the limited number of borings placed on the proposed consolidation site relative to its size, the lack of baseline analytical data relative to site subsurface media, and possible impacts from historic lagoons that may have been previously located on the site. These concerns were expressed in our July 27, 1995 comments on the Draft Consolidation Landfill Feasibility Study Work Plan. MADEP requests that these issues be resolved prior to publication of the final FS. Response: For purposes of the conceptual design, the geotechnical evaluation of the consolidation landfill site presented in the Landfill Remediation FS Report (LRFS) Appendix F adequately portrays site soils as being capable of providing support for the loadings proposed for a consolidation landfill. The MADEP issues of baseline analytical data and possible impacts from historic lagoons can be addressed by the Army during the final design phase, when more details (e.g., exact location of landfill footprint and actual depth of construction-related excavation) are known. No further site investigation, including soil borings and chemical analyses, are necessary prior to distribution of the FS.
3.	Comment: **Section 1.0, Pg. 1-1, Para. 4** - Please include AOCs 4 and 18 in the delineation of Shepleys Hill Landfill. Response: AOCs 4 and 18 have been delineated on LRFS Figure 8-8. A written description has been added to the Subsection 1.2 text.
4.	Comment: **Section 5.0, Pg. 5-5, Para. 1** - The MADEP requests confirmatory sampling of sediment excavations to ensure complete removal of all contaminated material.

Comment #	**Comment/Response**

Response: Confirmatory sampling will occur after sediment removals at AOC 40. The scope of the confirmatory sampling and analysis program will be developed by the Army during the final design phase when the sediment removal work plan is prepared. Costs for the program are accommodated in the LRFS Report in the Undeveloped Design Details contingency.

5. Comment: **Section 5.0, Pg. 5-5, Para. 4** - Please review the anticipated removal volume from AOC 40. The draft FS notes a volume of 100,000 cubic yards while the BCT Plan of Action indicates a volume of 40,000 yards.

Response: The waste volume estimate for AOC 40 has been recalculated in the LRFS Report. The most recent estimate uses test excavation data performed by SEA Consultants in 1996, subsequent to issuance of the Draft Landfill Consolidation FS Report. The revised waste volume, 110,000 cubic yards, is presented in the LRFS Report.

6. Comment: **Section 5.0, Pg. 5-6, Para. 2** - Please specify the level of further archeological study required at SA 6 prior to conduct of removal operations. Although further study was "recommended" by Public Archeology Labs on the site, what, if any, requirements exist for further study?

Response: According to the Public Archaeology Laboratory, SA 6 is potentially eligible to be listed on the National Register of Historic Places. This observation was made after PAL monitored test pit excavations at the site in August 1994. PAL recommends that four additional test pits up to 12 feet deep be performed. The excavations would be located in areas not covered by the six explorations performed in 1994. PAL proposes that a sample of the debris be submitted for laboratory processing and analysis. A record search of deeds and town meeting records, and local informant interviews would assist with reconstructing the site's history. The additional field work, debris analysis, and background research would be used to provide the information necessary to determine eligibility of SA 6 to the National Register of Historic Places.

7. Comment: **Section 5.0, Pg. 5-8, Para. 4** - Please specify the September 1993, MADEP Landfill Technical Guidance Manual as a reference for landfill design and construction.

Response: The September 1993 Landfill Technical Guidance Manual will be included as a reference in the LRFS Report.

8. Comment: **Section 5.0, Pg. 5-10, Para. 1** - The MADEP recommends increasing the timespan for operation of the landfill to correspond with the timeframe for removal of the remaining

underground storage tanks on Fort Devens. It is anticipated that future removals will generate additional soil requiring disposal.

Response: If the actual timespan of landfill operation corresponds to the schedule for tank removals at Fort Devens, the Army will consider disposing additional soils into the landfill.

9. Comment: **Section 5.0, Pg. 5-10, Para. 1** - The proposed hydraulic barrier exceeds the requirements of the MADEP Landfill Technical Guidance Manual in that the conceptual design notes both compacted soil with hydraulic conductivity of 10 E-7 and a 60-mil geomembrane. Current guidance requires only the soil or the geomembrane, not both. The inclusion of both materials may add to the construction costs of the consolidation facility.

Response: The LRFS Report will eliminate low-permeability soil in the proposed landfill cover.

10. Comment: **Figure 5-8** - The hydraulic soil barrier portion of the liner should have a thickness of at least 24" and be compacted in lifts.

Response: The hydraulic soil barrier portion of the liner will be increased to 24 inches in the LRFS Report.

FORSCOM COMMENTS ON THE DRAFT CONSOLIDATION LANDFILL FEASIBILITY STUDY

Comment #	Comment/Response

1. Comment: **a.** The study is premature in that, for some sites, it short circuits the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) process. For instance, the RI/FS for site 11 (Lovell Street Landfill, Area of Contamination 11) apparently called for No Further Action. The study does not make clear why this site should now be excavated.

   Response: In the July 1996 Development and Initial Screening of Remedial Alternatives Report for AOC 11, a range of alternatives including No Action, Capping, Consolidation, and Waste Treatment for disposed wastes were recommended for detailed evaluation. No Action and Limited Action (i.e., habitat monitoring), were recommended for wetland sediments. Actions evaluated in the LRFS Report for disposed wastes and wetland sediments at AOC 11 are consistent with these recommendations.

2. Comment: **b.** Subject document does not address or analyze the full range of alternatives required by the National Contingency Plan (NCP). Specifically, it does not consider alternatives which would involve containment rather than excavation.

   Response: The LRFS Report evaluates several alternatives containing containment actions.

3. Comment: **c.** The study does not appear to have gathered information from various affected agencies. For instance, there is no indication the Fish and Wildlife Service had a chance to give its opinion about the issue of excavating site 11 which is located in property scheduled for their reuse.

   Response: Fish and Wildlife Service comments on the Draft Consolidation Landfill FS Report indicated that the report adequately addressed most of their concerns regarding the excavation of wastes at AOC 11. It should be noted that AOC 11 is no longer scheduled for reuse by Fish and Wildlife; the Army will retain the property containing AOC 11.

4. Comment: **d.** The study includes three sites in the southern training area. It is not clear why these areas are included as part of this action, since this area will not be transferred from Amy ownership. For those areas to be retained under federal ownership, Base Realignment and Closure (BRAC) funds will not be used to conduct environmental restoration work. If there are any restoration sites within these areas, those projects will be prioritized and funded through the Defense Environmental Restoration Account (DERA) program.

   Response: The three southern training area sites (Sas 6, 12, and AOC 41) have been identified by the regulators as waste disposal sites requiring management. In terms of total cost, it is both economically and administratively advantageous to the Army to manage the three sites in conjunction with the four sites located outside of the southern training area.

Comment #	Comment/Response
5.	Comment: e. The plan, while admirably "holistic," seems to be designed in part to increase the value of the land being transferred for reuse. This is not a proper use of federal BRAC clean-up funds. The key questions are whether the disposal sites considered individually constitute "hazardous waste" or "solid waste", and whether they pose a significant ecological or human health risk. Response: The LRFS Report documents results of test excavations at the disposal sites, including 1996 investigations at AOCs 9 and 40, which verify that the wastes are generally demolition debris (i.e., solid waste), not hazardous waste. Section 3 of the LRFS Report summarizes the extent of human health and environmental site risks. Section 8 of the LRFS Report evaluates the effectiveness of remedial alternatives on the identified risks.
6.	Comment: Request you revise the subject Feasibility Study to address our comments and delete those portions of the study dealing with the retained federal property. In addition, do not proceed on the proposed plan until all issues are resolved. Response: The LRFS Report addresses issues raised in FORSCOM comments. The Proposed Plan will reflect resolution of these issues.
7.	Comment: You may contact Mr. Victor M. Bonilla, DSN 367-6346, or COMM (404) 669-6346, if additional information is required. Response: No action required.

Comment #	Comment/Response

SPECIFIC COMMENTS

1. Comment: **a.** Document fails to address the potential effectiveness of the no action alternative for individual disposal sites. While it is granted that some disposal areas require further action, it is clear that a number of the disposal sites pose no threat to human health and the environment and no further action seems appropriate. What is the basis for the conclusion stated with respect to Study Area (SA) 12, SA 13, and Area of Contamination (AOC) 41 that closure in place "appears impractical" (pages 3 and 4 of the Plan of Action)? Is management under State solid waste regulations technologically feasible? What would be the costs, and how do they compare to excavation/consolidate costs?

   Response: The LRFS Report evaluates alternatives containing No Action at the disposal sites. In-place closure of AOC 41 is evaluated in the LRFS Report.

2. Comment: **b.** The subject document is biased towards the excavation/consolidation alternative. The single most important step in any study is to define the objective. Without a clear, concise statement of what the study is to evaluate, the study will not be successful. The objective of subject document has been stated improperly. The objective indicates that the study was done to justify a conclusion (that is, consolidation of the seven debris areas) and not to determine, without bias, the alternative which is protective of human health and the environment and cost effective as well.

   Response: The LRFS Report evaluates containment and consolidation options. Section 8 of the report presents evaluation of the options with respect to protection of human health and the environment and cost.

3. Comment: **c.** The key questions are whether the disposal sites considered individually constitute "hazardous waste" or "solid waste", and whether they pose a significant ecological or human health risk. The answers to these questions determine the "legal driver" (that is; whether hazardous waste or solid waste rules apply to a particular debris pile or landfill). Is management (of any particular debris pile) under the State solid waste regulations warranted or more appropriate? What management and closure requirements would apply? There is no information as to whether any of the sites would have to be closed under Massachusetts landfill regulations.

   Response: Test excavations at the disposal sites reveal that the sites contain demolition debris, i.e., solid waste. A summary of ecological and human health risks posed at the sites are presented in Section 3 of the LRFS Report. MADEP has stated on numerous occasions the requirement that all seven landfills must be managed, at a minimum, under their solid waste regulations. Combinations of disposal site management actions, including containment in

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	conformance with MADEP solid waste regulations as well as consolidation, are included as alternatives in the LRFS Report.
4.	Comment: **d.** The study does not appear to have gathered information from various affected agencies. For instance, there is no indication the Fish and Wildlife had a chance to give its opinion about the issue of excavating site 11 which is located in property, scheduled for their reuse. Proper coordination with Fish and Wildlife has to be conducted regarding the issue of excavating Lovell Street landfill (Area of Contamination 11) which is located in property scheduled for their reuse. We strongly believe that excavation in a flood plain, will cause potential adverse effects not only to the river banks but to the river as well. Response: Fish and Wildlife Service comments on the Draft Consolidation Landfill FS Report indicated that the report adequately addressed most of their concerns regarding the excavation of wastes at AOC 11. It should be noted that AOC 11 is no longer scheduled for reuse by Fish and Wildlife; the Army will retain the property containing AOC 11.
5.	Comment: **e.** There is no information to indicate that the waste classification and risk questions were specifically answered for each of the disposal sites. In fact, it appears that the decision to address all seven disposal sites under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) was not based on ecological or human health risk. Instead, it appears that the decision was made for reasons of (1) administrative convenience (2) presumptions of negative impact on "water supply and wastewater resources, as well as property values"; and (3) assumptions that "managing debris disposal areas in a holistic manner" will result in "cost savings from lower operating and maintenance requirements at a consolidated disposal area", despite the apparent absence of any study of State debris disposal area management requirements and associated costs. It also states that the consolidation option will increase the value of the land for reuse. All this is very nice, but BRAC funds can not be used for property improvements. In addition, factors for selecting a remedial action under CERCLA are that it must be protective of human health and the environment and should be cost effective among others. Response: Test excavations at the disposal sites reveal that the sites contain demolition debris, i.e., solid waste. A summary of ecological and human health risks posed at the sites are presented in Section 3 of the LRFS Report. Remedial alternatives are evaluated in Section 8 of the LRFS Report with regard to mitigation of site risks and cost.
6.	Comment: **f.** On page 1-3 it is mentioned that increases in the preliminary cost estimates presented in the Plan of Action are due to unforeseen construction-related items such as unexploded ordnance. Unforeseen cost due to increases in volume of debris to be excavated also has to be considered as part of this analysis. Experience has shown us that volume to be

Comment # **Comment/Response**

excavated is often under-estimated. Once we start excavation we have to continue until all debris has been removed. Therefore, an increase of volume to be excavated must be added to the consolidation alternatives in order to make the FS more realistic.

Response: Based on results of test excavations and visual observations at the disposal areas, waste volume calculations in the LRFS Report are believed to be within the bounds of accuracy acceptable for a feasibility study. The estimates of direct costs for the alternatives evaluated in detail include a 25% contingency to account for the preliminary nature of the engineering study.

7. Comment: **g.** According to representatives of ABB Environmental Services at the 12 Sep 95 meeting at Fort Devens, this report was supposed to contain costing information on all the alternatives which FORSCOM could use in evaluating the alternatives as stated in the original Plan of Action. However, only the preferred alternatives proposed (excavation of all sites and consolidation in landfill with or without recycling) by the BRAC Cleanup Team (BCT) were provided and evaluated. This is totally inadequate for an effective FS.

Response: The LRFS Report contains detailed evaluations of nine alternatives comprised of various combinations of containment of some landfills and consolidation actions at others. These nine alternatives are similar, and in one instance identical, to those proposed in the Plan of Action.

8. Comment: **h.** The conclusions of the Plan of Action, as cited on page 1-4, state that this excavation and relocation will eliminate the need for subsequent environmental monitoring at the excavation sites. Is this based on the assumption that no hazardous waste materials are discovered in the excavation? It is difficult to believe the regulators will allow no monitoring under such conditions.

Response: The LRFS Report documents the test excavations leading to the conclusion that the disposal areas generally contain demolition debris, i.e., nonhazardous wastes. Excavation and relocation of site wastes precludes the need to perform post-removal monitoring.

9. Comment: **i.** In regards to the Remedial Response Objectives, the first objective listed on page 3-1 should be chanted to read, "Remove any identified threat of release to groundwater that may result in contamination exceeding state and federal standards from unlined debris disposal areas." The term "future release" should be deleted. The objective of the remediation process is to address identifiable sources of release. Using the term "future release" leaves the Army liable to "chasing ghosts" in the search of speculative releases. This is a totally ineffective approach in addressing the real requirements for these sites and will lead to unnecessary allocation of scarce resources.

Comment #	Comment/Response
	Response: The term "future release" does not appear in the remedial response objectives stated in Section 5 of the LRFS Report.
10.	Comment: j. The second Remedial Response Objectives, listed on page 3-1 should be changed to read, "Remove any identified of releases that may result in contamination exceeds ambient water quality criteria or ecological risk-based levels resulting from exposure to contaminated surface water." Once again, the term "future release" should be deleted. The objective of the remediation process is to address identifiable sources of release. Rationale is the same as in above paragraph. Response: The term "future release" does not appear in the remedial response objectives stated in Section 5 of the LRFS Report.
11.	Comment: k. The second Remedial Response Objective on page 3-2 concerning the elimination of long-term management of multiple closed in-place debris disposal areas should be eliminated. This Remedial Response Objective effectively precludes any reasonable consideration of in-place closure which may be the most cost-effective alternative and protective of human health and the environment. Response: The cited response objective has been deleted from the LRFS Report.
12.	Comment: l. The third Remedial Response Objectives, on page 3-2 should be changed to read, "Remove any identified threat of releases that may result in contamination that exceeds ambient water quality criteria or ecological risk-based levels resulting from exposure to flood plains and wetlands." Again the word "potential" as well as "future" leaves the Army liable to "chasing ghosts" in the search of speculative releases. Response: The words "potential" and "future" do not appear in the remedial response objectives stated in Section 5 of the LRFS Report.
13.	Comment: m. The term "maximize" should be better defined in the fourth Remedial Response Objective on page 3-2. Does this mean maximize property value or what? BRAC does not pay for property enhancement as part of its mandate. Response: The cited response objective has been rewritten. The term "maximize" no longer appears in the objective.

Comment #	Comment/Response
14.	Comment: **n.** The term "technically difficult" should be better defined in the fifth Remedial Response Objective on page 3-2. Any remedial action can be loosely interpreted to be "technically difficult". Response: The cited response objective has been rewritten. The term "technically difficult" no longer appears in the objective.
15.	Comment: **o.** The No-Action Alternative (section 4.1.1) should discuss the potential impacts of leaving each disposal area unremediated. Response: The LRFS Report contains evaluations of No Action at each disposal area.
16.	Comment: **p.** A description of the No-Action Alternative should be included in section 5.1.1 that clearly defines how each disposal area may meet the Remedial Response Objectives stated in section 3 of the FS. For example, a number of disposal sites will not impact groundwater even if no action is taken. This makes the following statement at the end of paragraph 5.1.1, "No action will be taken to meet the response objectives...", incorrect. Response: The LRFS Report contains evaluations of No Action at each disposal area.
17.	Comment: **q.** Section 6 inadequately evaluates the No-Action Alternative by including the negative aspects for a few disposal areas in the evaluation of all disposal sites. This consolidation of characteristics of seven distinct disposal areas and treating them as one site fails to adequately assess a reasonable approach to the actions required on a site-by-site basis. This type of approach is consistent throughout the FS and clearly demonstrates a consistent bias towards consolidation leaving no room for a thorough analysis of all viable alternatives. Response: Bias toward consolidation does not appear in the LRFS Report. The report evaluates each site separately with regard to the No Action alternative.
18.	Comment: **r.** Table ES-2 fails to distinguish the individual characteristics of the seven disposal areas. The terms "potential" and "exceedances" should be defined. The objective of the remediation process is to address identifiable sources of release. Same rationale found in paragraph f. Response: This comment is not relevant to the LRFS Report. The comparative analysis of alternatives (LRFS Report Section 9) section cited in the review comment is now based on the alternatives presented in LRFS Report Section 8.

Comment #	Comment/Response
19.	Comment: **s.** Table 1-1, as stated in paragraph d should contain costing information on all the alternatives cited in this table. However, only the preferred alternatives proposed by the BCT were provided which indicates that only these alternative were truly considered. Again, this is totally inappropriate for an effective FS. Response: The cited Table 1-1 does not appear in the LRFS Report. Evaluation of "BCT preferred alternatives" has been replaced by nine alternatives combining no action, containment, and consolidation options.
20.	Comment: **t.** In Table 2-1, the regulations cited as Applicable Relevant and Appropriate Requirements for flood plains require federal agencies to evaluate the "potential adverse effects" associated with direct and indirect "development" of a flood plain. For wetlands, the regulations cited required that actions in wetlands minimize their destruction, loss, or degradation. The investigations of these sites clearly demonstrate that the existence of these sites does not degrade or adversely impact the ecology of these areas. In fact, it could be argued that excavation could cause more damage than simply leaving these sites alone as they have been for years. Therefore, we strongly believe that excavation of disposal area 11, which is located in a flood plain, will cause potential adverse effect to the river banks. Request the impacts, cost and benefits (both financial and ecological) of excavating the disposal sites in flood plains and wetlands with no known ecological impacts be fully addressed in the FS. Response: Appropriate regulatory agencies will be contacted during the landfill remediation design phase regarding conformance to permit requirements. Although the AOC 11 disposal area is located within the Nashua River floodplain, only a relatively small portion lies within a defined wetland area. Delineated wetlands exist to the north and to the south of the disposal area. The total refuse surface area located within the wetlands is estimated to be less than one acre. Solid waste removal at AOC 11 within the floodplain can occur during drier periods of the year to avoid run-in of water to the excavations. When completed, excavations would be backfilled with clean soil and revegetated to approximate existing conditions. Erosion control measures can be enacted to minimize sediment runoff to the river during waste removal.
21.	Comment: **u.** Table 4-2 should include the No-Action Alternative with details of individual disposal sites. Response: The No Action alternative is evaluated in the LRFS Report with respect to its impact at each of the seven disposal sites.

Comment #	Comment/Response
22.	Comment: v. In regards to Tables 5-5 and 5-8, see comment d and p.
	Response: The Army is addressing the seven disposal areas, including those in the South Post, as a group to take advantage of the inherent economic and administrative advantages. After the LRFS Report is completed, the possibility of separating the sites based on funding allocation can be pursued by the Army.
23.	Comment: w. A table in the BCT plan of action shows the seven disposal areas and indicates that there have been Site Investigations for several of them. The plan also states that several of the areas were nominated for No Further Action (NFA) under CERCLA. How did we get from NFA to "removal recommended" on the chart? Why are we consolidating the three south post locations and AOC 11 (Lovell St. Landfill) if they are not going to the MGLB?
	Response: Notwithstanding the statement in the Plan of Action, the LRFS Report evaluates alternatives containing actions other than removing wastes at the seven landfills. The alternatives include No Action at the landfills, including those on the South Post.
24.	Comment: x. The Remedial Response Objectives stated in the FS, and the Remedial Technology Alternatives screened and evaluated, were based on a predetermination that excavation with consolidation was the alternative of choice. This appearance is supported by the paragraphs from the Plan of Action and by summary statements in the Plan of Action that AOC 9, SA 12, SA 13, and AOC 41 pose "little risk" or "no significant risk"; and by the title given to the project and feasibility study: "Consolidation Landfill."
	Response: Predetermination of waste consolidation is no longer an issue in the LRFS Report. The report evaluates landfill management alternatives consisting of various options including containment and no action.

LANDFILL REMEDIATION FEASIBILITY STUDY

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EXECUTIVE SUMMARY

ABB Environmental Services, Inc. (ABB-ES) prepared this Feasibility Study (FS) Report in accordance with the U.S. Army Environmental Center (USAEC) Contract DACA31-94-D-0061, Task Order No. 0002. The objective of this task order is to complete an engineering feasibility study that will enable preparation of a Record of Decision (ROD) for managing seven debris disposal areas at the Devens Reserve Forces Training Area (RFTA, formerly Fort Devens), Devens, Massachusetts.

The FS is being conducted in accordance with the U.S. Environmental Protection Agency (USEPA) Remedial Investigation/Feasibility Study Guidance Manual (USEPA, 1988), the USEPA guidance on conducting Remedial Investigation/Feasibility Studies for CERCLA Municipal Landfill Sites (USEPA, 1991a), the Federal Facility Agreement between the USEPA and the U.S. Department of the Army, also referred to as the Interagency Agreement (IAG) (USEPA, 1991b), and the National Contingency Plan (NCP) (USEPA, 1990a).

During the collection of information for the MEP and subsequent studies, the Army identified seven debris disposal areas throughout Fort Devens. These disposal areas are in addition to the Shepley's Hill Landfill, which has served as the primary solid waste disposal location at the installation. This 80-acre facility (Area of Contamination [AOC] 05) has closed under a state-approved Resource Conservation and Recovery Act (RCRA) Subtitle D Closure Plan and is being remediated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The seven debris disposal areas have been the subject of previous investigations under CERCLA, and have been found to pose varying risks to public health and the environment. The Army has determined from discussions with federal and state regulatory agencies that the disposal areas must be managed, with consideration given to the Massachusetts solid waste management regulations.

The Army has decided to address the disposal areas under the CERCLA Feasibility Study process due to the benefits of: (1) a consistent administrative approach for all sites; (2) similarity of waste material; and (3) the administrative difficulty in mixing CERCLA and non-CERCLA waste.

Management of the debris disposal areas is being further influenced by property reuse considerations. The Massachusetts Government Land Bank (MGLB) and its consultants have indicated that water supply and wastewater resources will be affected by the management options chosen for the disposal areas.

Three previous documents contained evaluations of options for managing the seven debris areas. These are the Plan of Action (see Appendix A), the Draft Landfill Consolidation Feasibility Study Report (ABB-ES, 1995), and the Debris Disposal Area Technical Memorandum (ABB-ES, 1996). Pertinent information developed in the documents are contained in this report.

Plan of Action. The Plan of Action constituted an agreement to proceed with plans for consolidating debris from the seven disposal areas into a single disposal site. The Plan was endorsed by the Fort Devens BRAC Environmental Coordinator, USEPA Region I, Massachusetts Department of Environmental Protection (MADEP), and the MGLB. The Plan of Action considered six debris management options. Each option was comprised of one or more of the following actions: (1) debris consolidation to a single on-site disposal area, (2) capping of debris disposal areas in-place, and (3) debris disposal at an offsite commercial facility. Of these, Plan of Action proponents favored excavating debris from all seven areas, and consolidating the debris at a vacant parcel of land east of Shepley's Hill Landfill.

Landfill Consolidation Feasibility Study Report. The consolidation FS report evaluated in detail the excavation/consolidation option endorsed in the Plan of Action. Its purpose was to enable preparation of a ROD for consolidating debris from the seven disposal areas into a single waste disposal site. However, review comments on the FS report from the U.S. Army Forces Command (FORSCOM) caused Plan of Action proponents to reconsider the evaluation process from which landfill consolidation was selected. FORSCOM requested evaluation of non-consolidation options such as capping disposal areas in-place or no further action.

Debris Disposal Area Technical Memorandum. The technical memorandum evaluated a containment (i.e., capping) alternative, and a consolidation alternative for each of the seven landfills. The memorandum was prepared in response to FORSCOM comments on the consolidation FS report.

To further respond to FORSCOM's concerns, Plan of Action proponents chose to prepare this FS report. In addition to the consolidation-only option, this report evaluates debris management options containing non-consolidation actions, including those originally developed in the Plan of Action.
The purpose of this FS Report is to:

- establish response objectives describing the environmental and administrative benefits of debris management;
- identify the types of response actions necessary to achieve response objectives;
- identify and screen specific remedial technologies that may be capable of attaining response objectives;
- develop and evaluate a range of remedial alternatives based on those technologies; and
- compare the alternatives in accordance with criteria recommended by USEPA.

This FS Report is based on information and data presented in the various Site Investigation (SI) and Remedial Investigation (RI) reports prepared for the seven debris disposal areas. The debris disposal areas are: Study Areas (SAs) 6, 12, and 13, and Areas of Contamination (AOCs) 9, 11, 40, and 41.

Site Investigations (SIs) were conducted at Study Areas (SAs) 12 and 13 and AOCs 9, 40, and 41 to verify the presence or absence of environmental contamination and to determine whether further investigation or remediation was warranted. Supplemental SI activities were also conducted at SAs 12 and 13 and AOC 41 to address data gaps identified in the SI reports. RIs were completed at AOCs 11, 40, and 41 to further assess the distribution of contaminants; the RIs included human health and ecological risk assessments for the three sites.

In addition to the SI and Supplemental SI activities, predesign investigations were conducted at SAs 6, 12, and 13 AOCs 9, and 40 to define the depth, areal extent, composition of waste, and site conditions in order to identify appropriate remedial alternatives.

Development of alternatives to meet landfill management goals begins with the identification and screening of potentially applicable remedial technologies. The number of identified technologies was reduced during screening in which the advantages and disadvantages of the effectiveness and implementability of each technology were evaluated. Technologies retained have the potential for effectively achieving response objectives, either alone or in combination with other technologies. The process used for technology screening is consistent with USEPA RI/FS guidance.

Remedial technologies retained after screening for each site were assembled into remedial alternatives. The remedial alternatives were then screened upon consideration of effectiveness, implementability, and cost. A summary of alternatives considered for detailed evaluation is presented in Table ES-1.

The alternatives retained after screening (i.e., Alternative Nos. 1 through 9 in Table ES-1) were evaluated in detail using criteria suggested in the RI/FS guidance. The alternatives evaluated include consolidating debris at a proposed site near Shepley's Hill Landfill, and capping the landfills in place. A summary of the detailed evaluation of the retained alternatives is presented in Table ES-2.

1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES) prepared this Feasibility Study (FS) Report in accordance with the U.S. Army Environmental Center (USAEC) Contract DACA31-94-D-0061, Task Order No. 0002. The objective of this task order is to complete an engineering FS that will enable preparation of a Record of Decision (ROD) for managing seven debris disposal areas at the Devens Reserve Forces Training Area (RFTA, formerly Fort Devens), Devens, Massachusetts. These disposal areas are:

- Study Area (SA) 6
- Area of Contamination (AOC) 9
- AOC 11
- SA 12
- SA 13
- AOC 40
- AOC 41

The FS is being conducted in accordance with the U.S. Environmental Protection Agency (USEPA) Remedial Investigation (RI)/FS guidance manual (USEPA, 1988), the USEPA guidance on Conducting Remedial Investigation/Feasibility Studies for CERCLA Municipal Landfill Sites (USEPA, 1991a), the Federal Facility Agreement between the USEPA and the U.S. Department of the Army, also referred to as the Interagency Agreement (IAG) (USEPA, 1991b), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (USEPA, 1990a).

Fort Devens was identified for cessation of operations and closure under Public Law 101-510, the Defense Base Closure and Realignment (BRAC) Act of 1990, and officially closed in September 1996. Portions of the property formerly occupied by Fort Devens were retained by the Army for reserve forces training and renamed the Devens Reserve Forces Training Area. Areas not retained as part of the Devens RFTA were, or are in the process of being, transferred to new owners for reuse and redevelopment. Fort Devens was placed on the National Priority List (NPL) on December 21, 1989, under the

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA).

1.1 Devens Reserve Forces Training Area Background

The Devens RFTA is located within the towns of Ayer and Shirley (Middlesex County) and Harvard and Lancaster (Worcester County), approximately 35 miles northwest of Boston, Massachusetts. It was established in 1996, coincident with the closure of Fort Devens, to provide facilities for the training of reserve forces in central New England. The Devens RFTA includes portions of the former North Post and Main Post, and the entire South Post, and lies within the Ayer, Shirley, and Clinton map quadrangles (7½-minute series).

Fort Devens was established in 1917 as Camp Devens, a temporary training camp for soldiers from the New England area. In 1931, the camp became a permanent installation and was redesignated as Fort Devens. Throughout its history, Fort Devens served as a training and induction center for military personnel and a unit mobilization and demobilization site. All or portions of this function occurred during World Wars I and II, the Korean and Vietnam conflicts, and operations Desert Shield and Desert Storm.

Over 3,000 acres at Fort Devens were developed for housing, buildings, and other facilities and the installation was reported as the largest undeveloped land holding under a single owner in north-central Massachusetts (U.S. Fish and Wildlife Service [USFWS], 1992). The North Post consisted primarily of the Moore Army Airfield and the site of the installation's wastewater treatment facility. The Main Post was the site of numerous buildings, including vehicle maintenance facilities, training and administrative buildings, barracks and other military housing, and recreational facilities. The South Post, largely undeveloped, is located south of Massachusetts Route 2 and was used for field training exercises.

1.2 STATUS OF LANDFILLS AT FORT DEVENS

In conjunction with the U.S. Army Installation Restoration Program, the USAEC developed a Master Environmental Plan (MEP) for Fort Devens in 1992. The MEP included assessments of the environmental status of study areas (SAs), specified necessary investigations, and provided recommendations for response actions with the objective of identifying priorities for environmental restoration at Fort Devens. Areas Requiring Environmental Evaluation (AREEs) and SAs were identified and investigations initiated to determine where removal actions were necessary.

During the collection of information for the MEP and subsequent studies, the Army identified seven debris disposal areas throughout Fort Devens (Figure 1-1). These disposal areas were in addition to the Shepley's Hill Landfill, which served as the primary solid waste disposal location at the installation. This 80-acre facility (Area of Contamination [AOC] 05) was closed under a state-approved Resource Conservation and Recovery Act (RCRA) Subtitle D Closure Plan, and is being remediated under CERCLA. The ROD for the Shepley's Hill Landfill Operable Unit (ABB-ES, 1995b) describes the selected remedy for the site (i.e., landfill closure with a low-permeability cap and associated actions).

Included within AOC 05 are the smaller AOC 04 and AOC 18. AOC 04, the sanitary landfill incinerator, was located in former Building 38 near the end of Cook Street within the area included in Phase I of the sanitary landfill closure. The incinerator was constructed in 1941, and burned household refuse until the late 1940s. Ash from the incinerator was buried in the landfill. The incinerator was demolished and buried in the landfill in September 1967. The building foundation was removed and buried on-site in 1976.

AOC 18, the asbestos cell, is located in the section of the landfill that was closed during Phase IV. An estimated 6.6 tons of asbestos construction debris were placed in the section closed during Phase IV-A, between March 1982 and November 1985. A new asbestos cell was opened in 1990 in the section closed during Phase IV-B, and used for disposal of small volumes of asbestos-containing material until July 1992.

The seven debris disposal areas have been the subject of previous investigations under CERCLA, and have been found to pose varying risks to human health and the environment. The Army has determined from discussions with federal and state regulatory agencies that the disposal areas must be managed, with consideration given to the Massachusetts solid waste management regulations.

The Army has decided to address the disposal areas under the CERCLA Feasibility Study process due to the benefits of: (1) a consistent administrative approach for all sites; (2) similarity of waste material; and (3) the administrative difficulty in mixing CERCLA and non-CERCLA waste.

Management of the debris disposal areas is being further influenced by property reuse considerations. The Massachusetts Government Land Bank (MGLB) and its consultants have indicated that water supply and wastewater resources will be affected by the management options chosen for the disposal areas.

1.3 PREVIOUS DOCUMENTS ADDRESSING DEBRIS AREA MANAGEMENT

Three previous documents evaluated options for managing the seven debris areas: the BRAC Cleanup Team (BCT) Plan of Action (Appendix A), the Draft Landfill Consolidation Feasibility Study Report (ABB-ES, 1995), and the Debris Disposal Area Technical Memorandum (ABB-ES, 1996a). Pertinent information developed in the latter documents is contained in this report.

Plan of Action. The Plan of Action constituted an agreement to proceed with plans for consolidating debris from the seven disposal areas into a single disposal site. The Plan was endorsed by the Fort Devens BRAC Environmental Coordinator, USEPA Region I, Massachusetts Department of Environmental Protection (MADEP), and the MGLB. The Plan of Action considered six debris management options, each comprised of one or more of the following actions: (1) debris consolidation to a single on-site disposal area, (2) capping of debris disposal areas in-place, and (3) debris disposal at an offsite commercial facility. Of these, Plan of Action proponents favored excavating debris from all seven areas and consolidating the debris at a vacant parcel of land east of Shepley's Hill Landfill.

Landfill Consolidation Feasibility Study Report. The consolidation FS report (ABB-ES, 1995c) evaluated in detail the excavation/consolidation option endorsed in the Plan of Action. Its purpose was to enable preparation of a ROD for consolidating debris from the seven disposal areas into a single waste disposal site. However, review comments on the FS report from the U.S Army Forces Command (FORSCOM) caused the Plan of Action proponents to reconsider the evaluation process from which landfill consolidation was selected. FORSCOM requested evaluation of non-consolidation options such as capping disposal areas in-place or no further action.

Debris Disposal Area Technical Memorandum. The technical memorandum evaluated a containment (i.e., capping) alternative and a consolidation alternative for each of the seven landfills. The memorandum was prepared in response to FORSCOM comments on the consolidation FS report.

To further respond to FORSCOM's concerns, Plan of Action proponents chose to prepare this FS report. In addition to the consolidation-only option, this report evaluates debris management options containing non-consolidation actions, including those originally developed in the Plan of Action.

1.4 Purpose and Organization of Report

The purpose of this FS Report is to:

- establish response objectives describing the environmental and administrative benefits of debris management;
- identify the types of response actions necessary to achieve response objectives;
- identify and screen specific remedial technologies that may be capable of attaining response objectives;

- develop and evaluate a range of remedial alternatives based on those technologies; and

- compare the alternatives in accordance with criteria recommended by USEPA.

This report is based on information and data presented in the various Site Investigation (SI) and RI reports prepared for the seven debris disposal areas. These reports are referenced in the debris disposal site descriptions presented in this section.

This report consists of nine sections. Section 2 provides descriptions of the seven debris disposal sites, including the nature and extent of contamination. Section 3 summarizes results of the baseline risk assessment and preliminary risk evaluation (PRE) discussions presented in the SI and RI reports.

Section 4 discusses chemical-specific, location-specific, and action-specific Applicable or Relevant and Appropriate Requirements (ARARs) and their role in site remediation. Section 5 identifies remedial action objectives. Section 6 identifies and screens potential remedial technologies.

Section 7 develops and screens potential remedial alternatives. Section 8 contains the detailed analysis of alternatives, and Section 9 contains the comparative analysis of alternatives.

2.0 CHARACTERIZATION OF WASTE DISPOSAL SITES

The Enhanced Preliminary Assessment (Weston, 1992) identified and characterized areas requiring environmental evaluation (AREESs) associated with historical and current uses of the Devens property.

The Enhanced PA recommended that site reconnaissance and a geophysical survey be conducted at each of the seven landfills to determine their exact location and areal extent. A field investigation comprised of surface water, sediment, soil, and/or groundwater sampling would follow. The Enhanced PA further proposed that if necessary, remedial action would be taken at SA 12, SA 13, and AOC 41. For AOC 41, the report recommended that a Remedial Investigation/Feasibility Study (RI/FS) be undertaken. The RI/FS would include soil, groundwater, surface water and sediment sampling as well as quarterly water level measurement.

SIs were conducted at SAs 12 and 13, and AOCs 9, 40, and 41 to verify the presence or absence of environmental contamination and to determine whether further investigation or remediation was warranted. In addition, supplemental SI activities were conducted at SAs 12 and 13, and AOC 41 to address data gaps identified in the SI reports. RIs were completed at AOCs 11, 40, and 41 to further assess contaminant distribution; the RIs included baseline human health and ecological risk assessments for the three sites. Risk assessment results are summarized in Section 3.

In addition to the SI and Supplemental SI activities, predesign investigations were conducted at SAs 6, 12, and 13, and AOCs 9 and 40 to define depth, areal extent, type of waste, composition of waste, and site conditions to help identify appropriate remedial alternatives.

The following subsections describe the history of waste disposal and associated nature and extent of contamination at the seven landfills. Previous documentation of the disposal areas can be found in the Administrative Record according to study group. The study group number pertinent to each area is designated in parentheses in the subsection titles.

2.1 STUDY AREA 6 (GROUP 10)

The South Post Household Debris Landfill (Landfill No. 2), also referred to as SA 6, was used between 1850 and 1920 for disposal of household waste (Biang et al., 1992). It is located on the South Post, within Tactical Training Area 6A. A variety of household wastes were deposited in a low area, less than 0.25 acres in size, south of the access road. SA 6 is moderately forested with hardwood trees (e.g., red maple, ash, yellow birch, and hickory), with trunk diameters up to 12 inches. An abandoned cellar hole is located across the road. The disposal area has not been covered, and trash is visible on the ground surface. Figure 2-1 is a plan of the site showing the extent of debris as interpreted from test trenches. Scattered surficial debris may extend beyond the limits shown. Cross sections depicting subsurface information learned from test trenching are shown in Figures 2-2 and 2-3.

Nature and Extent of Contamination. Predesign activities at this site included excavation of six test trenches to define the extent and depth of landfilled material and to determine the composition of the waste. The trenches contained concentrated household debris, primarily metal and glass. Military-type waste was not observed. Waste appeared to be deposited on a layer of cobbles, presumably a natural formation. The water table, encountered at a depth of approximately 5 feet below ground surface (bgs) at the lowest area of the landfill, was observed to be below the bottom of waste at that location. The maximum depth of waste was observed to be approximately 5 feet. The volume of waste in the landfill, calculated based on observed depth and lateral extent, was approximately 500 cubic yards (cy). Waste volume calculations for SA 6 and the other six Devens landfills can be found in Appendix B. Actual waste volumes may vary from those derived in the calculations. The volumes are believed to be within the bounds of accuracy acceptable for this preliminary engineering study.

Due to the apparent age of waste at the site, archaeologists were present during trench excavation to characterize and date the waste and to assess the cultural value of the site. Personnel from The Public Archaeology Laboratory, Inc. of Pawtucket, Rhode Island observed the excavations at SA 6 (Public Archaeology Laboratory, Inc., 1994). The archaeologists noted cultural materials at the site manufactured in the late 1700s to early

1900s, with the majority of the material dating from the late 1800s to 1900. Waste was identified as primarily household debris, potentially originating from more than one household proximal to the site prior to the property's incorporation into Fort Devens. The site was determined to be potentially valuable in researching the socioeconomic status and refuse disposal behavior of 19th Century northern Lancaster residents. Additional studies of the site prior to remedial or removal actions were recommended by the archaeologists. Soil sampling was not conducted at SA 6 due to the age and type of waste observed, and the lack of evidence of contamination.

ABB-ES personnel also characterized the site to determine whether the site would be considered a wetland under state or federal jurisdiction. Vegetation, hydrology, and soil type were examined within the basin-like depression in the western portion of SA 6. This basin represents the lowest point of elevation at SA 6. While it is possible that during the spring and early summer this basin may hold water, no federal or state jurisdictional wetlands were identified at SA 6.

2.2 AREA OF CONTAMINATION 9 (GROUP 5)

AOC 9, the North Post Landfill, is located on the North Post, west of the Fort Devens wastewater treatment plant. It is known informally as the old "stump dump" or "wood dump", or Landfill No. 5. The landfill is part of a larger area that is controlled by Fort Devens Range Control and occasionally used for tactical training exercises.

The landfill was operated from the late 1950s until 1978, when access was uncontrolled. It was used by the Army, National Guard, contractors, and off-post personnel (McMaster et al., 1982; Biang et al., 1992). Materials reportedly disposed of at this location include tree stumps, limbs, and the debris from about 100 demolished buildings. Automobiles, automobile parts, and other debris (including asphalt, bedsprings, and 5-gallon cans) were observed in a location above and adjacent to the north side of the landfill, on the lower slope from the wastewater infiltration beds.

The landfill occupies a low area that originally contained a small pond (Jahns, 1953), and the bluffs to the west have been used for gravel quarrying. The disposal of solid waste and placement of cover gravel have filled the depressions and raised the land surface approximately 35 to 40 feet (ft) (McMaster et al., 1982). Because of the extent and effectiveness of the partially vegetated cover, the area is generally not recognizable as a former landfill. Soils are typical of kame, kame-plain, and ice-contact deposits consisting of sand and pebble-to-cobble gravel. These soils are also visible in the bluff to the west of the landfill. Immediately south of the landfill are post-glacial swamp and floodplain deposits consisting of sand with variable gravel and silt content.

An SI was conducted by ABB-ES under contract with the USAEC (ABB-ES, 1996b). The purpose of the SI was to verify the presence or absence of environmental contamination and to determine whether further investigation or remediation was warranted.

A geophysical survey was conducted at the landfill to supplement information derived from evaluation of aerial photographs and delineate the actual limits of the landfill. The results of the survey assisted in the placement of test pits and groundwater monitoring wells, and provided insight into the distribution of landfilled materials. Results of the geophysical survey indicated that the landfill consists of five areas: a larger northern pod containing the majority of landfilled materials, and four smaller southern pod adjacent to the wetlands containing mostly near-surface debris (Figure 2-4). Cross sections depicting subsurface information from test trenching are shown in Figures 2-5 and 2-6.

Nature and Extent of Contamination. Surface water and sediment samples were collected from the Nashua River and the swampy area south of the landfill. Results indicated that coliform bacteria counts and concentrations of inorganics were elevated in surface water samples. Polynuclear aromatic hydrocarbons (PAHs) were detected in sediment samples from the Nashua River and the pond nearby. Concentrations of these analytes were generally low, and no consistent distribution along the river was apparent. Total petroleum hydrocarbon compounds (TPHC) were detected in sediment samples in a similar sporadic distribution, but no significant correlation between PAHs and TPHC was evident. TPHC and inorganics were elevated in sediment in the swampy area.

Soil borings for monitoring wells G5M-92-01X through G5M-92-03X were drilled just outside the limits of the North Post Landfill (to avoid penetrating landfill materials), to approximately 10 ft below the water table. Two rounds of groundwater samples and water table measurements, collected three months apart, were collected from the three new monitoring wells and 16 existing monitoring wells. The 16 existing monitoring wells were installed to evaluate the effectiveness of the wastewater treatment plant (SA 19). Due to cross-contamination likely resulting from the pump used to purge the wells during the second sampling round, a third round of groundwater samples was collected for volatile organic compounds (VOCs) only. To evaluate the potential impact to groundwater due to releases from the landfill, analytes detected in five selected wells located radially around the landfill (WWTMW-07, WWTMW-08, G5M-92-01X, G5M-92-02X, and G5M-92-03B) were compared to the other 14 wells. The absence of organic compounds in groundwater adjacent to and downgradient from the mapped landfill suggests that the organic compounds detected in soil have not impacted groundwater quality. Low counts of coliform bacteria were measured in landfill wells G5M-92-01X and G5M-92-02X in Round 1 and WWTMW-08 in Round 2. In the five selected landfill wells, concentrations of several inorganic analytes were elevated in up-, down-, and cross-gradient wells. Elevated concentrations of these analytes correlated well with elevated total suspended solids (TSS) concentrations. Filtered samples collected during Round 2 exhibited significant reductions in the concentrations of inorganic analytes such as arsenic, chromium, iron, lead, vanadium, and zinc. Other more soluble inorganic analytes also showed concentration reductions, but not to the same magnitude.

To further characterize the nature of soils and landfilled materials, four test pits (09E-92-01X through 09E-92-04X) were excavated in 1992 in areas where landfilled material was identified during geophysical surveys. A cross section depicting subsurface information from test pitting is shown in Figure 2-5. Test pitting within the suspected landfill limits showed the landfilled contents consist of mixed refuse, including piping, brick, charred wood, roof slate, bottles, carpet, and plastic, and silt and sand. Soil samples were collected from apparent zones of contamination in each of the four test pits. In most cases, the samples were collected from darkened or stained soil, presumably from burned materials. A total of eight soil samples was collected. Significant semivolatile organic compound (SVOC) concentrations (mostly PAHs) were detected in soil samples from test pits 09E-92-01X and 09E-92-02X. SVOCs were, however, absent in soil collected from test pits 09E-92-03X and 09E-92-04X. TPHC levels were detected in all test pits except 09E-92-04X, located just outside the southern limit of geophysical mapped landfill materials. The test pit log for 09E-92-04X indicated that the soil was relatively free of landfill debris, suggesting that this pit is on the fringe of the landfill. Organic compounds detected in soil samples collected from the landfill test pits are likely derived from the ash and charred wood observed during sampling; absence of volatile petroleum compounds in soil supports this contention. Absence of organic compounds in groundwater adjacent to and downgradient from the landfill suggest that organic compounds detected in soil have not impacted groundwater quality. Several inorganic analytes, including barium and zinc, were detected in test pit soils above the calculated background concentrations for Fort Devens soils.

Predesign activities at AOC 9 included excavation of four test trenches in 1994. Because three test pits were excavated in the main portion of the landfill in 1992, this predesign activity focused on verifying the extent of debris identified by a previous geophysical survey and determining the composition of waste in the southernmost part of the landfill. A cross section depicting subsurface information from test trenching is shown in Figure 2-6.

Test trench 09E-94-05X was excavated across the gravel access road on the south end of the landfill. A layer (1 to 4 ft in depth) of clean fill was exposed above a layer of concentrated lumber, concrete, sheet metal, structural steel, pipes, asphalt pavement, and insulation. The layer was observed to have been burned. The test trenches were excavated no deeper than the water table, which was encountered approximately 6 ft bgs in 09E-94-05X. The bottom of the debris layer is below the water table.

Test trench 09E-94-06X was excavated in the southernmost portion of the landfill. Sheet metal, pipe, steel cable, bricks, a section of a brick chimney, and a 4 ft x 4 ft x 2 ft block of formed concrete were primarily located in the top 1 foot of soil. This layer consists of organic-rich sand and roots of alder, poplar, and birch trees. Natural soil, (gravelly sand to silty fine sand) was observed below 1 foot. The water table is approximately 5 ft bgs at this location. Material in test trench 09E-94-07X is similar to that observed in 09E-94-06X, but the fill layer is approximately 2.5-ft thick. The water table was encountered at approximately 6 ft bgs at this location.

Test trench 09E-94-08X intercepted a gravelly sand fill berm along the roadside. Beneath and east of the berm, debris similar to that described in the other trenches was encountered in a layer 2.5- to 5-ft thick. The water table was approximately 7 ft bgs at this location.

SEA Consultants (SEA), under contract with MGLB, excavated 22 test pits at AOC 9 in 1996 (SEA, 1996). Waste depths observed in those explorations augmented information from the 1992 and 1994 test excavations. The type of waste observed by SEA was generally demolition debris (i.e., wood, concrete, asphalt, metal, brick, plastic, glass, and stumps). The combined information was used to calculate debris volume at AOC 9, by multiplying the waste areas (from the geophysical survey) by the average depth of waste (as interpreted from test trenches. The volume of waste is estimated at 112,000 cy (see Appendix B).

A vegetated wetland area lies to the south of AOC 9. Although much of this wetland is subject to both state and federal jurisdiction, a small region of wetlands in the eastern portion of the site contains wetlands that are subject to state, but not federal, jurisdiction.

2.3 AREA OF CONTAMINATION 11 (GROUP 9)

The Lovell Road Debris Disposal Area (Landfill No. 7), also referred to as AOC 11, was identified as a 2-acre landfill that received wood-frame hospital demolition debris from 1975 to 1980. The landfill is within a wetlands complex that runs along the western side of the Nashua River. East of the landfill, a 40-ft-wide soil berm separates the landfill from the Nashua River. Refuse, including large pieces of metal, wood, bricks, and other construction debris is exposed at the ground surface throughout the site, except where an access road has been constructed over the fill. The landfill area is vegetated and is bordered on the north and south by wetlands. Site features are shown on Figure 2-7. Cross sections depicting subsurface information from test trenches are shown in Figures 2-8 and 2-9.

Nature and Extent of Contamination. Initial SI activities at AOC 11 were conducted in 1993 as part of the Main Post SI (Arthur D. Little, 1994). The SI consisted of geophysics to determine the extent of waste, sampling and analysis of soil in test pits excavated in the landfill area, and sampling and analysis of surface water and sediment samples from the Nashua River and wetlands areas adjacent to the landfill. Metal, wood, and plastic debris was observed in the test pits. Test pit soils contained acrylonitrile, PAH compounds, pesticides, and several inorganic analytes. Metals, SVOCs, pesticides, and TPHC were detected in surface water and sediments in the wetlands. Contaminant concentrations in wetland sediments were not significantly higher than concentrations in the Nashua River. Most contaminant concentrations, with the exception of iron, in the river near AOC 11 were not significantly elevated in comparison with other sample locations upstream and downstream of AOC 11.

Because contaminants were detected in soils, surface water, and sediment during the SI, further investigation was recommended and an RI was conducted at AOC 11 from September to December 1994 (Arthur D. Little, 1995). The RI field work included excavation of additional test pits and sampling of subsurface soil, surface soil sampling, ambient air sampling, surface water and sediment sampling, monitoring well installation, and groundwater sampling. Piezometers and surface water gauges were also installed to evaluate the hydraulic connection between wetlands, groundwater, and the Nashua River.

Test pits excavated during the RI indicated that debris was present over a 2.1-acre area, to depths ranging from 2 to 13.5 ft. In test pits where the water table was encountered, refuse extended an average of 2 ft below the water table (see Figures 2-8 and 2-9). The volume of waste was estimated to be approximately 35,000 cy (see Appendix B). Refuse observed in the test pits included wood, concrete, metal pipes, scrap metal, wire, tile, and glass, intermixed with sand.

The RI analytical results indicated that surface and subsurface soils within the landfill area contain pesticides, metals including cadmium, copper, and mercury, and PAHs. The wetlands adjacent to AOC 11 contain pesticides, metals, PAHs, and polychlorinated biphenyls (PCBs), where concentrations are similar to or lower than concentrations of these contaminants in the reference wetland upstream of AOC 11. Surface water data did not indicate that contaminants are migrating beyond the wetlands. Groundwater sample results indicated that low levels of some metals are being transported from the landfill to the Nashua River via groundwater flow.

2.4 Study Area 12 (Group 7)

The Range Control Landfill (Landfill No. 8), also referred to as SA 12, was used by the Army beginning in 1960, was still in use in 1982, and appeared in 1988 to have been inactive for several years (McMaster et al., 1982; Biang et al., 1992). The debris came from construction and range operations. The landfill is about 0.5 acre in size, located on a steep, wooded slope adjacent to the Nashua River floodplain and partially encroaching on associated wetlands on the South Post of Fort Devens. The landfill is located across Dixie Road from B and P Ranges.

The top of the slope is covered with dense brush. The north and south sides of the landfill are bounded (and defined) by dense growth of large (60-ft high, 20-inch diameter) oak trees. A wetland is located at the base of the slope on the east side. Site features are shown on Figure 2-10. A representative cross section based on test trench data is shown on Figure 2-11.

Nature and Extent of Contamination. Initial SI activities at SA 12 were conducted in August 1992 as part of the Group 7 field activities (ABB-ES, 1995d). The SI consisted of sampling and analysis of groundwater from a monitoring well installed upgradient of the landfill, sampling and analysis of four surface soil samples from the landfill cover material, sampling and analysis of four groundwater and sediment sample pairs from shallow sumps dug in the floodplain near the base of the landfill, and sampling and analysis of four surface water and sediment sample pairs (two from the backwater lagoon and two from the Nashua River). Samples collected from the cover soil contained low concentrations of pesticide and PCB compounds, and several inorganic analytes were detected above Fort Devens background values. Pesticides, PCBs, PAHs, TPHC, and several inorganics were detected in sediments in the backwater area at the base of the slope.

Potential human health and ecological risks were identified during the SI based on the concentrations of organic and inorganic analytes in surface water and sediment at SA 12 (ABB-ES, 1994a). In order to better identify the sources and the fate and transport mechanisms for site contaminants, Supplemental SI field activities were implemented. The

Supplemental SI focused on sampling surface water and sediment in the backwater area adjacent to SA 12 to further define contaminant distribution and to provide a partial basis for distinguishing SA-derived contamination from Nashua River-derived contamination, particularly in the SA 12 backwater. Reference backwater sampling locations were also selected at upriver and downriver locations to determine if similar contaminant profiles exist in the surface water and sediment of comparable floodplain environments remote from SA 12 (i.e., to identify the contribution of Nashua River contamination in the SA 12 backwater). Results of this investigation concluded that similar contaminants were present in the backwater areas upstream and downstream of SA 12, and a comparison of arsenic, copper, and lead concentrations in sediment in the area immediately downgradient of the landfill suggested that contamination in the backwater may have resulted from seasonal flooding of the Nashua River rather than from the landfill.

Predesign activities at SA 12 included excavation of five test trenches to define the western extent and depth of landfilled material and to determine the composition of the waste. A representative cross section based on test trench data is shown in Figure 2-11. Gravelly sand with debris such as lumber, sheet metal, concrete, and other construction materials, was encountered in the top layer of each test trench. A 6- to 12-inch layer of leaves, wood, and wood ash mixed with soil was observed beneath the top layer in test trenches 12E-94-02X through 12E-94-04X. Beneath this layer, dense, silty sand was observed. While some debris was observed in the silty sand layer in trench 12E-94-03X, this layer is not believed to contain significant landfilled material. Samples were not collected for chemical analysis. The volume of waste was estimated to be approximately 8,700 cy, based on the area and estimated average depth of 12 ft (see Appendix B).

Due to the past use of the site as the Range Control Landfill, unexploded ordnance (UXO) clearance specialists were subcontracted to excavate and monitor the trenches. No live ordnance or explosive materials were encountered. ABB-ES personnel also characterized the site to determine the wetland limits under state or federal jurisdiction.

The topography at SA 12 is distinct and the wetland boundary abrupt. The borders of the wetlands under federal and state regulations are not differentiated; therefore, a joint state/federal wetland boundary line is delineated at this study area.

2.5 STUDY AREA 13 (GROUP 2)

The Lake George Street Landfill (Landfill No. 9), also referred to as SA 13, was used between 1965 and 1970 for disposal of construction debris, stumps, and brush (McMaster et al., 1982; Biang et al., 1992). Landfill No. 9 was "reported to contain some oil (unknown quantity)" (McMaster et al., 1982, Table 2.2-3). Debris appears to have been dumped and pushed over the slope. The landfill is less than 1 acre in size and is located on the west side of Lake George Street near Hattonsville Road on the Main Post.

Unauthorized dumping appears to have continued after the dump was closed. In 1989, the Fort Devens Environmental Management Office observed and recommended the removal of recently disposed stumps, branches, steel fencing, plumbing fixtures and pipes. The landfill is currently closed to waste disposal.

SA 13 is surrounded by large trees (e.g., oak, red maple, ash, hickory), but no trees are growing on the landfill itself. Tree stumps, limbs, and trunks have been deposited on the surface of the landfill and down the steep lower slope. A wetland is located at the base of this slope. Site features are shown on Figure 2-12. Cross sections depicting subsurface information learned from test trenches are shown on Figures 2-13 and 2-14.

Nature and Extent of Contamination. The initial SI activities were conducted in July 1992 as part of the Group 2 field activities (ABB-ES, 1995). The investigation at SA 13 was designed to determine whether the waste material in the landfill, and past waste disposal practices, were adversely impacting environmental media at this SA. The program consisted of the collection of surface water and sediment samples, surface soil samples, subsurface soil samples, and installation and sampling of an upgradient groundwater monitoring well. Nitroglycerin, lead, and mercury were detected at elevated concentrations in surface water samples, while TPHC, PAHs, pesticides, and inorganics were detected at elevated concentrations in sediment. Pesticides, PCBs, PAHs, TPHC, and several inorganics were detected in cover soils. Pesticides and inorganic analytes were detected in subsurface soils. Elevated inorganic concentrations were detected in the upgradient well and in groundwater collected from the downgradient sumps.

The SI concluded that a supplemental investigation was warranted at SA 13. A Supplemental SI (ABB-ES, 1994a) was conducted to determine whether downgradient groundwater and soil quality was being impacted by potential contaminants emanating from the waste material. The results of the water samples collected from the sump during the SI were deemed unrepresentative of shallow groundwater conditions. Therefore, two shallow well points were installed in the wet area downgradient of the waste material and samples of the shallow groundwater were collected and analyzed. In addition, one subsurface soil sample from each of the well point borings was also collected and submitted for laboratory analysis. Results of downgradient soil and groundwater sampling did not indicate that the contaminants detected in the surface soil samples collected during the SI have migrated to the soil at the base of the waste material or groundwater downgradient of the site.

Predesign activities at this site included excavation of six test trenches to define the extent and depth of landfilled material and to determine the composition of the waste. Cross sections depicting subsurface information learned from test trenching are shown in Figures 2-13 and 2-14. Trenches 13E-94-01X and 13E-94-02X were excavated on a mound of soil originally thought to be part of the landfill. The soil encountered in these trenches was loose, distinctly stratified sand and gravel typical of river or deltaic deposits. There was no evidence of debris in either trench. Trenches 13E-94-03X through 13E-94-06X contained demolition debris, including lumber, asphalt, bricks, concrete, air ducts, cable, angle iron, and sheet metal. The top 2 ft of test trench 13E-94-03X were observed to consist of organic-rich gravelly sand fill containing limited debris. Below the fill layer, a 2-ft layer of charred and burned lumber was observed, tapering off to the northeast. Bouldery sand containing concentrated debris was observed beneath the burned wood. Undisturbed soil was encountered approximately 8 ft bgs at the northeast end of the trench, but the bottom of the landfill was not reached on the southwest side. Test trenches 13E-94-04X and 13E-94-05X were excavated to define the west side of the landfill. Trench 13E-94-04X exposed gravelly sand mixed and interlayered with lumber, slabs of concrete, electric cable, sheet metal, and pipes. No evidence of burning was apparent. The base of the debris unit contained concentrated roots, suggesting in-situ pre-landfill ground surface, now buried. On the west side of the landfill, outside the limit of debris, yellow till, similar to the undisturbed soil encountered at the bottom of 13E-94-03X, was observed. The waste within trench 13E-94-05X was similar to

13E-94-04X, but included a layer of burned wood similar to that found in 13E-94-03X. On the east side of trenches 13E-94-04X and 13E-94-05X, debris extended below the bottom of the 10- to 12-ft deep trenches. Trench 13E-94-06X, on the east side of the landfill, contained similar layers of fill and debris as 13E-94-03X and 13E-94-05X. The bottom of the landfill was encountered from 4 to 10 ft bgs. A water tank was discovered approximately 7 ft bgs in this trench, and was removed. Groundwater was not encountered in the trenches.

The water table was not encountered in test trenches at SA 13. Samples were not collected for chemical analysis. The volume of waste was calculated electronically at SA 13 by comparing pre-landfill and current topography. The volume was estimated at 10,000 cy (see Appendix B).

ABB-ES personnel also characterized the site to determine the wetland limits under state or federal jurisdiction. A joint state/federal vegetated wetland lies north of an access road adjacent to the SA 13 landfill. In most areas, a steep bank slopes down to the wetland area. A small island of upland is located within the wetland. In addition, an intermittent drainage ditch runs perpendicular to the wetland boundary; because no Bordering Vegetated Wetland is associated with this intermittent stream, it is not considered a state jurisdictional wetland.

2.6 AREA OF CONTAMINATION 40 (GROUP 1A)

Cold Spring Brook Landfill occupies approximately four acres along the edge of Patton Road in the southeastern part of the Main Post. It extends for approximately 800 ft along Patton Road and out into the former wetland along Cold Spring Brook, now mostly submerged beneath Cold Spring Brook Pond (Figure 2-15). The upper surface of the landfill slopes gently toward the north and east and varies in elevation from about 250 to 260 ft above sea level (ASL). The surface is densely covered with small trees and scrub, the trees being predominantly pines. The edge of the landfill falls off abruptly to the wetland or to the pond with an elevation drop that ranges between 10 and 20 ft. Based on visual observations at the edge of the landfill, the bottom of debris is estimated by ABB-ES to extend to approximately 237 ft ASL.

SEA excavated eight test pits at AOC 40 in 1996 (SEA, 1996). The types of wastes observed by SEA were generally demolition debris and solid waste (i.e., wood, concrete, asphalt, metal, brick, wire, ash, stumps, and logs). Debris volume is estimated at 110,000 cy (see Appendix B). Cross sections showing estimated debris disposal depths are shown in Figures 2-16 and 2-17.

Aerial photographs showed that Patton Road formerly curved around the Cold Spring Brook wetland before realignment during the mid-to-late 1960s (Detrick, 1991, Figures 21, 22, and 23). Deposition of material at the landfill coincided with the realignment of Patton Road and apparently began very close to the edge of Patton Road. Based on terrain conductivity and magnetic survey data collected during the RI (E&E, 1993), Patton Road was interpreted to have been built on clean borrow material, and the landfill interpreted to extend north from the road embankment.

The elevation of the landfill along its southern edge is essentially the same as that of Patton Road. No roadside drainage ditch exists, and the existing surface of the landfill slopes down to the north toward the pond and toward the east at a rate of approximately 2 percent. Remnants of the old roadbed are still visible between well CSB-3 and Patton Road. South of the old roadbed is a flat area with little vegetation, that appears to have been excavated for gravel and sand. Beyond the apparent excavation area, a low hill covered with trees rises abruptly to about 350 ft ASL. Previous studies do not identify landfilling in this area.

Cold Spring Brook Landfill, considered abandoned, was identified in November 1987 when 14 55-gallon drums were discovered along the edge of Cold Spring Brook Pond. An identification number on the drums indicated that the original contents of several drums had been antifreeze manufactured by Union Carbide and that the drums were 15 to 20 years old. Apparently, the drums had been painted yellow and reused. A response team from a Union Carbide facility in New Hampshire examined the drums in March 1988, identified seven Union Carbide drums, and sampled their contents. Analysis revealed the presence of chlorinated solvents and some metals. Other wastes at the landfill included concrete slabs, wire, storage tanks, rebar, timber, and debris. No landfill hot spots or suspect hazardous waste disposal areas were identified during RI or Supplemental RI activities.

The 3.5-acre Cold Spring Brook Pond was created between 1965 and 1972 by the raised inlet of the Patton Road culvert, as shown in aerial photographs from that period. The pond has a surface elevation of approximately 240 ft ASL, and depth that ranges from 1 foot or less at its western end to a maximum of approximately 6 ft near its eastern end.

Patton Well, a water supply well for Devens, is located south of Patton Road, about 600 feet west of the landfill. Patton Well is screened from 46 to 76 ft bgs and appears to tap the same aquifer as that monitored by several landfill wells. Patton Well operates on an on-demand basis at approximately 800 gallons per minute (gpm). An ammunition storage facility lies west of the pond, and Cold Spring Brook originates as drainage from a wetland in the center of this area. The brook drains north to Grove Pond, passing through several palustrine forested or scrub/shrub wetlands before reaching the pond.

The U.S. Army Environmental Hygiene Agency (USAEHA) completed a hydrological investigation of Cold Spring Brook Landfill in 1988. The investigation showed that the landfill is located over glacial sand and gravel deposits in, or adjacent to, a former wetland. U.S. Geological Survey (USGS) information indicates the area is underlain by swampy deposits of muck and peat, with adjacent units of sand and gravel from kame deposits.

Eight wetland vegetative cover types were identified in the vicinity of Cold Spring Brook Landfill during the RI through the completion of New England Division Army Corps of Engineers (USACE) Wetland Delineation Data Forms (E&E, 1993). Each wetland cover type meets the three criteria (i.e., hydrophytic vegetation, hydric soils, and wetland hydrology) necessary to be classified as jurisdictional wetland. Interpreted wetlands delineation is shown on Figure 2-18. No 100-year flood plain is located in the vicinity of Cold Spring Brook Landfill.

<u>Nature and Extent of Contamination</u>. Three samples were collected from landfill cover materials during the RI in 1991 and analyzed for Target Compound List (TCL) organics and Target Analyte List (TAL) metals. PAHs (up to 2.6 micrograms per gram [μg/g]),

and the pesticide residues 2,2-bis(para-chlorophenyl)-1,1-dichloroethane (DDD) (up to 0.10 μg/g) and 2,2-bis(para-chlorophenyl)-1,1,1-trichloroethane (DDT) (up to 0.23 μg/g), were identified as cover soil contaminants. In addition, a number of inorganics were reported above background concentrations and considered contaminants (E&E, 1993). Cover soil was not sampled during the supplemental RI in 1992 (ABB-ES, 1993b).

Groundwater quality was characterized through two rounds of sampling at seven monitoring wells during the RI, and two confirming rounds at 10 wells during the supplemental RI.

The explosives 1,3,5-trinitrobenzene and 1,3-dinitrobenzene, detected in well CSB-1 at 7.94 micrograms per liter (μg/L) and 2.86 μg/L, respectively, were the only interpreted organic contaminants in groundwater in the RI Report. Inorganics were interpreted as contaminants in several wells, including upgradient/background wells (E&E, 1993).

Investigations during the Supplemental RI allowed refinement of the hydrogeologic model for Cold Spring Brook Landfill and of the contamination assessment. The RI Addendum Report concluded that monitoring wells CSB-3 and CSB-8 were upgradient of the landfill and CSB-1, CSB-6, and CSB-7 were cross-gradient of the landfill. Wells CSM-92-02A and CSM-92-02B, screened at and below the water table, respectively, were interpreted to be slightly cross-gradient of groundwater flow at the western end of Cold Spring Brook Landfill while monitoring wells CSB-2 and CSM-93-01A were interpreted as being downgradient. Although located close to the upgradient edge of the landfill, the boring log indicates that well CSB-8 is not constructed in landfill materials. Wells CSB-4 and CSB-5 are located in a peat formation considered unrepresentative of a productive aquifer and were not used during the contamination assessment.

Resurvey of Cold Spring Brook Landfill monitoring wells in March 1995 revealed several errors in previous survey data that affected the previous interpretation of groundwater flow. Specifically, the updated indicate that groundwater does not flow from Cold Spring Brook Landfill toward Patton Well under non-pumping conditions, or during pumping conditions of upto about 250,000 gallons per day.

The only Project Analyte List (PAL) organic detected in groundwater at Cold Spring Brook Landfill during supplemental RI sampling was bis(2-ethylhexyl)phthalate (BEHP), in the Round 1 sample from well CSM-93-02B at 14 μg/L. BEHP was undetected (i.e., <4.5 μg/L) in the three primary Round 2 samples, but was reported at 4.4 μg/L in the duplicate sample from well CSM-93-02B. The explosives 1,3,5-trinitrobenzene and 1,3-dinitrobenzene were not detected during Supplemental RI sampling.

Based on the distribution pattern for inorganics in unfiltered samples and comparison of data from filtered and unfiltered samples, the RI Addendum Report concluded that Cold Spring Brook Landfill is not a source of inorganic groundwater contamination.

The characterization of Cold Spring Brook Pond was accomplished during both the RI and Supplemental RI. The RI Report concluded that pond sediments were contaminated with the inorganics arsenic, lead, manganese, mercury, and zinc. Organic contaminants included PAHs (total concentration of 13 PAHs up to 79.6 μg/g), DDD (up to 1.29 μg/g), and 2,2-bis(para-chlorophenyl)-1,1-dichloroethene (DDE) (up to 0.202 μg/g) (E&E, 1993).

The RI Addendum Report concluded that pond sediments were contaminated with several PAHs, inorganics, and the pesticides DDD, DDE, and DDT. PAHs were detected most frequently and at the highest concentrations near the pond outlet. A second area of PAH contamination was also identified at the small cove near CSD-92-09X. Low concentrations of the pesticides DDD, DDE, and DDT were detected throughout the pond. The RI Addendum Report concluded that pond sediments are contaminated with arsenic, manganese, barium, iron, chromium, nickel, zinc, lead, and copper. The Final Feasibility Study Report (ABB-ES, 1994b) identified areas (Areas I and II on Figure 2-15), where sediment would be removed during remedial action.

2.7 Area of Contamination 41 (Group 1B)

Unauthorized Dumping Area (Site A) (AOC 41) is located on the South Post, approximately 0.5 mile west of the Still River Gate, on the north shore of New Cranberry Pond. This 0.14-acre dump was discovered by Fort Devens personnel. No record of its origin or use is known to exist, but it was observed that "...it appears that the site was used up to the 1950s for disposal of nonexplosive military and household debris" (Biang et al., 1992).

Most of the visible debris at the time of the SI consisted of rusted "cone-top" beer cans (e.g., Harvard Ale, Boston Post Beer). Cone-top beer cans were manufactured between 1935 and the mid-1950s. Rusted vehicle fenders appeared by their shape to date approximately from the 1910s or 1920s. No military debris was observed during the SI (ABB-ES, 1995d).

The site is overgrown with trees and brush. Wetlands delineation, documented in Appendix C, was performed by ABB-ES in June 1995. Site features are shown on Figure 2-19. Cross sections depicting subsurface information from test excavations are shown on Figures 2-20 and 2-21.

Nature and Extent of Contamination. The initial SI field activities were conducted by ABB-ES in September 1992 as part of the Group 7 field activities. The objective of the SI was to investigate the presence or absence of environmental contaminants in the different environmental media found at the site, and to assess the vertical and horizontal distribution of the contaminants. Samples of soil and groundwater were collected to characterize local impacts from the dump. Surface water and sediment samples were collected for laboratory analysis to assess potential downgradient impacts from the dump. TPHC, PAHs, pesticides, and inorganic analytes were detected in surface soil samples collected from the landfill. VOCs and inorganics were detected in groundwater samples. Significant contamination was not detected in surface water; however, pesticide compounds and inorganic analytes were detected in sediment samples.

The Supplemental SI was conducted to assess other potential sources of the groundwater contamination detected during the SI, further define the hydrogeologic conditions, and further investigate the potential for contaminant migration from the landfill waste material to New Cranberry Pond. A surficial geophysical survey was conducted in the area directly north of the debris disposal area to locate a source area of the chlorinated solvent contaminants, detected in groundwater during the SI. Based on the results of the surveys, no magnetic or ferrous metal anomalies were detected. These results indicate that there did not appear to be a source area directly north of the waste material.

Three sediment samples were collected from the wet area at the base of the waste material. No surface water samples were collected from these sampling points due to insufficient surface water volumes at the time of sampling. Two surface water and sediment pairs were collected from the northern side of New Cranberry Pond. The surface water samples did not contain elevated levels of contaminants. Notable concentrations of PAHs and lead were detected in sediment samples.

Groundwater samples were collected from the five newly installed monitoring wells and the existing monitoring well in October 1993 and January 1994. VOCs and inorganics were detected in these wells. Because the source of the VOCs in groundwater had not been identified, an RI was conducted at AOC 41 (ABB-ES, 1996c).

The RI program for AOC 41 consisted of geophysical surveys, surficial and down-hole UXO clearance, soil borings, test pits, subsurface soil sampling, monitoring well installation and sampling, aquifer conductivity testing, and a survey of explorations to attempt to locate the source and extent of groundwater contamination at the site. Because groundwater contamination is being addressed as a separate operable unit at AOC 41, only the test pit results from the RI program are discussed in the following paragraphs.

A total of nine test pits (41E-94-01X through 41E-94-09X) was excavated in and around the landfill waste material, geophysical anomalies, and monitoring wells 41M-93-03X and 41M-94-03B. Up to three soil samples were collected from each test pit. Test pits excavated within the landfill area (41E-94-01X through 41E-94-03X) indicated that debris is primarily surficial. Cross sections depicting subsurface information from test pitting are shown in Figures 2-20 and 2-21. Waste material observed in the test pits included cone-top beer cans, glass bottles, and other scattered metal debris (e.g., car parts, water cans). The glass appeared deformed, indicative of burning. Topsoil was observed in the top 1 foot. A sand layer underlain by clay, was encountered from 1 to 7 ft bgs. Groundwater was encountered in one test pit at a depth of approximately 10.5 ft bgs. Groundwater has been observed at 13 ft bgs at the top of the slope and at 4 to 5 ft bgs at the base of the landfill.

Analytical results from the soil samples collected from these test pits indicated that no SVOCs or TPHC were present in these samples. Trichlorofluoromethane was detected consistently at low concentrations, but is not believed to be a site-related contaminant. It was determined that the source of groundwater contamination detected at AOC 41 was not the landfill. A ROD for AOC 41 groundwater (Horne, 1996__) describes the selected remedy (i.e., no formal remedial action). Long-term groundwater monitoring will be conducted as part of the "no action" decision. To facilitate inclusion of AOC 41 into the multi-site ROD, it was transferred to Group 1B from Group 7 prior to ROD preparation.

The inorganic results indicated that several inorganic analytes were detected above the calculated Fort Devens background concentrations. Results of Toxicity Characteristic Leaching Procedure (TCLP) testing indicated that detected concentrations of arsenic and barium in the TCLP extract were below regulatory levels. These results suggest that the waste and underlying soil at AOC 41 are not likely to be classified as hazardous. The volume of waste is estimated to be 1,500 cy (see Appendix B).

3.0 RISK ASSESSMENT SUMMARIES

This section presents the results of human health and ecological risk studies prepared for each of the seven debris areas. The information is summarized from previous SI, Supplemental SI, RI, and FS reports as referenced. The RI reports for AOCs 11 and 40 contain baseline risk assessments that quantify potential risks to human and ecological receptors. The SI reports for AOC 9, SA 12, SA 13, and AOC 41 contain PREs. PREs are qualitative evaluations of potential risk which compare exposure point concentrations to benchmark values. The outcome of a PRE is a statement that benchmarks have been exceeded or not exceeded and that the potential for adverse effects may or may not exist. The exceedance of a benchmark does not mean that adverse effects are a certainty. The probability of adverse effects is interpreted through consideration of several factors including exposure point concentration, exposure frequency, and receptor sensitivity. PREs are often used as conservative screening tools to assess whether more detailed baseline risk assessments are warranted. Table 3-1 presents an interpretation of information contained in this section. It includes the risk evaluation approach for each area of contamination, and the status of anticipated human health and ecological risks for each medium.

3.1 Summary of Human Health Risk Assessments

The following subsections summarize the human health risk evaluation/assessment results for the debris areas.

3.1.1 Study Area 6

Previous investigations at SA 6 consisted of only predesign activities. A PRE or risk assessment was not performed, because SI or RI activities were not conducted at SA 6. However, observations made during predesign activities indicate that SA 6 contains only household debris, primarily metal and glass, dating from the late 1700s to the early 1900s. Military-type waste was not observed. Human health risk evaluations were not performed for SA 6. Due to the relatively small volume, nature, and age of the waste at this site, there is no reason to expect risk to human health at SA 6.

3.1.2 Area of Contamination 9

The human health PRE presented in the SI Report for AOC 9 (ABB-ES, 1996b) evaluated potential human health risks associated with exposure to site contaminants in surface soil, subsurface soil, groundwater, surface water, and sediment. Based on the results, there is no evidence or reason to conclude that landfill wastes at AOC 9 pose a threat to human health.

Citing no evidence or reason to conclude that AOC 9 landfill contents are causing significant environmental contamination or threat to human health and the environment, a No Further Action Decision under CERCLA document (ABB-ES, 1993a) was submitted by the Army to USEPA, Region I. USEPA did not concur with the decision to remove AOC 9 from the CERCLA process, stating the following: "The [Decision Document] indicates that there is hazardous waste contamination due to the landfill that may pose a threat to human health or the environment. In groundwater levels of certain organic and inorganic analytes were detected above MCLs and appear to be outside EPA's acceptable target risk range for unrestricted future use. If, after evaluating alternatives, an institutional and/or engineered alternative is appropriate, it appears the nature of the wastes would require, under CERCLA, that the standards of RCRA Subtitle C would be applicable or relevant and appropriate to the closure of the landfill." As a result of USEPA's non-concurrence, AOC 9 was added by the Army to the group of landfills being considered for remediation in this FS report.

The type of waste observed in past test excavations at AOC 9 was demolition debris (i.e., wood, concrete, asphalt, metal, brick, plastic, glass, and tree stumps). Based on site test excavations and the human health PRE results summarized below, there is no evidence or reason to conclude that landfill wastes at AOC 9 pose a threat to human health.

Surface Soil. Three inorganic compounds (i.e., copper, lead, and nickel) were detected in surface soil at concentrations above base-wide background levels; however, concentrations were well below USEPA Region III residential soil concentrations.

Although arsenic was detected at a concentration above the USEPA Region III residential soil concentration, it did not exceed the base-wide statistical background concentration. Further, the Devens Commerce Commission has determined future land use at AOC 9 will be Environmental Business. Commercial activities such as light industrial business or technology research are planned for the site. No residential use is planned. Therefore, comparison of chemical concentrations in surface soil to values developed as protective of site residents is conservative, and likely overstates risk.

Subsurface Soil. Organic compounds detected in AOC 9 subsurface soil consisted mostly of PAHs. Of the sixteen detected PAHs, the maximum detected concentrations of six exceeded the USEPA Region III commercial/industrial soil concentrations.

Although several inorganic compounds were detected in AOC 9 subsurface soil at concentrations above base-wide statistical background concentrations, only two compounds (i.e., arsenic and beryllium) were present at concentrations above the USEPA Region III commercial/industrial soil concentrations. In the case of arsenic, the maximum detected concentration (i.e., 21 μg/g) is equal to the base-wide statistical background concentration. Although the maximum beryllium concentration (i.e., 1.0 μg/g) exceeded the USEPA Region III commercial/industrial concentration (0.67 μg/g), the exceedance is very slight.

TPH were detected in subsurface soil samples from 4 test-pits; however, there are no applicable federal soil standards for TPH in soil. Comparison of reported concentrations to Massachusetts Contingency Plan (MCP) criteria shows that concentrations in all samples were below S-1/S-2 criteria except the 8-feet bgs sample from test-pit 09E-92-02X. The reported concentration of 5,300 ug/g exceeded the MCP S-2 criteria of 2,500 ug/g for soils at depths of 3 to 15 feet and slightly exceeded the 5,000 ug/g criteria for soils deeper than 15 feet bgs.

Although several exceedances of screening standards were noted, the PRE concluded that the potential for exposure was minimal under reasonable foreseeable site use and that cleanup of subsurface soils was unnecessary.

Groundwater. Two organic analytes, chloroform and TPHC, were detected in AOC 9 monitoring wells. Chloroform was detected once in Round 1 at 0.585 μg/L, a concentration below its Massachusetts drinking water guideline. The SI report for AOC 9 (ABB-ES, 1996b) attributed the chloroform detection to laboratory contamination. TPHC was detected in three out of ten samples, once in Round 1 and twice in Round 2. No federal drinking water standard or guideline exists for TPHC, so concentrations were compared to proposed Massachusetts Contingency Plan (MCP) GW-1 guidance values. The detected concentrations were only slightly greater than the proposed guidance value. Two of the three TPHC detections were in a groundwater monitoring well located upgradient of the landfill boundary.

Inorganic analytes were detected above background in virtually all groundwater samples collected from up-, down-, and cross-gradient AOC 9 monitoring wells. The maximum detected concentrations of eight of the 18 inorganic analytes exceeded their respective drinking water standard or guideline. The eight analytes were aluminum, arsenic, chromium, cobalt, iron, lead, manganese, and nickel.

Filtered samples collected during Round 2 showed significant reductions in the concentrations of these analytes. Therefore, elevated concentrations of inorganics were believed to be the result of suspended materials in the unfiltered groundwater samples. Concentrations of chromium, lead, and nickel, in four out of four filtered samples were below the respective drinking water standard or guideline. Concentrations of aluminum, arsenic, and iron, in three out of four filtered samples were below drinking water standards or guidelines. The standard for arsenic was exceeded in a sample collected upgradient from the landfill boundary. Cobalt was not detected above the detection limit in four out of four filtered samples. For manganese, the concentrations of two out of four filtered samples were below the USEPA secondary MCL for manganese. The Devens Commerce Commission has determined future land use at AOC 9 to be Environmental Business. Commercial activities such as light industrial business or technology research are planned for the site. No residential use is planned. Therefore, comparison of chemical concentrations in groundwater to values protective of site resident ingestion of groundwater is conservative, and likely overstates risk.

Surface Water. Of the eight analytes detected in the surface water in this area, only two (i.e., BEHP and iron) were detected at concentrations above their respective drinking water standards and guidelines. BEHP was detected in one of three samples at a concentration only slightly above the USEPA Region III tap water concentration. Iron was detected in three of three samples at concentrations above the USEPA secondary MCL for iron. The magnitude and frequency of exposure to surface water in this area would be expected to be much less than that upon which the drinking water guidelines are based. The use of drinking water guidelines for comparison to surface water concentrations is a conservative approach and was used due to a lack of available health-based guidelines for exposure to surface water.

Sediment. Of 13 analytes detected in sediments, arsenic is the only one that has concentrations exceeding USEPA Region III residential soil concentrations. The USEPA Region III residential soil concentration is designed to be protective for exposures that could occur 350 days per year for a residential lifetime of 30 years. Arsenic, therefore, is not expected to pose a significant human health risk in the sampled swampy area, because exposure to sediment in this area would be much less than that expected in a residential setting.

3.1.3 Area of Contamination 11

The baseline human health risk assessment (RA) presented in the Draft RI Report for AOC 11 (Arthur D. Little, Inc. [ADL], 1995) evaluated potential human health risks associated with exposure to site contaminants in surface soil, surface water and sediment. Conservative exposure parameters and model inputs were selected for calculation of risk, resulting in conservative estimates of potential site-related risks. The risk assessments conclude that no unacceptable carcinogenic and noncarcinogenic health risks are associated with exposure to surface soil, surface water, and sediment at AOC 11.

Surface Soils. Risks were calculated for recreational exposures to adults and children including incidental ingestion and dermal contact. Cancer risks related to incidental ingestion for the average and maximum exposure scenarios are all equal or below $1x10^{-6}$. No individual contaminants of concern (COCs) contribute greater than $1x10^{-6}$ to the incremental cancer risk from incidental ingestion. For potential dermal exposures, no cancer risks were calculated due to a lack of recommended absorption values or published toxicity values for the COCs. The risk assessment results show no unacceptable carcinogenic health effects are likely to occur from exposure to surface soils at AOC 11.

The noncancer hazard index (HI) for all scenarios is less than 1. The risk assessment results show no unacceptable noncancer health effects are likely to occur from exposure to surface soils at AOC 11.

Surface Water. Risks associated with Nashua River surface water were calculated based on adult and child swimming scenarios (i.e., incidental ingestion and dermal contact). Risks associated with surface water in the Northern and Southern Wetlands were based on adult and child wading scenarios (i.e., dermal contact). Carcinogenic risks for incidental ingestion of Nashua River surface water were below the USEPA's guidance range of $1x10^{-6}$ to $1x10^{-4}$. Noncancer risks for incidental ingestion of Nashua River surface water were also below guidance values.

Total cancer risks associated with dermal contact with Nashua River surface water are below the USEPA guidance for average concentrations, and within the guidance range for maximum concentrations. Only BEHP has an individual cancer risk that exceeds the lower value of the range. The RI report points out, however, that BEHP is a common laboratory contaminant. It is possible that the BEHP reported in AOC 11 samples resulted from laboratory contaminant. Cancer risks are also within the USEPA risk range for dermal contact with surface waters from the Northern and Southern Wetland. In the Northern Wetland, the risk is primarily due to concentrations of DDD, DDT, and arsenic. In the Southern Wetland, DDD and DDT are the primary contributors to risk. The risk assessment results indicate that unacceptable carcinogenic health effects are unlikely to occur from exposure to surface water at AOC 11.

Noncancer risks associated with dermal contact of surface water in all three locations are less than the USEPA guidance value of 1. The risk assessment results indicate that noncancer health effects are unlikely to occur as a result of this surface water exposure level.

Sediment. Risks associated with sediment from the three locations were calculated based on adult and child dermal contact scenarios. Estimated cancer risks for dermal contact with sediment in the Nashua River were equal to the low limit of the guidance range, and no individual COC exceeded this range. The cancer risk was associated with potential exposure to Aroclor 1016, Aroclor 1254, and Aroclor 1260. Because inorganic COCs do not have recommended dermal absorption values or published toxicity values, estimated cancer risks for Northern and Southern Wetland sediments were not calculated.

Noncancer HIs do not exceed 1 for dermal contact with sediment in the Nashua River, Northern Wetland, or Southern Wetland, indicating that noncancer health effects are unlikely to occur when individuals contact these sediments.

3.1.4 Study Area 12

Based on the result of site test excavations and of the human health PRE summarized below, it is concluded that surface water and sediment do not pose unacceptable risk to human health with respect to the site's future land use. Unacceptable risk may be posed by contaminants in stained surface soil locations directly above the landfill wastes if the site were to be developed for residential use. Site groundwater may pose unacceptable risk to human health if it were to be ingested by residents living at the site. However, no plans exist for residential use of the site.

The human health PRE presented in the Revised Final SI Report for SA 12 (ABB-ES, 1995d) evaluated potential human health risks associated with exposure to site contaminants in surface soil, groundwater, and sediment. The Final SI Report for SA 12 (ABB-ES, 1993a) evaluated potential human health risks associated with surface water. The future use of SA 12 was assumed to be residential for purposes of the PRE. However, the Army is retaining the property on Devens' South Post, including SA 12. The Army has no plans to develop residences at SA 12. Therefore, comparison of chemical concentrations in site media to values considered protective of site resident exposure is conservative, and likely overstates risk.

Surface Soil. Surface soils at SA 12 were collected from stained surficial soils and shallow soil depths. The levels of detected organic analytes in surface soil were generally below the USEPA Region III residential soil concentrations. Exceptions are Aroclor 1254 and benzo[b]fluoranthene, which was detected at a concentration of 1 μg/g in one of the nine samples collected. The USEPA Region III residential concentration for benzo[b]fluoranthene is 0.87 μg/g. Aroclor 1254 was detected at a concentration of 6.9 μg/g in one of the nine samples collected. The USEPA Region III residential soil concentration for Aroclor 1254 is 0.0083 μg/g.

Of the eight inorganic analytes detected above the base-wide statistical background concentrations, beryllium and lead were detected at concentrations above their respective health-based soil guideline. Lead (at a maximum concentration of 880 μg/g) was detected at concentrations exceeding the USEPA Superfund lead cleanup level of 500 μg/g; however, this exceedance occurred in only one sampling location. Beryllium concentrations (maximum at 0.74 μg/g) exceeded the USEPA Region III residential soil concentration (i.e., 0.15 μg/g) in three of nine samples. Arsenic was detected at concentrations (maximum at 21 μg/g) above its USEPA Region III residential soil concentration (i.e., 0.36 μg/g). However, the maximum arsenic concentration did not exceed the base-wide statistical background concentration. Based on this screening-level analysis, it appeared that beryllium and lead may pose a potential risk to human health at the reported sampling locations among the area of stained surficial soils, if the site were to be developed for residential use. However, no plans exist for residential use of the site.

Groundwater. Unfiltered groundwater samples from four downgradient sump locations were used to assess the impact of the landfill on groundwater. Of the two organic compounds (i.e., BEHP and chloroform) detected in groundwater associated with SA 12, only BEHP concentrations exceeded a drinking water standard. BEHP was detected in one of six samples at a concentration of 9.1 μg/L slightly above the USEPA Region III tap water concentration of 6.1 μg/L. BEHP therefore was not believed to pose a significant human health risk. The SI report points out that BEHP is a common laboratory contaminant. It is possible that the BEHP reported in SA 12 samples resulted from laboratory contamination.

When comparing inorganic concentrations to the base-wide statistical background concentrations, significant exceedances included: aluminum, arsenic, chromium, copper, iron, lead, manganese, mercury, and zinc. Seven inorganic analytes were detected at concentrations above their drinking water standard/guideline. Aluminum, iron, and manganese were detected in six of six samples collected and each average concentration exceeded its respective USEPA secondary MCL. Beryllium, antimony, and cadmium were detected in one of six samples and the detected concentration of each contaminant exceeded its respective drinking water standard/guideline. In addition, the maximum and average concentrations of lead exceeded the USEPA lead action level.

A filtered sample was collected during Round 2 sampling. A comparison of the filtered and unfiltered samples indicated that high TSS levels were responsible for high levels of some inorganic analytes, such as aluminum, calcium, iron, potassium, magnesium, and manganese. Based on the filtered-sample screening-level analysis, it appears that possibly beryllium and antimony may pose a potential risk to human health at the reported sampling locations, assuming groundwater at the site were to be ingested. Even so, the assessment is inconclusive. Although the filtered concentrations of beryllium and antimony are below detection limits, the detection limits for the two inorganics are above the drinking water standards used in the risk evaluation. In any case, groundwater at the site would not be ingested because the Army is retaining SA 12 and has no plans to use groundwater as a drinking water supply.

Surface Water. One organic compound, BEHP, was detected below its USEPA Region III tap water concentration in surface waters associated with SA 12. BEHP is a common laboratory contaminant, and it is possible that the BEHP reported in SA 12 samples resulted from laboratory contamination. Five inorganic analytes were detected in surface waters at concentrations that exceeded their respective drinking water standard/guideline. The maximum concentration of lead was three times the USEPA lead action level and the average concentration slightly exceeded the action level. Aluminum, iron, and manganese were detected in all samples collected and each exceeded its respective USEPA secondary MCL. The maximum concentration of arsenic exceeded the Massachusetts drinking water guideline; however, the average concentration in the four surface water samples did not.

Use of drinking water guidelines for comparison to chemical concentrations in surface water is a conservative approach and is used due to lack of available health-based guidelines for surface water exposure. SA 12 is being retained by the Army. The magnitude and frequency of exposure to surface water associated with SA 12 is expected to be much less than that upon which drinking water guidelines are based. Because exposure to surface water is anticipated to be restricted to wading, it is not likely an individual would encounter inorganic concentrations that would pose a threat to the individual's health.

Sediment. Several organic analytes were detected in sediment samples, including: pesticide residues, PAHs, PCBs, acetone, and BEHP. Acetone and BEHP are common laboratory contaminants and were not considered to be SA 12-related contaminants. The levels of PAHs detected in the sediment were below MCP S-2/GW-1 soil standards and USEPA Region III residential soil concentrations. Detected concentrations of DDT and its breakdown products were also below Region III residential soil concentrations.

Aroclor 1248 and Aroclor 1260 were the detected PCBs. The maximum detected concentrations of Aroclor 1248 and Aroclor 1260 exceeded the Region III residential soil concentration for PCBs.

Of the inorganic analytes detected in the sediment, antimony, arsenic, cadmium, and lead exceed their respective USEPA Region III residential soil concentration. However, these compounds are not expected to pose a significant health risk in the sampled areas because exposure to sediment in these areas would be much less than that expected in a residential setting. The Army is retaining property in Devens' South Post, including SA 12. The Army has no plans to develop residential housing at the site. Further, the SI report noted similar contaminants were reported in both the Nashua River-fed surface water and the sediment samples collected between the SA 12 landfill and the river. The report linked this sharing with possible contaminant contribution from upriver sources in the Nashua River.

3.1.5 Study Area 13

Based on results of site test excavations and results of the human health PRE summarized below, it is concluded that groundwater, surface water, and sediment do not pose unacceptable risk to human health with respect to future land use at SA 13. Contaminants at a few stained surface soil locations directly above the landfill wastes exceeded residential benchmark concentrations. However, no plans exist for residential use of the site.

The human health PRE presented in the SI Report for SA 13 (ABB-ES, 1995d) evaluated potential human health risks associated with exposure to site contaminants in surface soil, groundwater, surface water, and sediment. The landfill is not currently in use. Future use of SA 13 was assumed to be residential for purposes of the PRE. However, the Devens Commerce Commission has determined that future land use at SA 13 will be Greenway/Innovative Technology. Commercial activities such as technology research or a recreational park are planned for the site. No residential use is planned. Therefore, comparison of chemical concentrations in the various media to values protective of site resident exposure is conservative, and likely overstates risk.

Surface Soil. The levels of detected organic analytes in surface soil are below USEPA Region III residential soil concentrations, with the exception of four PAHs. These four PAHs slightly exceed their respective USEPA Region III residential soil concentrations, and each was detected in only one of four samples collected. Benzo[a]anthracene was detected at a concentration of 3 μg/g; its Region III residential soil concentration is 1.6 μg/g. Benzo[a]pyrene was detected at 2 μg/g; its Region III residential soil concentration is 0.23 μg/g. Benzo[b]fluoranthene was detected at 4 μg/g; its Region III residential soil concentration is 1.9 μg/g. Indeno[1,2,3-c,d]pyrene was detected at 1 μg/g; its Region III residential soil concentration is 0.84 μg/g.

Of the 13 inorganic analytes detected above the base-wide statistical background concentrations, arsenic and beryllium were detected at concentrations above their respective USEPA Region III residential soil concentrations. The maximum detected concentration of arsenic (i.e., 38 μg/g) exceeds the base-wide background concentration of 21 μg/g. The maximum and average concentrations of beryllium, 1.18 μg/g and 0.9 μg/g, respectively, are above the base-wide background concentration of 0.347 μg/g. Elevated concentrations of inorganics were identified in the stained soil directly on top of the landfill.

Groundwater. A comparison of unfiltered groundwater concentrations to the Devens background indicated that the maximum detected concentration of every analyte exceeded background concentrations. Four of these detections were at concentrations above their respective drinking water standard or guideline. Aluminum, manganese, and iron had average concentrations (i.e., 7,118.3, 390, and 11,358.3 μg/L, respectively) that exceeded their respective USEPA secondary MCL (i.e., 50-200, 50, and 300 μg/L, respectively). The maximum detected concentration of lead (i.e., 17.7 μg/L) exceeded the lead action level of 15 μg/L; however, the average concentration (i.e., 8.8 μg/L) did not.

Filtered groundwater samples, in general, showed significantly lower concentrations than unfiltered samples. In the four filtered samples, the concentrations of aluminum, lead, and iron were below detection limits, and the concentration of manganese dropped below the secondary MCL. Based on the filtered sample data, the high inorganic concentrations detected in the unfiltered groundwater samples appear to have been associated with suspended solids in the samples, not landfill contamination. Therefore, groundwater at SA 13 was not believed to pose a risk to human health.

Surface Water. Two organic compounds were detected in the surface waters associated with SA 13, BEHP and nitroglycerine. BEHP, a common laboratory contaminant, was not considered to be a SA-related contaminant. Nitroglycerine was detected in one of four samples at a concentration of 38.5 μg/L. The USEPA Lifetime Health Advisory for nitroglycerine is 5 μg/L.

The concentrations of four inorganic analytes that were detected in the surface water exceed their respective drinking water standard/guideline. Aluminum, iron, and manganese were detected in the four samples collected, and each detection exceeded its respective USEPA secondary MCL. The maximum concentration of lead (i.e. 18.9 μg/L) exceeded the USEPA action level of 15 μg/L.

Use of drinking water guidelines for comparison to chemical concentrations in surface water is a conservative approach and is used due to lack of available health-based guidelines for exposure to surface water. The magnitude and frequency of exposure to surface water associated with SA 13 is expected to be much less than that upon which drinking water guidelines are based. Because exposure to surface waters in the wetlands is anticipated to be restricted to wading in the future, it is not likely an individual would encounter concentrations that would pose a threat to the individual's health.

Sediment. Several organic contaminants were detected in sediment samples collected from the wetland area southwest of SA 13; however, the levels of all detected organics are below USEPA Region III residential soil concentrations. Of the inorganic analytes detected in sediment, arsenic and beryllium at maximum concentrations of 22 μg/g and 2.52 μg/g, respectively, exceed their respective USEPA Region III residential soil concentrations of 0.97 μg/g and 0.4 μg/g, respectively. Concentrations of inorganics in sediment are not expected to pose a significant health risk in the sampled area because based on planned future site use, exposure to sediment would be much less than that expected in a residential setting. The use of residential soil concentrations for comparison to sediment concentrations is a conservative approach used due to a lack of available health-based guidelines.

3.1.6 Area of Contamination 40

A Supplemental Risk Assessment was performed for Cold Spring Brook Landfill and presented in the Final RI Addendum Report (ABB-ES, 1993b) to evaluate potential human health risk associated with exposure to site contaminants in surface soil and groundwater, and sediment.

Fish Sampling Program. Fish tissue analyses obtained through the October 1992 fish sampling program provided measured chemical of potential concern (CPC) concentrations in fish. The health risks faced by a recreational fisherman or family member who consumes fish from Cold Spring Brook Pond fell within the USEPA target risk range. The maximum detected concentrations of mercury, DDE, and DDD in the fish at Cold Spring Brook Pond were also below their respective U.S. Food and Drug Administration action levels.

Surface Soil. The health risks associated with contact with surface soil at Cold Spring Brook Landfill are below the USEPA cancer risk guidance value of $1x10^{-6}$ and target HI of 1. Under current land use conditions, an adult and child are assumed to be exposed to soil by dermal contact and incidental ingestion five days per year for 30 and 5 years, respectively. The health risks associated with surface soil exposure under future assumed residential conditions (350 days/year) are within the USEPA carcinogenic guidance range of $1x10^{-6}$ to $1x10^{-4}$, and below the noncancer HI of 1.

Groundwater. Based on the groundwater sampling data from the March and June 1993 sampling rounds, cancer risks associated with future residential use of the unfiltered groundwater exceeded the USEPA points of departure and USEPA target risk range. Arsenic accounted for approximately 99 percent of the total risk. The cancer slope factor for inorganic arsenic is thought by many to overestimate the true cancer risk by as much as an order of magnitude relative to risk estimates associated with most other carcinogens. Two additional analytes, BEHP and manganese, presented risks above the points of departure. The hazard quotients (HQs) for manganese ranged from 16 to 37. BEHP presented cancer risks slightly above the point of departure (at $6.5x10^{-6}$). BEHP is a common laboratory contaminant and it is possible that the BEHP reported in AOC 40 samples resulted from laboratory contamination.

Although these risks are above USEPA guidance values, they were estimated based on residential exposure to groundwater under future land use conditions. However, the Devens Commerce Commission has determined future land use at AOC 40 will be Greenway/Innovative Technology. Commercial activities such as technology research or a recreational park are possible; no residential use is planned. Therefore, comparison of chemical concentrations in the various media to values protective of site resident exposure is conservative, and likely overstates risk. Because there is no residential groundwater exposure under current land use conditions there is no associated carcinogenic risk. In addition, the noncancer risks associated with manganese in drinking water may be overestimated due to the uncertainty and limitations of the one epidemiological study upon which the reference dose (RfD) for manganese is based.

In comparing the March and June 1993 sampling results to drinking water standards, the maximum detected concentrations from the March and June 1993 sampling rounds of aluminum, iron, and manganese exceeded their Secondary MCLs. The federal and state guidelines for sodium in drinking water were also exceeded. The primary MCL for BEHP of 6 μg/L was exceeded only by its maximum detected concentration of 14 μg/L; the average concentration of 4 μg/L was below the MCL.

Surface Water. During the RI, risks were calculated based on the scenario of incidental ingestion of surface water while fishing in Cold Spring Brook Pond. This exposure route did not present health risks above the Superfund points of departure. Although not evaluated as a potential exposure pathway in the risk assessment, the health risks from contact with the pond surface water while swimming were expected to be low. A comparison of the average and maximum concentrations of analytes in surface water to drinking water standards and guidelines showed the detected concentrations of all compounds except iron and manganese to be below standards. Because iron has a relatively low toxicity for humans, and the average concentration of manganese is below its Maximum Contaminant Level Goal, health risks are expected to be low.

Sediment. In the Supplemental Risk Assessment, direct contact with sediment presented cancer risks within the USEPA target risk range of 1×10^{-6} to 1×10^{-4} for both current and future land use conditions.

The health risks from lead in Cold Spring Brook Pond sediment could not be estimated quantitatively; however, the concentrations of lead in sediment were evaluated using the USEPA interim soil cleanup level for lead in residential settings of 500 µg/g. Although the maximum detected concentration of lead in Cold Spring Brook Pond sediment was above the soil lead cleanup level, the average concentration was below the soil lead cleanup level. Exposure to lead in sediment was also predicted to be much less than in a residential setting. Therefore, lead in sediment was not predicted to pose a significant health risk.

3.1.7 Area of Contamination 41

Based on the result of site test excavations and of the human health PRE summarized below, it is concluded that surface water and sediment do not pose unacceptable risk to human health with respect to future land use at AOC 41. Contaminants in surface soil locations directly above landfill wastes and between the waste area and New Cranberry Pond exceeded residential benchmark concentrations. However, no plans exist for residential use of the site.

The human health PRE presented in the SI Report for AOC 41 (ABB-ES, 1995d) evaluated potential human health risks associated with exposure to site contaminants in surface soil, groundwater, surface water, and sediment. Subsequent to the SI and Supplemental SI, investigation of groundwater contamination at AOC 41 was conducted under a separate operable unit from that of the other media. The recently completed RI for AOC 41 (ABB-ES, 1996c) focused on the groundwater operable unit only; however, test pits were completed in the waste material to determine whether the waste is a source of groundwater contamination. Data from collected soil samples indicated that the waste material is not the source of groundwater contamination. Because groundwater contamination is being addressed as a separate operable unit and is not related to debris at this AOC, only the potential human health risks associated with exposure to site contaminants in surface soil, surface water, and sediment are summarized in this subsection. For purposes of the PRE, it was assumed that future use of AOC 41 would be residential. The Army is retaining property on Devens' South Post including AOC 41. The Army has no plans to develop residences at AOC 41. Therefore, comparison of chemical concentrations in site media to values considered protective of site resident exposure is conservative, and likely overstates risk.

Surface Soil. Surface soil samples at AOC 41 were collected from areas of stained soils and from shallow soil depths. The levels of detected organic analytes in surface soil were below the USEPA Region III residential soil concentrations, with the exception of benzo[a]pyrene, benzo[a]anthracene, benzo[b]fluoranthene and indeno[1,2,3-c,d]pyrene. The maximum detected concentration of benzo[a]pyrene (2.0 µg/g) exceeds the USEPA Region III residential soil concentration of 0.23 µg/g. Benzo[a]pyrene was detected in only two of ten samples collected. Indono[1.2.3-c,d]pyrene was detected in only one of ten samples at a concentration of 1 µg/g, exceeding the USEPA Region III residential soil concentration of 0.84 µg/g. While the maximum detected concentrations of benzo(a)anthracene (2 µg/g) and benzo[b]fluoranthene (2 µg/g) slightly exceed their USEPA Region III residential soil concentrations of 1.6 µg/g and 1.9 µg/g respectively, their average concentrations do not.

Inorganic contamination exists in AOC 41 surface soil, particularly in the stained soils directly on top of the waste material. Of the twelve inorganic analytes detected above established background concentrations, two analytes were detected at concentrations above their respective health-based soil guideline. Beryllium was detected (maximum: 2.2 μg/g) above USEPA Region III's residential soil concentration of 0.4 μg/g. The USEPA Superfund lead cleanup level of 500 μg/g was exceeded (maximum detection: 1,400 μg/g) at two of ten sampling locations. Arsenic was detected at concentrations above the USEPA Region III residential soil concentration of 0.36 μg/g. Arsenic was detected (maximum detection: 14.0 μg/g) above the residential soil concentration, but the maximum detected concentration did not exceed the established background concentration for arsenic of 21 μg/g. Based on this screening-level analysis, beryllium and lead at the reported sampling locations may pose a potential risk to human health if the site were to be developed for residential use. However, no plans exist for residential use of the site.

During the Supplemental SI, three surface soil samples were collected from the low area at the base of the waste material. Several PAHs, acetone, di-n-butylphthalate, and Aroclor 1260 were detected in the samples. Five of the PAHs, each detected in only one of four samples, exceeded either the USEPA Region III residential soil concentrations and/or the MCP S-2/GW-1 soil standard. Aroclor 1260 was detected in all four samples at concentrations above the residential soil concentration but below the MCP S-2/GS-1 soil standard. Arsenic was the only inorganic detected above health screening guidelines; however, the concentration is below the basewide background level of 21 μg/g. Based on these comparisons, PAHs present a potential risk under a residential setting. However, no plans exist for residential use of the site.

Surface Water. Two organic compounds, toluene and dichloroethane (DCA) were detected in surface waters associated with AOC 41. The maximum concentrations of both were below their respective primary drinking water MCLs.

The concentrations of four inorganic analytes that were detected in the surface water exceed their respective drinking water standard/guideline. The average concentration of lead (i.e., 21.7 μg/L) detected in New Cranberry Pond exceeds the USEPA lead action level of 15 μg/L. Aluminum, iron, and manganese were detected (maximum concentrations of 8,100, 16,400, and 976 μg/L, respectively) in all samples collected and each exceeded its respective USEPA secondary MCL (i.e., 50-200, 300, and 50 μg/L, respectively). The use of drinking water guidelines for comparison to surface water concentrations is a conservative approach and was used due to a lack of available health-based guidelines for exposure to surface water. Because exposure to surface water was expected to be restricted, it is unlikely that contaminants would pose a significant threat to public health.

Sediment. Several organic analytes were detected in sediment samples: pesticide residues, acetone, chloroform, and Aroclor 1260. Acetone and chloroform are common laboratory contaminants and were not considered to be site-related. The levels of all pesticide residues detected in sediment were below the USEPA Region III residential soil concentrations and MCP S-2/GW-1 soil standards. The concentration of Aroclor 1260 (i.e., 0.316 μg/g) exceeded the Region III residential soil concentration of 0.083 μg/g, but not the MCP S-2/GW-1 soil standard.

Of the inorganic analytes detected in sediment, arsenic (maximum detection of 13.5 μg/g) exceeded its USEPA Region III residential soil concentration (i.e., 0.36 μg/g) but not the MCP S-2/GW-1 soil standard. Concentrations of contaminants detected in sediment are not expected to pose a significant health risk in the sampled area because exposure to sediment in this area would be much less than expected in a residential setting.

3.2 Summary of Ecological Evaluations and Risk Assessments

The following subsections discuss the ecological risk evaluation/assessment results for the debris areas. The ecological PREs contained in the SI reports for AOC 9, SA 12, SA 13, and AOC 41 are summarized, as are the ecological risk assessment contained in the RI reports for AOC 11 and AOC 40, to provide a broad overview of potential ecological risks associated with the debris areas.

3.2.1 Study Area 6

As discussed in Subsection 3.1.1, the risk to potential human receptors at SA 6 are expected to be minimal because of the relatively small volume and nature of the waste at this site. The same conclusion can be applied to potential ecological receptors.

3.2.2 Area of Contamination 9

The ecological PRE presented in the SI Report for AOC 9 (ABB-ES, 1996a) evaluated potential ecological risks associated with exposure to site contaminants in surface soil, surface water, and sediment.

Surface Soil. The inorganic analytes copper, lead, and nickel were detected above background in two surface soil samples taken from test pits on the AOC 9 landfill. A screening-level evaluation of the potential effects from surface soil exposure was conducted by comparing the maximum concentrations of these contaminants to their respective protective contaminant levels (PCLs). The maximum concentrations of copper and nickel were less than their respective PCLs, and the maximum concentration of lead was greater than the PCL, which was established to be the background concentration.

Although lead exceeded the PCL, it was not considered to pose ecological risks to terrestrial receptors at the site for several reasons: (1) the maximum lead concentration is less than twice the background value; (2) areas of unvegetated terrestrial habitat, that are unsuitable for foraging, exist at the AOC 9 landfill; and (3) PCLs derived for other receptors are at least an order of magnitude above the detected lead concentrations at AOC 9.

Surface Water. Several inorganic compounds were detected and chosen as COCs from three surface water samples taken from wetlands located to the southeast of the AOC 9 landfill. Risks to aquatic receptors in wetlands surface water were evaluated through direct comparison of maximum concentrations to aquatic benchmark values. Concentrations of aluminum, lead, and iron detected above Federal Ambient Water Quality Criteria (AWQC) were most likely reflective of background conditions rather than landfill-related conditions. Concentrations of aluminum and lead, although above the chronic AWQC, were lower than the acute AWQC. In addition, a review of AWQC documents indicated that early life stages of trout are among the most sensitive ecological receptors. Because the site's ecological receptors are likely to be more tolerant of contamination, it is unlikely that the low levels of contamination in surface water will have an adverse effect on receptors.

Sediment. Maximum lead and arsenic concentrations in wetlands sediments exceeded the screening level benchmark toxicity values. The average lead concentration is identical to the New York State Department of Environmental Conservation (NYSDEC) sediment quality guideline and less than the Natural Oceanic and Atmospheric Administration (NOAA) effects range-low (ER-L) value (Long and Morgan, 1990). Therefore, lead is not considered to be causing significant ecological risk at AOC 9. The average arsenic concentration is only slightly greater than the NYSDEC sediment quality guideline and is considerably less than the ER-L of NOAA (Long and Morgan, 1990). Therefore, arsenic is not considered to be causing any significant ecological risk at AOC 9.

3.2.3 Area of Contamination 11

The Ecological Risk Assessment presented in the Draft RI Report for AOC 11 (ADL, 1995) evaluated potential ecological risks associated with exposure to site contaminants in surface soil, surface water, and sediment.

Surface Soils. Exposure risks are expected to be moderate for cadmium and high for lead from dietary exposures in the AOC-11 disposal area. These risks, however, are based on conservative scenarios of restricted foraging entirely within the 2-acre habitat found on the debris disposal area surface, and are therefore, likely overestimated. Maximum debris disposal area soil exposure risks are expected to be low for other COCs, essentially identical to those for the Devens' soil background.

Surface Water. Surface water risks associated with the Northern and Southern wetlands, are elevated due to the presence of metals and pesticides, although the wetlands do not appear to have been functionally impaired and do not exhibit obvious stress symptoms. Surface water risks associated with the Nashua River are insignificant and do not increase adjacent to or downstream of AOC 11.

The results of toxicity tests performed on the downstream wetlands indicated that wetlands surface water samples are not toxic to test organisms. Similar tests revealed the same results in samples collected from the upstream wetlands. These test results failed to indicate any toxicity that is strictly associated with AOC 11 wetland surface waters.

Sediment. Both AOC 11 wetlands exhibit high average and maximum, noncarcinogenic sediment risks for metals and pesticides, with pesticides accounting for most of the risk. However, with the exception of the maximum detected levels of a few COCs, most of the wetland risks do not significantly exceed those observed in the upstream reference wetland located within the same, western floodplain as the AOC 11 wetlands. This information suggests that the contamination is likely reflecting historical and continuing inputs from over-bank flooding by the Nashua River rather than current site conditions. The results of toxicity tests indicate that, in general, the wetlands sediment samples are not toxic to most of the test organisms. The tests fail to indicate any toxicity that was strictly associated with the AOC 11 wetlands.

Most of the aquatic ecological risks in the Nashua River are attributed to sediment contamination with metals and pesticides. Significant incremental risk increases occur in river sediments adjacent to AOC 11 for several metals and pesticides. Since these increases do not appear to be related to current surface water influx of suspended sediments from AOC 11 wetlands to the river, the increase may be due to historical sediment releases from the wetlands during infrequent high-flow events and/or subsurface migration of inorganics via groundwater flow from the AOC 11 refuse area. The occurrences may also reflect local variation in these contaminant concentrations along the entire length of the Nashua River.

The elevated risk levels in the AOC 11 wetlands are not clearly attributed, at least solely, to contaminants derived from AOC 11. Rather, periodic over-bank flooding of the Nashua River appears to have contributed a portion of the metal and pesticide contamination found in both the AOC 11 and upstream wetlands, while the wetlands appear to be retarding contamination influx to the Nashua River. Remedial action within these wetlands could exacerbate existing river contamination by resuspending sediment-sorbed contaminants into the water and releasing them into the river.

3.2.4 Study Area 12

The ecological PRE presented in the Revised Final SI Report for SA 12 (ABB-ES, 1995d) evaluated potential ecological risks associated with exposure to site contaminants in surface soil, and sediment. The Final SI Report for SA 12 (ABB-ES, 1993a) evaluated potential ecological risks associated with surface water.

Surface Soil. The maximum concentrations of barium, lead, zinc, and Aroclor 1254 exceeded their respective surface soil benchmark values used for the screening-level evaluation. The maximum detected concentration of lead was approximately 18 times its benchmark value. Aroclor 1254, detected in only one sample, was approximately twice the benchmark value established for this PCB. The maximum barium and zinc concentrations were approximately 4 and 6 times their respective surface soil benchmark values. This information suggests possible adverse effects to ecological receptors from surface soil contamination in the landfill area.

Surface Water. Risks to aquatic receptors in wetlands surface waters were evaluated through comparison of maximum concentrations to aquatic benchmark values. The maximum concentrations of aluminum, chromium, copper, iron, lead, and zinc in SA 12 floodplain surface water exceeded their respective aquatic benchmark values. Generally the USEPA chronic AWQC was used as the benchmark value. The maximum detected concentration of aluminum was approximately 13 times the chronic AWQC and the maximum detected concentration of iron was approximately 74 times the chronic AWQC. Maximum concentrations of chromium, copper, lead, and zinc were all several times higher than their respective aquatic benchmark values. These values suggest possible adverse effects to ecological receptors from surface water contamination; however, the concentrations of inorganics detected in Nashua River surface waters are most likely representative of background surface water conditions and are not site related.

Sediment. The pesticides DDD and DDE were both detected at concentrations approximately an order of magnitude greater than their total organic carbon (TOC)-normalized benchmark values. Aroclor 1248 and BEHP were detected at maximum concentrations that were approximately twice their respective sediment benchmark values.

The maximum concentrations of 11 inorganic and four organic analytes in floodplain sediments exceeded their respective sediment benchmark values. Antimony, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, silver, and zinc in wetlands sediment were all detected at levels greater than their sediment benchmark values. The maximum detected concentration of arsenic was approximately 15 times its benchmark value, while cadmium was detected at approximately 270 times its benchmark value. The maximum detected concentration of chromium was approximately 13 times its benchmark value and the maximum concentration of copper was approximately 27 times its benchmark value. Lead and mercury were both detected at maximum concentrations approximately 30 times their sediment benchmark values. The maximum concentrations of the inorganic analytes in the Nashua River floodplain sediment may be the most significant contributors to ecological risk in the vicinity of SA 12; however, these concentrations are most likely representative of Nashua River surface water conditions and are not site related.

3.2.5 Study Area 13

The ecological PRE presented in the SI Report for SA 13 (ABB-ES, 1995d) evaluated potential ecological risks associated with exposure to site contaminants in surface soil, surface water, and sediment.

Surface Soil. A screening-level evaluation of potential effects from surface soil exposure was conducted by comparing the maximum concentrations of all CPCs to their respective surface soil benchmark values. No organic analytes at SA 13 were found to exceed their ecological benchmark values; however, the maximum concentrations of arsenic, barium, beryllium, cadmium, lead, and selenium were greater than their respective surface soil benchmarks. The maximum concentrations of arsenic, barium, beryllium, cadmium, and selenium were only slightly higher than their respective benchmark values and therefore were not considered a significant ecological risk.

The maximum lead concentration was approximately 6.5 times greater than the benchmark for lead in surface soils, and the average lead concentration was approximately twice the benchmark value. These concentration of lead may pose a risk to certain ecological receptors.

Surface Water. Risks to aquatic receptors in surface water were evaluated through comparison of maximum concentrations to USEPA chronic AWQC. The maximum concentration of aluminum exceeded the acute and chronic AWQC, while iron and lead exceeded only the chronic AWQC. Because these compounds were present at high levels in background soils and groundwater at Devens, their presence in SA 13 surface water may be reflective of background conditions, and not of landfill impacts. Furthermore, a review of AWQC documents indicated that the ecological receptors upon which the guidance levels are based were among the most sensitive. It is unlikely that the levels of aluminum, iron, and lead in surface water will have an adverse effect on the site's ecological receptors, which are likely to be more tolerant than the risk targeted receptor.

Mercury was detected in one of the three surface water samples in addition to the duplicate sample. The maximum concentration was less than the acute AWQC, but approximately an order of magnitude greater than the chronic AWQC. The presence of mercury in SA 13 surface water may pose a threat to ecological receptors.

Sediment. Risks to ecological receptors from sediments were evaluated through comparison of maximum concentrations to sediment benchmark values. Maximum lead, copper, arsenic, DDE, gamma-chlordane, and heptachlor concentrations exceeded the screening level benchmark toxicity values. The average lead concentration was lower than the NYSDEC sediment quality guideline and the ER-L of NOAA. The average concentrations of arsenic and copper were only slightly greater than the NYSDEC sediment quality guidelines, and were considerably less than their respective NOAA ER-L. Therefore, lead, copper, and arsenic were not considered to be causing significant ecological risk in SA 13 sediments.

The maximum DDE concentration is approximately twice the TOC-normalized USEPA Sediment Quality Criteria (SQC) (USEPA, 1989) and approximately an order of magnitude greater than the NOAA ER-L (Long and Morgan, 1990). Heptachlor and gamma-chlordane are also present at concentrations at least an order of magnitude greater than their respective sediment benchmark values. These compounds may be causing significant risks to ecological receptors.

3.2.6 Area of Contamination 40

A supplemental ecological risk assessment was performed at the Cold Spring Brook Landfill and presented in the Final RI Addendum Report (ABB-ES, 1993c) to integrate information gathered from several phases of investigation at the Group 1A sites and determine whether environmental contaminants may pose a risk to ecological receptors. Specifically, the supplemental risk assessment evaluated sediment and fish tissue analytical data that were unavailable when the RI Report was produced. The risk assessment of the RI Report indicated that sediment contamination in Cold Spring Brook Pond may pose a risk to ecological receptors (E&E, 1993). Arsenic was found to be the primary risk contributor to aquatic and semi-aquatic biota. Risks to aquatic biota were also predicted from DDD.

Fish Sampling Program. Average and maximum fish tissue analyte concentrations of fish collected from Cold Spring Brook Pond were compared to regional and national data bases by trophic level. The average fish tissue concentration from Cold Spring Brook Pond exceeded regional averages for the following analytes; DDE, iron, manganese, and zinc. The maximum Cold Spring Brook Pond whole body chain pickerel concentrations of mercury and zinc exceeded their respective National Contaminant Biomonitoring Program 85th percentile concentrations. Fish body weight (and concomitantly trophic status) appears to be a good predictor of mercury contaminant burden in Cold Spring Brook Pond, with higher trophic level fish species having accumulated higher concentrations of this analyte.

A total of 95 fish representing five families and six species were collected in Cold Spring Brook Pond. A gross pathological examination of the fish suggested that the individuals from the population examined were healthy. No tumors, lesions, or other significant abnormalities were observed in any fish examined.

Macroinvertebrates. The macroinvertebrate program at Cold Spring Brook Pond was designed to provide baseline information regarding the biota associated with aquatic habitats in the vicinity of the landfill. The macroinvertebrate community data suggested that Cold Spring Brook Pond may be unimpacted or slightly impacted. Within Cold Spring Brook Pond, sampling stations located adjacent to the landfill appeared to have lower diversity and abundance of aquatic macroinvertebrates than the station located furthest from the landfill. However, water quality parameters did not appear to be influencing factors in the differences observed. A statistical analysis, although generally inconclusive, did suggest that a group of approximately 15 inorganic CPCs may collectively impact the macroinvertebrate community adversely.

Surface Soils. Based on a review of field sampling data collected during the RI, risks to upland terrestrial wildlife from surface soils were not calculated. The review indicated a lack of significant soil contamination.

Surface Water. The average Cold Spring Brook Pond surface water concentrations of iron and manganese slightly exceeded their respective chronic AWQC values. Under the reasonable maximum exposure (RME) scenario, the maximum concentrations of copper and zinc exceeded their respective acute AWQC values. For both the average exposure and RME scenarios at Cold Spring Brook Pond, no HQs were greater than 1 for any of the eight evaluated semi-aquatic receptor species.

In the absence of site-specific information regarding bioavailability and toxicity, literature sources were used to establish a range of candidate arsenic and lead preliminary remediation goals (PRGs) for this site. PRG determination for arsenic and lead in sediment was documented in the AOC 40 Final Feasibility Study Report (ABB-ES, 1994b). The AOC 40 FS Report recommended sediment removal at two hot spots (Areas I and II) at Cold Spring Brook Pond (see Figure 2-15). Sediment removal at Areas I and II are included as a component of the remedial alternatives evaluated in Section 8.0 of this report.

Sediment. Concentrations of DDD, DDE, DDT, anthracene, arsenic, barium, iron, lead, manganese, mercury, nickel, silver, and zinc exceeded the available sediment quality criteria and guidelines. Review of the derivation of the USEPA sediment quality criteria for DDD, DDE, and DDT indicates, however, that the criteria are based on fish lipid values that are not representative of fish living in Cold Spring Brook Pond. Because of this, the sediment quality criteria were adjusted to represent more realistic site-specific conditions. This is described in detail in Appendix S of the RI Addendum report for Cold Spring Brook Landfill (ABB-ES, 1993c). Use of the adjusted pesticide sediment quality criteria HQ eliminates the risk from DDE for the average exposure scenario and lowers risks from DDD for RME scenarios.

3.2.7 Area of Contamination 41

The ecological PRE presented in the Revised Final SI Report for AOC 41 (ABB-ES, 1995d) evaluated potential ecological risks associated with exposure to site contaminants in surface soil, surface water, and sediment.

Surface Soil. The Final SI PRE reported that no organic compounds in surface soil exceeded established benchmark values; however, the maximum detected concentrations of the inorganics antimony, barium beryllium, cadmium, copper, lead, and zinc did exceed their respective benchmark values. These maximum concentrations were associated primarily with samples collected from the landfill surface.

Subsequent to the Final SI, three surface soil samples were collected downgradient of the landfill. With the exception of cobalt, for which no background data are available, the maximum concentrations of all inorganics were less than background concentrations. In addition to inorganics, 16 organic compounds, including 13 PAHs and a PCB, were detected in additional soil samples. A screening-level evaluation of potential effects from surface soil exposure was conducted in which no surface soil benchmark values were exceeded by the maximum detected concentrations of contaminants.

Although several analytes associated with surface soil samples collected during the SI exceeded ecological benchmark values, ecological risks are likely to be minimal. Elevated analyte concentrations were generally associated with samples taken directly from the landfill, and contaminated surface soils do not appear to pose a risk to ecological receptors elsewhere at AOC 41.

Surface Water. The results from two surface water samples collected during the Supplemental SI were combined with surface water sample data from the Final SI. Two organic compounds, DCA and toluene, were detected but are thought to be common laboratory contaminants and not site related. The maximum concentrations of aluminum, copper, iron, lead, and zinc exceeded their benchmark values. Concentrations ranged from two to 93 times the benchmark values.

Although the inorganic analytes exceeded surface water screening values, the maximum concentrations of these compounds were all detected in one sample. Additionally, copper and zinc were undetected in all other surface water samples. It is believed that aluminum and iron were present at naturally high levels in background soils and groundwater at Devens, and the presence of these analytes may be reflective of background conditions, rather than landfill impacts. Furthermore, AWQC documents indicate that standards are based on ecological receptors that are more sensitive than those likely to occur in AOC 41 wetlands. Lastly, it is likely that the use of unfiltered surface water samples lead to unrepresentatively high levels of inorganics due to contamination entrained on suspended solids. It is highly unlikely that the elevated levels of contaminants detected will have an adverse effect on potential ecological receptors.

Sediment. During the Supplemental SI, two sediment samples were collected at AOC 41 and the data combined with sediment sample data from the Final SI. Seven organic compounds and 11 inorganic analytes were detected in sediment samples.

The maximum concentrations of DDD, DDE, heptachlor, arsenic, lead, and zinc were the only values identified above their respective benchmark values. Arsenic was detected in all samples at a maximum concentration over twice its benchmark value. Lead was detected in both samples at a maximum concentration approximately 1.5 times its benchmark value. The maximum concentrations of zinc and heptachlor slightly exceeded their benchmarks.

The maximum concentration of all the compounds were detected in one sediment sample. The average concentrations of all three inorganic analytes were at or near the benchmark values, indicating that it is highly unlikely that arsenic, lead, and zinc pose an ecological risk to aquatic receptors. Additionally, the Interim SQC for DDT and its breakdown products likely represents an extremely conservative guideline for use at Devens. Therefore, it is unlikely that these pesticides in New Cranberry Pond sediments pose a risk to ecological receptors.

4.0 ASSESSMENT OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Compliance with ARARs is one of the CERCLA criteria to be evaluated for each of the alternatives screened for detailed analysis in Section 8. CERCLA was passed by Congress and signed into law on December 11, 1980 (Public Law 96-510). This act was intended to provide for "liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and cleanup of inactive waste disposal sites." SARA, adopted on October 17, 1986 (Public Law 99-499), did not substantially alter the original structure of CERCLA, but provided extensive amendments to it.

In particular, §121 of CERCLA specifies that remedial actions for cleanup of hazardous substances must comply with requirements or standards under federal or more stringent state environmental laws that are applicable or relevant and appropriate to the hazardous substances or circumstances at a site. Inherent in the interpretation of ARARs is the assumption that protection of human health and the environment is ensured.

4.1 TERMS AND DEFINITIONS

The following is an explanation of the terms used throughout this ARARs discussion:

Applicable requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site" (52 FR 32496, August 27, 1987).

Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (52 FR 32496).

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. However, requirements must be both relevant and appropriate for compliance to be necessary. In the case where both a federal and a state ARAR are available, or where two potential ARARs address the same issue, the more stringent regulation must be selected. The final NCP notes that a state standard must be legally enforceable and more stringent than a corresponding federal standard to be relevant and appropriate (55 FR 8756, March 8, 1990). However, CERCLA §121(d)(4) provides several ARAR waiver options that may be invoked, providing that the basic premise of protection of human health and the environment is not ignored. A waiver is available for state standards that have not been uniformly applied in similar circumstances across the state. In addition, CERCLA §121(d)(2)(C) forbids state standards that effectively prohibit land disposal of hazardous substances.

CERCLA on-site remedial response actions must comply only with the substantive requirements of a regulation and not the administrative requirements to obtain federal, state, or local permits [CERCLA §121(e)]. As noted in the ARARs guidance (USEPA, 1988):

> The CERCLA program has its own set of administrative procedures which assure proper implementation of CERCLA. The application of additional or conflicting administrative requirements could result in delay or confusion.

Substantive requirements pertain directly to the actions or conditions at a site, while **administrative requirements** facilitate their implementation. In order to ensure that CERCLA response actions proceed as rapidly as possible, the USEPA has reaffirmed this position in the final NCP (55 FR 8756, March 8, 1990). The NCP defines on-site as "the areal extent of contamination and all areas in very close proximity to the contamination necessary for implementation of the response action." The Interagency Agreement (IAG) provides additional guidance on the applicability of permitting requirements to response actions at the RFTA (USEPA, 1991b). The USEPA recognizes that certain of the administrative requirements, such as consultation with state agencies and reporting, are accomplished through the state involvement and public participation requirements of the NCP.

The provisions of the MCP, (310 Code of Massachusetts Regulations [CMR] 40.0000) (November 19, 1993) are mostly administrative in nature and, therefore, do not have to be complied with in connection with the response action selected for the Consolidation Landfill. Further, the MCP contains a specific provision (310 CMR 40.0111) for deferring application of the MCP at CERCLA sites. 310 CMR 40.0111(1)(a) provides that response actions at CERCLA sites shall be deemed adequately regulated for purposes of compliance with the MCP, provided the MADEP concurs in the CERCLA ROD.

In the absence of federal- or state-promulgated regulations, many criteria, advisories, guidance values, and proposed standards are not legally binding, but may serve as useful guidance for remedial actions. These are not potential ARARs, but are "to-be-considered" (TBC) guidance. These guidelines may be addressed as deemed appropriate.

ARARs are divided into the three categories listed below.

- **Location-specific ARARs** "set restrictions upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations" (53 FR 51394). In determining the use of location-specific ARARs for selected remedial actions at CERCLA sites, one must investigate the jurisdictional prerequisites of each of the regulations. Basic definitions and exemptions must be analyzed on a site-specific basis to confirm the correct application of the requirements.

- **Chemical-specific ARARs** are usually health- or risk-based standards that limit the concentration of a chemical found in or discharged to the environment. They govern the extent of site remediation by providing either actual cleanup levels, or the basis for calculating such levels. For example, groundwater MCLs may provide the necessary cleanup goals for sites with contaminated groundwater. There are no direct chemical-specific ARARs for soils. Chemical-specific ARARs for the site may also be used to indicate acceptable levels of discharge in determining treatment and disposal requirements, and to assess the effectiveness of future remedial alternatives.

- **Action-specific ARARs** set controls or restrictions on particular kinds of activities related to the management of hazardous waste (53 FR 51437). Selection of a particular remedial action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals. Action-specific ARARs are established under RCRA, the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act, and other laws.

Many regulations can fall into more than one category. For example, many location-specific ARARs are also action-specific because they are triggered if remedial activities affect site features. Likewise, many chemical-specific ARARs are also location-specific.

The Occupational Safety and Health Administration (OSHA) has promulgated standards for protection of workers at hazardous waste operations at RCRA or CERCLA sites (29 CFR Part 1910). These regulations are designed to protect workers who would not be exposed to hazardous waste. Federal construction activities involving no potential for hazardous substance exposure are covered by the OSHA standards found in 29 CFR Part 1926. USEPA requires compliance with the OSHA standards in the NCP (40 CFR 300.150), not through the ARAR process. Therefore, the OSHA standards are not considered as ARARs. They are discussed in the site-specific Health and Safety Plan.

Section 8 contains alternative-specific discussions of ARARs.

The following subsections present general discussions of location-, chemical-, and action-specific ARARs as they pertain to the remedial alternatives being considered for the landfills at Devens.

4.2 LOCATION-SPECIFIC ARARs

Federal and Massachusetts location-specific ARARs identified for landfill remediation are discussed in the following paragraphs. These location-specific ARARs are primarily related to the location of the various debris areas in or near wetlands or floodplains, critical habitats, or areas of potential historical or archeological significance. Table 4-1 presents location-specific ARARs.

4.3 CHEMICAL-SPECIFIC ARARs

Federal and Massachusetts chemical-specific ARARs are discussed in the following paragraphs. These chemical-specific ARARs are primarily related to the remedial actions proposed for the Cold Spring Brook Landfill, and are discussed in more detail in the Cold Spring Brook Landfill Operable Unit FS (ABB-ES, 1994b). Table 4-2 presents chemical-specific ARARs.

4.4 ACTION-SPECIFIC ARARs

Table 4-3 lists regulations identified as potential ARARs for possible remedial alternatives. Significant requirements that pertain to landfills are discussed in the following paragraphs. Action-specific ARARs for each remedial alternative that passes initial screening will be discussed in Section 8 during the detailed analysis of those remedial alternatives retained after screening.

This subsection discusses the closure and post-closure regulations which are potential action-specific ARARs for SA 6, AOC 9, AOC 11, SA 12, SA 13, AOC 40, and AOC 41. The regulations define the requirements pertaining to installation of a landfill cover as part of landfill closure, and specify post-closure requirements such as cover system maintenance, groundwater and landfill gas monitoring, and data reporting. The identification of regulations relating to landfill closure is particularly important because of the high cost associated with designing, constructing, and maintaining a landfill cover.

The following regulations are discussed in this section because they may be pertinent to the seven disposal areas:

- USEPA Regulations for Owners and Operators of Permitted Hazardous Waste Facilities at 40 CFR Part 264
- USEPA Criteria for Municipal Solid Waste Landfills at 40 CFR Part 258
- Massachusetts Hazardous Waste Management Rules at 310 CMR 30.000
- Massachusetts Solid Waste Management Regulations at 310 CMR 19.000

USEPA Regulations for Owners and Operators of Permitted Hazardous Waste Facilities at 40 CFR Part 264. These regulations were promulgated pursuant to RCRA Subtitle C. Subpart N (40 CFR 264.300 through 264.317) pertains specifically to hazardous waste landfills and contains requirements for closure and post-closure care which are potential action-specific ARARs. RCRA Subtitle C requirements for the treatment, storage, and disposal of hazardous wastes are applicable for a Superfund remedial action if the following conditions are met:

The waste is a RCRA hazardous waste, and either:

1) The waste was initially treated, stored, or disposed of after November 19, 1980, the effective date of Subtitle C regulations, or

2) The activity at the CERCLA site constitutes treatment, storage, or disposal.

The regulations would be relevant and appropriate if RCRA hazardous wastes were disposed of prior to November 19, 1980, or if the disposed of waste were similar to RCRA hazardous waste.

There is no documented evidence of RCRA hazardous waste disposal at any of the seven disposal areas considered in this FS. Further environmental sampling has not provided evidence that the disposal areas were used for hazardous waste disposal. Low concentrations of a hazardous constituent dispersed in soil over a wide area generally do not trigger Subtitle C as relevant and appropriate. Therefore, RCRA Subtitle C is not considered an ARAR.

USEPA Criteria for Municipal Solid Waste Landfills at 40 CFR Part 258. USEPA regulations at 40 CFR Part 258 establish minimum national criteria under RCRA for Municipal Solid Waste Landfills (MSWLF) units. These regulations contain closure and post-closure requirements applicable to MSWLF units that received waste after October 9, 1991. Limited requirements may apply to MSWLF units that received waste after October 9, 1991, but stopped receiving waste before April 9, 1994. The USEPA has delegated authority to the Commonwealth of Massachusetts to administer RCRA Subtitle D requirements under Massachusetts Solid Waste Management Regulations at 310 CMR 19.000. Therefore, Subtitle D is not considered an action-specific ARAR.

Massachusetts Hazardous Waste Management Regulations at 310 CMR 30.000. These regulations address the generation, storage, collection, transport, treatment, disposal, use, reuse, and recycling of hazardous materials in Massachusetts. There is no documented evidence of hazardous waste disposal at any of the seven disposal areas considered in this FS. Further environmental sampling has not provided evidence that the disposal areas were used for hazardous waste disposal. Therefore, Massachusetts regulations at 310 CMR 30.000 are not considered action-specific ARARs.

Massachusetts Solid Waste Management Regulations at 310 CMR 19.000. These regulations address the storage, transfer, processing, treatment, disposal, use, and reuse of solid waste in Massachusetts. The regulations apply to all solid waste management facilities, including landfills. The regulations were adopted effective July 1, 1990 and contain provisions for facilities which were active at that time, inactive facilities that ceased operation between April 21, 1971 and July 1, 1990, and inactive facilities that ceased operation prior to April 21, 1971. Specifically 310 CMR 19.021 outlines schedules for filing plans for each facility category. For facilities that ceased operation prior to April 21, 1971 (also considered inactive landfills), the regulations at 310 CMR 19.021(4)(b) indicate the facility may be required to file a closure/post-closure plan if so ordered by the MADEP. For facilities that operated after April 21, 1971 but ceased operation prior to July 1, 1990 (also, inactive landfills), the regulations at 310 CMR

19.021(4)(a) specify that the facility should be closed according to plans approved by the MADEP, or that a closure/post-closure plan be submitted according to 310 CMR 19.030(3)(c)5. For facilities that operated after July 1, 1990 (i.e., existing facilities), the regulations at 19.021(3) identify specific cover system and post-closure monitoring requirements.

The landfill final cover system performance and design standards are specified at 310 CMR 19.112. The general performance standards for a final cover include:

- minimize percolation of water through the final cover
- promote proper drainage
- minimize erosion of the final cover
- facilitate the venting and control of landfill gas
- ensure isolation of landfill wastes from the environment
- accommodate settling and subsidence of the landfill

Final cover system components include the following:

- subgrade layer
- landfill gas venting layer
- low permeability layer
- drainage layer
- vegetative layer

Sections 19.118 and 19.132 outline the monitoring requirements for groundwater, surface water, and landfill gas. Section 19.132 requires that groundwater and surface water be monitored semiannually, at a minimum, for the parameters listed at 19.132(1)(h). According to 19.118(2)(b), minimum groundwater monitoring will include one monitoring well or cluster of wells hydraulically upgradient from the limit of waste, and three monitoring wells or clusters hydraulically downgradient. These regulations also outline the surface water and landfill gas monitoring requirements.

Section 19.142 requires that the post-closure period extend for a minimum of 30 years and include the following activities:

- maintain the integrity of the final cover system, including corrective actions
- monitor and maintain environmental monitoring systems
- maintain access roads
- protect and maintain surveyed benchmarks

Massachusetts Solid Waste Management Regulations at 310 CMR 19.113 provide for MADEP approval of alternative landfill final cover system designs if (1) it is satisfactorily demonstrated that the alternative cover system design meets standards established under 310 CMR 19.105, or (2) as a result of the Landfill Assessment Requirements at 310 CMR 19.150, the MADEP determines that an alternative cover design would adequately protect public health, safety and the environment.

As shown in the following table, disposal at AOC 9, AOC 11, SA 12, and SA 13 ceased between April 21, 1971 and July 1, 1990. These areas are considered inactive under 310 CMR 19.021(4)(a). Because no previous plans have been prepared, the regulations would require submittal of a closure/post-closure plan. The regulations do not specify the scope or extent of closure/post-closure activities for landfills in this category, which may be less than those listed in 310 CMR 19.140 and 19.142. The remaining three disposal areas (SA 6, AOC 40 and AOC 41) ceased operation prior to April 21, 1971, therefore the closure/post-closure plan requirement is not applicable for these inactive areas unless so ordered by the MADEP (310 CMR 19.021(4)(b)). None of the disposal areas in this FS report operated after July 1, 1990, therefore they are not existing facilities under the state Solid Waste Management Regulations.

Disposal Area	Cessation of Operations
SA 6	1920
AOC 9	1978
AOC 11	1980
SA 12	1982
SA 13	1990
AOC 40	late 1960s
AOC 41	1950s

5.0 BASIS FOR REMEDIATION

Response objectives, identified in this section, form the basis for identifying remedial technologies and developing remedial alternatives. Response objectives are site-specific, qualitative objectives based on the nature and extent of waste, the resources currently or potentially affected, and the potential for human and environmental exposure.

For Devens landfill remediation, response objectives were formulated based on environmental concerns defined in the pertinent environmental contamination assessments, risk assessments, and ARARs analyses presented in the SI and RI reports prepared for the seven Devens landfills. Response objectives were used to develop appropriate remedial alternatives.

The following response objectives were identified for landfill remediation:

- Prevent human exposure to groundwater contaminants released from Devens landfills that exceed acceptable risk thresholds.

- Protect human and ecological receptors from exposure to landfill soils having concentrations of contaminants exceeding acceptable risk thresholds.

- Prevent landfill contaminant releases to surface water that result in exceedance of AWQC or acceptable ecological risk-based thresholds.

- Prevent exposure by ecological receptors to landfill-contaminated sediments exceeding acceptable risk-based thresholds.

- Reduce adverse impacts from contaminated landfill media to the environment that would reduce the amount of land area available for natural resources use.

6.0 TECHNOLOGY IDENTIFICATION AND SCREENING

Remedial technologies considered implementable, and which address the response objectives listed in Section 5, are identified in this section. Candidate remedial technologies are then screened based on their applicability to landfill remediation. The purpose of the screening is to produce an inventory of suitable technologies that can be assembled into remedial alternatives capable of meeting response objectives.

6.1 TECHNOLOGY IDENTIFICATION

Categories of remedial technologies and specific process options were identified based on a review of literature, vendor information, and experience in developing other FSs under CERCLA. Table 6-1 identifies remedial technologies and debris process options to be considered for inclusion in remedial alternatives. Table 6-2 provides descriptions for debris process options.

6.2 TECHNOLOGY SCREENING

The technology screening process reduces the number of potentially applicable technologies and process options by evaluating factors that may influence process option effectiveness and implementability. This overall screening is consistent with the guidance for conducting FSs under CERCLA (USEPA, 1988).

The screening process assesses each technology or process option for its probable effectiveness and implementability with regard to site-specific conditions, and physical debris characteristics. The effectiveness evaluation focuses on: (1) whether the technology is capable of handling the estimated debris volume and of meeting the goals identified in the response objectives; (2) the effectiveness of the technology in protecting human health during the construction and implementation phase; and (3) the reliability of the technology with respect to debris characteristics and conditions at the various sites where the work will take place. Implementability encompasses both the technical and institutional feasibility of implementing a technology. Effectiveness and implementability are incorporated into two screening criteria: waste- and site-limiting characteristics.

Waste-limiting characteristics largely establish the effectiveness and performance of a technology; site-limiting characteristics affect implementability of a technology. Waste-limiting characteristics consider the suitability of a technology based on debris types. Site-limiting characteristics consider the effect of site-specific physical features, including topography and available space. Technology screening based on waste- and site-limiting characteristics serves the two-fold purpose of screening out technologies whose applicability is limited by debris characteristics or site considerations, while retaining as many potentially applicable technologies as possible.

Table 6-3 summarizes the technology screening phase. Technologies and process options judged effective or implementable were retained for further consideration.

Table 6-4 summarizes the technologies retained for further consideration. The technologies retained following screening represent an inventory of technologies considered most suitable for landfill remediation. Technologies retained in this section may be used to develop remedial alternatives.

7.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

In this section, technically feasible technologies and process options retained following the screening described in Section 6 are combined to form remedial alternatives. Alternatives are developed to attain the remedial action objectives discussed in Section 5.

Six candidate alternatives for landfill remediation were developed by the Devens BRAC Cleanup Team (BCT) on March 31, 1995. These are documented in the BCT Plan of Action (Appendix A). The six alternatives included various combinations of capping landfills in-place, excavating landfill wastes, disposing of excavated debris in a new on-site landfill (excavation/consolidation), and disposing landfill wastes offsite. The waste consolidation alternatives were evaluated in the Draft Consolidation Landfill Feasibility Study report (ABB-ES, 1995c). The FS report evaluated only alternatives involving waste consolidation, and did not assess alternatives involving capping wastes in-place. The FS report was reviewed by MADEP, USEPA, U.S. Department of the Interior (Fish and Wildlife Service), and FORSCOM. Review comments by FORSCOM indicated a preference to evaluate cap-in-place alternatives as well as consolidation alternatives.

To respond to the FORSCOM comments, a Technical Memorandum (ABB-ES, 1996b) was prepared. The Technical Memorandum compared the costs of capping the seven landfills in-place with costs of consolidating landfilled waste. The memorandum documented that costs to cap landfills in-place are necessarily less, because additional site investigations, remedial alternative evaluations, and post-closure monitoring plans would also be required.

On December 9, 1996, the BCT developed nine alternatives for remediation of the landfills. As with the six alternatives developed in the Plan of Action, these nine alternatives were comprised of various capping and waste consolidation combinations at the seven disposal areas. Although similar to the six earlier alternatives, only one of the nine alternatives was identical. Thus, a total of fourteen alternatives were developed by the BCT. These are listed in Table 7-1. Alternative PA-2 is identical to Alternative 9, and will be eliminated from further discussion in this report.

The remedial alternatives were then screened with respect to the criteria of effectiveness, implementability, and cost to meet the requirements of CERCLA and the NCP. The screening step was designed to eliminate impractical and higher cost alternatives (i.e., order of magnitude cost differences) that provide little or no improvement in effectiveness or implementability over lower cost alternatives. Alternative 1 - No Further Action (NFA) under CERCLA will not be evaluated according to these screening criteria; this alternative will be screened as a baseline for the other retained alternatives (USEPA, 1988) during the detailed analysis. The three criteria used for screening the alternatives follow:

Effectiveness. Each alternative was judged for its ability to effectively protect public health and the environment by reducing the toxicity, mobility, or volume of contaminants. Both short- and long-term effectiveness were screened. Short-term effectiveness included reducing existing risks to the community and workers during the construction and implementation period, ability to meet remedial action objectives, and time frame required to achieve remedial action objectives. Long-term effectiveness, which applies after remedial action objectives have been attained, considered the magnitude of the remaining residual risk due to untreated wastes and waste residuals, and the adequacy and reliability of specific technical components and control measures. Effectiveness also considered adverse environmental impacts during construction and implementation of the alternative, and the availability of mitigating measures to minimize impacts.

Implementability. Each alternative was evaluated in terms of technical and administrative feasibility. In the assessment of short-term technical feasibility, availability of a technology for construction or mobilization and operation, as well as compliance with action-specific ARARs during the remedial action were considered. Long-term technical feasibility considered the ease of operation and maintenance (O&M), replacement, monitoring of technical controls of residuals and untreated wastes, technology reliability, and ease of undertaking additional remedial actions. Administrative feasibility for implementing a given technology addressed coordination with other agencies. Implementability also considers the availability of required services and trained specialists or operators.

Cost. The final criterion for screening of alternatives was the associated cost including relative capital and O&M costs, as well as factors influencing cost sensitivity. Absolute accuracy of cost estimates during screening was not considered essential. The focus was rather to make relatively accurate comparative estimates for alternatives so that cost decisions would be sustained as the accuracy of cost estimates improves beyond screening (USEPA, 1988). Detailed cost estimates for those alternatives not eliminated after screening are presented in the detailed analysis of retained alternatives in Section 8.

Alternative Evaluation. For each alternative, a matrix was developed highlighting the alternative's advantages and disadvantages with respect to effectiveness, implementability, and cost. The alternative evaluation matrix presented a concise procedure for screening potential remedial action alternatives. Based on this matrix, a decision was made to either retain the alternative for detailed analysis or eliminate it from further consideration.

7.1 Development of Alternatives for Landfill Remediation

Fourteen remedial alternatives were developed by the BCT to address remedial response objectives presented in Section 5. In assembling the alternatives, general response actions and technology process options selected to represent the various technology types were combined to form alternatives (USEPA, 1988). Alternatives were developed to provide a range of options consistent with USEPA RI/FS guidance (USEPA, 1988).

7.1.1 Alternative PA-1: Cap-in-Place AOCs 9, 11, 40, 41, and Excavate/Dispose Off-Site SAs 6, 12, 13

Alternative PA-1 consists of placing a low-permeability cap on landfills at AOCs 9, 11, 40, 41, excavating wastes at SAs 6, 12, 13, and disposing them off site.

The cap designs would include a hydraulic barrier layer to prevent infiltration of precipitation. A 30-year groundwater monitoring program would be performed at the capped landfills. Landfills where waste excavation occurs would be backfilled with soil and vegetated.

7.1.2 Alternative PA-2: Excavate/Consolidate AOCs 9, 11, 40, 41, and SAs 6, 12 and 13 near Shepley's Hill

Alternative PA-2 is identical to Alternative 9. See Subsection 7.1.15 for Alternative 9 description.

7.1.3 Alternative PA-3: Excavate/Consolidate AOCs 9, 40, 41, and SAs 6, 12, and 13 at the North Post Landfill, and Cap-in-Place AOC 11

Alternative PA-3 consists of excavating wastes at AOCs 9, 40, 41, and SAs 6, 12, 13, and disposing of them in a consolidation landfill to be constructed at AOC 9 (North Post Landfill). The consolidation landfill would contain a leachate collection system and be covered with a low-permeability cap.

The landfill at AOC 11 would be covered in-place with a low-permeability cap designed to prevent infiltration of precipitation. A 30-year groundwater monitoring program would be performed at the capped landfills.

7.1.4 Alternative PA-4: Excavate/Consolidate AOCs 9, 11, 40, 41, and SAs 6, 12, 13 at the North Post Landfill

Alternative PA-4 consists of excavating wastes at AOCs 9, 11, 40, and 41 and SAs 6, 12, 13 (all seven landfills) and disposing of them in a consolidation landfill to be constructed at AOC 9 (North Post Landfill). The consolidation landfill would contain a leachate collection system and be covered with a low-permeability cap. A 30-year groundwater monitoring program would be performed at the capped landfill.

7.1.5 Alternative PA-5: Excavate/Consolidate AOCS 40, 41, and SAs 6, 12, and 13 near Shepley's Hill, and Cap-in-Place AOCs 9 and 11

Alternative PA-5 consists of excavating wastes at AOCs 40 and 41 and SAs 6, 12, 13, and disposing of them in a consolidation landfill to be constructed in the expansion area near Shepley's Hill landfill. The consolidation landfill would contain a leachate collection system and be covered with a low-permeability cap.

Landfills at AOCs 9 and 11 would be covered in-place with a low-permeability cap designed to prevent infiltration of precipitation. A 30-year groundwater monitoring program would be performed at the capped landfills.

7.1.6 Alternative PA-6: Excavate/Consolidate AOCs 9, 11, 41 and SAs 6, 12, and 13 near Shepley's Hill, and Cap-in-Place AOC 40

Alternative PA-6 consists of excavating wastes at AOCs 9, 11, 41, and SAs 6, 12, and 13 and disposing of them in a consolidation landfill to be constructed in the expansion area near Shepley's Hill landfill. The consolidation landfill would contain a leachate collection system and be covered with a low-permeability cap.

The landfill at AOC 40 would be covered in-place with a low-permeability cap designed to prevent infiltration of precipitation. A 30-year groundwater monitoring program would be performed at the capped landfills.

7.1.7 Alternative 1: No Further Action

Alternative 1 consists of NFA at all seven landfills. No remedial activities would be undertaken to meet the response objectives described in Section 5 of this report.

7.1.8 Alternative 2: No Further Action at AOC 41, and SAs 6, 12, and 13; Limited Removal at AOC 11 (Disposal at AOC 9), and Cap-in-Place at AOCs 9 and 40

Alternative 2 consists of NFA at AOC 41 and SAs 6, 12, 13. At AOC 11, surface debris only would be removed and disposed under an in-place cap at AOC 9. At AOCs 9 and

40, a low-permeability cap designed to prevent infiltration of precipitation would be constructed. A 30-year groundwater monitoring program would be performed at the two capped landfills.

7.1.9 Alternative 3: No Further Action at AOC 41 and SAs 6, 12, and 13; and Cap-in-Place at AOCs 9, 11, and 40

Alternative 3 consists of placing a low-permeability cap designed to prevent infiltration of precipitation over landfills at AOCs 9, 11, 40. A 30-year groundwater monitoring program would be performed at the three capped landfills. No action would be taken at AOC 41 and SAs 6, 12, 13.

7.1.10 Alternative 4: No Further Action at AOC 41 and SAs 6, 12, and 13; Limited Removal at AOC 11 (Disposal in Consolidation Landfill); and Excavation and Consolidation AOCs 9 and 40

Alternative 4 consists of excavating wastes at AOCs 9 and 40, and disposing of them in a consolidation landfill to be constructed in the expansion area near Shepley's Hill landfill. The consolidation landfill would contain a leachate collection system and be covered with a low-permeability cap. At AOC 11, surface debris only would be removed and disposed in the consolidation landfill. NFA would be taken at AOC 41 and SAs 6, 12, 13.

7.1.11 Alternative 5: Limited Removal at AOC 11 (Disposal in Consolidation Landfill); and Cap-in-Place at AOC 41 and SAs 6, 12, and 13; and Excavation and Consolidation of AOCs 9 and 40

Alternative 5 consists of excavating wastes at AOCs 9 and 40, and disposing of them in a consolidation landfill to be constructed in the expansion area near Shepley's Hill landfill. The consolidation landfill would contain a leachate collection system and be covered with a low-permeability cap. A low-permeability cap designed to prevent infiltration of precipitation would be placed on landfills at AOC 41 and SAs 6, 12, 13. A 30-year groundwater monitoring program would be performed at the capped landfills. At AOC 11 surface debris only would be removed and disposed in the consolidation landfill.

7.1.12 Alternative 6: Cap-in-Place at AOC 41 and SAs 6, 12, and 13; and Excavation and Consolidation of AOCs 9, 11, and 40

Alternative 6 consists of excavating wastes at AOCs 9, 11, and 40, and disposing them in a consolidation landfill to be constructed in the expansion area near Shepley's Hill landfill. The consolidation landfill would contain a leachate collection system and be covered with a low-permeability cap. A low-permeability cap designed to prevent infiltration of precipitation would be placed on landfills at AOC 41 and SAs 6, 12, 13. A 30-year groundwater monitoring program would be performed at the capped landfills.

7.1.13 Alternative 7: Cap-in-Place at All Seven Disposal Areas

Alternative 7 consists of placing a low-permeability cap designed to prevent infiltration of precipitation on all seven landfills. A 30-year groundwater monitoring program would be performed at the capped landfills.

7.1.14 Alternative 8: Limited Removal at AOC 11 (Disposal in Consolidation Landfill); and Excavation and Consolidation of AOCs 9, 40, and 41, and SAs 6, 12, and 13

Alternative 8 consists of excavating wastes at AOCs 9, 40, 41 and SAs 6, 12, 13, and disposing them in a consolidation landfill to be constructed in the expansion area near Shepley's Hill landfill. The consolidation landfill would contain a leachate collection system and be covered with a low-permeability cap. At AOC 11, surface debris only would be removed and disposed in this consolidation landfill.

7.1.15 Alternative 9: Excavation and Consolidation of All Seven Disposal Areas

Alternative 9 consists of excavating wastes at all seven landfills and disposing them in a consolidation landfill to be constructed in the expansion area near Shepley's Hill landfill. The consolidation landfill would contain a leachate collection system and be covered with a low-permeability cap.

7.2 SCREENING OF ALTERNATIVES FOR THE CONSOLIDATION LANDFILL

Based on the screening approach presented at the beginning of this section, screening matrices for each alternative are presented in Table 7-2 and a screening summary is presented in Table 7-3.

7.2.1 Alternative PA-1: Cap-in-Place AOCs 9, 11, 40, and 41, and Excavate/Dispose Off-Site SAs 6, 12, 13

Effectiveness. The long-term effectiveness of a low-permeability landfill cover at controlling potential future releases from the unsaturated zone beneath would depend on maintenance of cap integrity. If adequately installed and maintained, low-permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

Excavation and offsite disposal of landfill debris would effectively prevent human and ecological exposure and prevent the landfill from being a potential source of future groundwater contamination.

Implementability. Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Debris excavation and offsite disposal can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available.

Cost. The capital costs associated with this alternative are moderate. The associated operating costs are moderate.

Conclusion. This alternative will be eliminated from further evaluation. Offsite disposal costs are too high compared to other available disposal options.

7.2.2 Alternative PA-2: Excavate/Consolidate AOCs 9, 11, 40, and 41, and SAs 6, 12, 13 near Shepley's Hill

Alternative PA-2 is identical to Alternative 9. See Subsection 7.2.15 for Alternative 9 screening.

7.2.3 Alternative PA-3: Excavate/Consolidate AOCs 9, 40, and 41 and SAs 6, 12, and 13 at North Post Landfill; Cap-in-Place AOC 11

Effectiveness. The long-term effectiveness of a low-permeability landfill cover at controlling potential future releases from the unsaturated zone beneath AOC 11 would depend on the maintenance of cap integrity. If adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

Implementability. Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at the excavated landfill.

Cost. The capital costs associated with this alternative are high. The associated operating costs are moderate.

Conclusion. This alternative will be eliminated from further evaluation. Costs associated with excavating and staging wastes at the North Post Landfill prior to constructing the consolidation landfill are too high compared to constructing the landfill near Shepley's Hill.

7.2.4 Alternative PA-4: Excavate/Consolidate AOCs 9, 11, 40, and 41 and SAs 6, 12, and 13 at North Post Landfill

Effectiveness. Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

Implementability. Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at the excavated landfill.

Cost. The capital costs associated with this alternative are high. The associated operating costs are moderate.

Conclusion. This alternative will be eliminated from further evaluation. Costs associated with excavating and staging wastes at the North Post Landfill prior to constructing the consolidation landfill are too high compared to constructing the landfill near Shepley's Hill.

7.2.5 Alternative PA-5: Excavate/Consolidate AOCs 40 and 41 and SAs 6, 12, and 13 near Shepleys Hill, Cap-in-Place AOCs 9 and 11

Effectiveness. The long-term effectiveness of a low-permeability landfill cover at controlling potential future releases from the unsaturated zone beneath the landfills would depend on the maintenance of cap integrity. If adequately installed and maintained, low-permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

Implementability. Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at the excavated landfill.

Cost. This capital costs associated with this alternative are high. The associated operating costs are moderate.

Conclusion. Alternative PA-5 will be eliminated from further evaluation. This alternative contains different actions for AOCs 9 and 40, the landfills having the two largest waste volumes. Thus, economies of scale cannot be realized.

7.2.6 Alternative PA-6: Excavate/Consolidate AOCs 9, 11, 41 and SAs 6, 12, 13 near Shepley's Hill, Cap-in-Place AOC 40

Effectiveness. The long-term effectiveness of a low-permeability landfill cover at controlling potential future releases from the unsaturated zone beneath AOC 40 would depend on the maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

Implementability. Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at the excavated landfill.

Cost. The capital costs associated with this alternative are high. The associated operating costs are moderate.

Conclusion. Alternative PA-6 will be eliminated from further evaluation. This alternative contains different actions for AOCs 9 and 40, the landfills having the two largest waste volumes. Thus, economies of scale cannot be realized.

7.2.7 Alternative 1: No Further Action

This alternative will pass through screening and be evaluated in detail in Section 8 as required by CERCLA.

7.2.8 Alternative 2: No Further Action at AOC 41, and SAs 6, 12, and 13; and Limited Removal at AOC 11 (Disposal at AOC 9); and Cap-in-Place at AOCs 9 and 40

Effectiveness. At SA 6, potential human health and environmental risks have not been evaluated in a PRE or baseline risk assessment. However, there is no reason to expect adverse risks to human health and the environment. Therefore, this alternative is considered to provide protection of human health and the environment at SA 6.

This alternative provides protection of human health and the environment at AOC 41.

This alternative provides protection of human health at SAs 12 and 13. However, interpreted environmental risks would not be addressed at these two sites.

At AOC 11, removal and disposal of surface debris would remove potential physical hazards to occasional site visitors. Because potential human health risks were within or below the USEPA target values, the human health risk reduction benefit is considered low. No actions would be included to reduce or monitor potential ecological risk from exposure to wetland soil/sediment or surface water.

The long-term effectiveness of a low permeability landfill cover at controlling potential future releases from the unsaturated zone beneath the landfills at AOCs 9 and 40 would depend on the maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

Implementability. The NFA portion of this alternative would be easy to implement and would not limit or interfere with the ability to perform future remedial actions.

Surface debris removal can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified and available.

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Cost. The capital costs associated with this alternative are low. The associated operating costs low.

Conclusion. This alternative will be retained for detailed evaluation in Section 8.

7.2.9 Alternative 3: No Further Action at AOC 41 and SAs 6, 12, and 13; and Cap-in-Place at AOCs 9, 11, and 40

Effectiveness. At SA 6, potential human health and environmental risks have not been evaluated in a PRE or baseline risk assessment. However, there is no reason to expect adverse risks to human health and the environment. Therefore, this alternative is considered to provide protection of human health and the environment at SA 6.

This alternative provides protection of human health and the environment at AOC 41.

This alternative provides protection of human health at SAs 12 and 13. However, interpreted environmental risks would not be addressed at these two sites.

The long-term effectiveness of a low permeability landfill cover at controlling potential future releases from the unsaturated zone beneath the landfills at AOCs 9, 11, and 40 would depend on the maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

Implementability. The NFA portion of this alternative would be easy to implement and would not limit or interfere with the ability to perform future remedial actions.

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Cost. The capital costs associated with this alternative are moderate. The associated operating costs are moderate.

Conclusion. This alternative will be retained for detailed evaluation in Section 8.

7.2.10 Alternative 4: No Further Action at AOC 41 and SAs 6, 12, and 13; and Limited Removal at AOC 11 (Disposal in Consolidation Landfill); and Excavation and Consolidation of AOCs 9 and 40

Effectiveness. At SA 6, potential human health and environmental risks have not been evaluated in a PRE or baseline risk assessment. However, there is no reason to expect adverse risks to human health and the environment. Therefore, this alternative is considered to provide protection of human health and the environment at SA 6.

This alternative provides protection of human health and the environment at AOC 41.

This alternative provides protection of human health at SAs 12 and 13. However, interpreted environmental risks would not be addressed at these two sites.

At AOC 11, removal and disposal of surface debris would remove potential physical hazards to occasional site visitors. Because potential human health risks are within or below the USEPA target values, the human health risk reduction benefit is considered low. No actions would be included to reduce or monitor potential ecological risk from exposure to wetland soil/sediment or surface water.

Excavation of landfill debris at AOCs 9 and 40 would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

Implementability. The NFA portion of this alternative would be easy to implement and would not limit or interfere with the ability to perform future remedial actions.

Surface debris removal can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified and available.

Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at the excavated landfill.

Cost. The capital costs associated with this alternative are moderate. The associated operating costs are low.

Conclusion. This alternative will be retained for detailed evaluation in Section 8.

7.2.11 Alternative 5: Limited Removal at AOC 11 (Disposal in Consolidation Landfill); and Cap-in-Place at AOC 41 and SAs 6, 12, and 13; and Excavation and Consolidation AOCs 9 and 40

Effectiveness. At AOC 11, removal and disposal of surface debris would remove potential physical hazards to occasional site visitors. Because potential human health risks are within or below the USEPA target values, the human health risk reduction benefit is considered low. No actions would be included to reduce or monitor potential ecological risk from exposure to wetland soil/sediment or surface water.

The long-term effectiveness of a low permeability landfill cover at controlling potential future releases from the unsaturated zone beneath the landfills at AOC 41 and SAs 6, 12, and 13 would depend on the maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

Excavation of landfill debris at AOCs 9 and 40 would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

Implementability. Surface debris removal can be accomplished using standard construction procedures and conventional earthmoving equipment. Many construction companies are qualified and available.

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at the excavated landfill.

Cost. The capital costs associated with this alternative are moderate. The associated operating costs are moderate.

Conclusion. This alternative will be retained for detailed evaluation in Section 8.

7.2.12 Alternative 6: Cap-in-Place at AOC 41 and SAs 6, 12, and 13; and Excavation and Consolidation of AOCs 9, 11, and 40

Effectiveness. The long-term effectiveness of a low permeability landfill cover at controlling potential future releases from the unsaturated zone beneath the landfills would depend on the maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

Implementability. Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at the excavated landfill.

Cost. The capital costs associated with this alternative are high. The associated operating costs are moderate.

Conclusion. This alternative will be retained for detailed evaluation in Section 8.

7.2.13 Alternative 7: Cap-in-Place at All Seven Disposal Areas

Effectiveness. The long-term effectiveness of a low permeability landfill cover at controlling potential future releases from the unsaturated zone beneath the landfills would depend on the maintenance of cap integrity. If adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

Implementability. Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Cost. The capital costs associated wit this alternative are high. The associated operating costs are high.

Conclusion. This alternative will be retained for detailed evaluation in Section 8.

7.2.14 Alternative 8: Limited removal at AOC 11 (Disposal in Consolidation Landfill); and Excavation and Consolidation of AOCs 9, 40, and 41, and SAs 6, 12, and 13

Effectiveness. At AOC 11, removal and disposal of surface debris would remove potential physical hazards to occasional site visitors. Because potential human health risks are within or below the USEPA target values, the human health risk reduction benefit is considered low. No actions would be included to reduce or monitor potential ecological risk from exposure to wetland soil/sediment or surface water.

Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

Implementability. Surface debris removal can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified and available.

Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at the excavated landfill.

Cost. The capital costs associated with this alternative are high. The associated operating costs are moderate.

Conclusion. This alternative will be retained for detailed evaluation in Section 8.

7.2.15 Alternative 9: Excavation and Consolidation of All Seven Disposal Areas

Effectiveness. Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

Implementability. Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at the excavated landfill.

Cost. The capital costs associated with this alternative are high. The associated operating costs are moderate.

Conclusion. This alternative will be retained for detailed evaluation in Section 8.

8.0 DETAILED ANALYSIS

This detailed analysis of alternatives provides a description of each candidate landfill remediation alternative and an evaluation using the first seven of the evaluation criteria recommended in USEPA's RI/FS guidance (USEPA, 1988) and described in Table 8-1. The remaining two criteria, state and community acceptance, will be addressed after the public comment period on the Proposed Plan. The nine alternatives that are evaluated in this section are those remaining after screening in Section 7 and listed in Table 7-3.

Alternative 1: No Further Action

Alternative 2: No Further Action at AOC 41, and SAs 6, 12, and 13; Limited Removal at AOC 11 (Disposal at AOC 9); and Cap-in-Place at AOCs 9 and 40

Alternative 3: No Further Action at AOC 41 and SAs 6, 12, and 13; and Cap-in-Place at AOCs 9, 11, and 40

Alternative 4: No Further Action at AOC 41 and SAs 6, 12, and 13; Limited Removal at AOC 11 (Disposal in Consolidation Landfill); and Excavation and Consolidation of AOCs 9 and 40

Alternative 5: Limited Removal at AOC 11 (Disposal in Consolidation Landfill); and Cap-in-Place at AOC 41 and SAs 6, 12, and 13; and Excavation and Consolidation of AOCs 9 and 40

Alternative 6: Cap-in-Place at AOC 41 and SAs 6, 12, and 13; and Excavation and Consolidation of AOCs 9, 11, and 40

Alternative 7: Cap-in-Place at All Seven Disposal Areas

Alternative 8: Limited Removal at AOC 11 (Disposal in Consolidation Landfill); and Excavation and Consolidation of AOCs 9, 40, and 41, and SAs 6, 12, and 13

Alternative 9: Excavation and Consolidation of All Seven Disposal Areas

8.1 ALTERNATIVE 1: NO FURTHER ACTION

This subsection describes the NFA Alternative and evaluates the alternative using the seven evaluation criteria.

8.1.1 Description of Alternative 1

The NFA Alternative serves as a baseline alternative with which to compare other alternatives per CERCLA regulations. No action will be taken to meet the response objectives stated in Section 5.

8.1.2 Detailed Evaluation of Alternative 1

The following subsections present an assessment of this alternative according to the seven evaluation criteria.

8.1.2.1 Overall Protection of Human Health and the Environment. The following paragraphs assess how the proposed actions of the NFA Alternative would provide protection of human health and the environment.

<u>SA 6</u>. Potential human health and environmental risks have not been evaluated in a PRE or baseline risk assessment. However, there is no reason to expect unacceptable risk to human health and the environment at SA 6. Therefore, this alternative is considered to provide protection of human health and the environment at SA 6.

<u>AOC 9</u>. This alternative does not include actions to provide protection of human health and the environment at AOC 9. However, it is the Army's interpretation that there is no significant risk to human health and the environment posed by environmental contamination at AOC 9. The human health PRE for surface water and sediment is based on comparison to drinking water and soil benchmarks values, respectively, and likely overestimates potential risks. Although the concentrations of contaminants in unfiltered groundwater samples exceed benchmark values, entrained soil particles in the samples may have contributed to the exceedances, and groundwater with high entrained solids

concentrations would be unlikely to be used as a drinking water source. Further, monitoring data indicate that exceedances occurred in samples collected both upgradient and crossgradient of AOC 9, suggesting that AOC 9 is not the source of the exceedances.

AOC 11, SA 12, SA 13, AOC 40, and AOC 41. It is the Army's interpretation that there is no significant risk to human health and the environment posed by environmental contamination at these sites. This alternative provides protection of human health at these areas, and protection of the environment at AOC 11 and AOC 41.

8.1.2.2 Compliance with ARARs. The NFA Alternative does not include any remedial actions and would not trigger any location-specific ARARs.

The National Primary Drinking Water Regulations (40 CFR Parts 141.60-141.63 and 141.50-141.52) are chemical-specific ARARs at AOC 40. Under Alternative 1, the MCL for BEHP would be met under average conditions, and the MCL for arsenic would be met under average and maximum conditions. Available data indicate that MCLs are not exceeded at the Patton Well.

As discussed in Section 4 of this FS, the Massachusetts Solid Waste Regulations are not ARARs for SA 6, AOC 40, and AOC 41. Therefore, these disposal areas are not out of compliance with these requirements and a closure/post-closure plan is not required.

Disposal areas AOC 9, AOC 11, SA 12, and SA 13 are considered inactive under the state Solid Waste Regulations. Because no previous plans have been prepared, the regulations require submittal of a closure/post-closure plan in compliance with 310 CMR 19.021. These disposal areas also have cover materials over the wastes, such as vegetative growth at AOCs 9 and 11, wooded growth and dense brush at SA 12, and native soil at SA 13. The cover materials serve as a physical barrier that prevents exposure to the wastes by human and terrestrial receptors. In addition, the current cover materials meet several of the final cover system general performance standards at 310 CMR 19.112.

8.1.2.3 Long-term Effectiveness and Permanence. The following paragraphs assess the long-term effectiveness and permanence of the proposed actions of the NFA Alternative.

SA 6. Because there is no reason to expect risks to human health, this alternative provides long-term effectiveness for protecting human health and environment at SA 6.

AOC 9. It is the Army's interpretation that there is no significant risk to human health and the environment posed by environmental contamination at AOC 9. Therefore, this alternative is interpreted to provide long-term effectiveness at protecting human health and the environment.

AOC 11, SA 12, SA 13, AOC 40, and AOC 41. It is the Army's interpretation that there is no significant risk to human health and the environment posed by environmental contamination at these sites. This alternative provides long-term effectiveness for protecting human health at these sites, and for protecting the environment at AOC 11 and AOC 41.

8.1.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment. The following paragraphs assess the reduction of toxicity, mobility, and volume of contaminants through treatment offered by the proposed actions of the NFA Alternative.

SA 6, AOC 9, AOC 11, SA 12, SA 13, AOC 40, and AOC 41. This alternative would not use removal, containment, or treatment processes to address contamination at this site. No reduction of toxicity, mobility, or volume of contaminants through treatment would occur. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

8.1.2.5 Short-term Effectiveness. The following paragraphs assess the short-term effectiveness of NFA proposed at each of the landfills.

SA 6, AOC 9, AOC 11, SA 12, SA 13, AOC 40, and AOC 41. This alternative would not provide any remedial actions. Therefore, no short-term risks to the community or environment would result from implementation.

8.1.2.6 Implementability. The following paragraphs assess the implementability of NFA proposed at each of the landfills.

<u>SA 6, AOC 9, AOC 11, SA 12, SA 13, AOC 40, and AOC 41</u>. This alternative would be easy to implement and would not limit or interfere with the ability to perform future remedial actions.

8.1.2.7 Cost. Because no action would be taken, there are no capital or operation and maintenance costs associated with this alternative.

8.2 ALTERNATIVE 2: NO FURTHER ACTION AT AOC 41, AND SAS 6, 12, AND 13; LIMITED REMOVAL AT AOC 11 (DISPOSAL AT AOC 9); AND CAP-IN-PLACE AT AOCS 9 AND 40

This subsection describes and evaluates Alternative 2 using the seven evaluation criteria, and provides a cost estimate.

8.2.1 Description of Alternative 2

This alternative includes different types of management at the seven disposal sites. At AOC 41, and SAs 6, 12, and 13 NFA would be taken. At AOC 11 only surface debris would be removed for disposal at AOC 9. At AOCs 9 and 40 a cap would be placed over the debris. AOC 9 will have some consolidation of debris, which will minimize both the area to be capped, and associated costs. The debris collected from AOC 11 would be placed under this cap. Alternative 2 also includes removing exposed drums at AOC 40 to remove a potential source of contamination, and excavation of sediment from two hot spots in Cold Spring Brook Pond to reduce ecological risk from exposure to contaminated sediments. These actions at AOC 40 were described previously in the FS for AOC 40 (ABB-ES, 1994b).

Key components of Alternative 2 include:

<u>No Further Action at AOC 41, SAs 6, 12, 13</u>

- No action.

Limited Removal at AOC 11

- Mobilization/demobilization;
- Excavation of debris and transportation to AOC 9;
- Backfilling site; and
- Site restoration.

Cap-in-Place AOCs 9 and 40

- Mobilization/demobilization;
- Site preparation;
- Sediment removal and disposal at AOC 40;
- Drum removal and disposal at AOC 40;
- Consolidate debris at AOC 9;
- Cap construction;
- Site restoration;
- Wetland restoration;
- Institutional controls;
- Cover system monitoring and maintenance; and
- Five-year site reviews.

Each of these actions is described below:

8.2.1.1 Description of No Further Action Components for Alternative 2. The NFA components are similar to those discussed for Alternative 1, Subsection 8.1.1.

8.2.1.2 Description of Limited Removal Components for Alternative 2.

Mobilization/demobilization. Excavation and backfill equipment including backhoes, front end loaders, and dump trucks would be mobilized to AOC 11 to remove surface debris and transport it to AOC 9. There would be minimal disruption to AOC 11. Clearing is not anticipated and no roads would be constructed.

Excavation of debris and transportation to AOC 9. Excavation at AOC 11 would be limited to surface debris and refuse. The 2+ acres of level area and the 10-foot banking along the south wetlands have exposed refuse including large pieces of metal, wood, bricks, and other construction debris. Clearing the landfill surfaces of trees and brush would be minimal. Individual protruding debris items would be removed by excavators of appropriate size, and hauled by truck to AOC 9, where it would be placed prior to cap installation. About 500 cy would be handled. Silt fences may be installed along the wetlands, to be removed after construction. No change in the wetlands footprint would result after the landfill banking was regraded and revegetated. Disturbed wetlands would be cleared of construction materials and left for natural revegetation.

Backfilling site. The excavated/disturbed areas of AOC 11 would be backfilled with vegetative soil and graded.

Site restoration. The site would then be restored by seeding, mulching, and fertilizing the disturbed areas. Wetlands would be left for natural revegetation.

8.2.1.3 Description of Cap-In-Place Components for Alternative 2.

Mobilization/demobilization. Excavation and backfill equipment including backhoes, bulldozers, and rollers would be mobilized at AOC 9 and AOC 40. Specialized equipment may be required for cap construction at AOC 40, due to steep banks and heavy debris at the bottom of the slopes at this area. Additional sediment removal equipment requiring mobilization at AOC 40 includes an excavator or a clamshell crane, watertight dump trucks, and water storage tanks. A plan view of AOC 9 is shown on Figure 8-1, and a cross-section view on Figure 8-2. A plan view of AOC 40 is shown on Figure 8-3; a cross-section view of AOC 40 is shown on Figure 8-4.

Site Preparation. Initial activities at both AOC 9 and AOC 40 would be some clearing of trees, constructing temporary access roads, and installing silt fences and erosion control measures. Contractor trailers with utilities would be established, and parking and staging areas prepared.

At AOC 40, Cold Spring Brook Landfill, drum removal would be attempted by hydraulic excavator or backhoe from the landfill surface. Some tree removal and minor regrading of the landfill surface may be needed to accomplish this task. Sediment removal from sediment Area I would also be attempted from the landfill surface. The most direct access to sediment Area I from Patton Road would be to cross the landfill east of well CSM-93-01A. However, the landfill surface is relatively high in this area and it may not be possible to reach the entire sediment removal area. As an alternative, approaching the sediment removal area via a more easterly route may make sense. The pond bank is lower and the debris/rubble would provide a relatively firm foundation for excavation equipment. Even with this approach, construction of up to 200 ft of temporary road along the edge of the pond/landfill may be necessary. A third alternative would be to construct approximately 500 ft of temporary access road along the northwestern side of the landfill. Construction of either access road would likely require placement of a geotextile mat and significant quantities of gravel over the naturally occurring peat to support heavy equipment. Construction of the longer road would also require removal of a number of trees. As indicated in Figure 8-3, it may be possible to construct the road along the northwest edge of the landfill without crossing wetland areas. However, this would need to be confirmed. The cost estimates for sediment removal at Area I are based on construction and subsequent removal of 200 ft of temporary access road.

Prior to excavation at sediment Area II near the outlet of Cold Spring Brook Pond, some fill material may need to be placed along the bank of the pond to provide a level platform for equipment. Access would be from Patton Road east of the pond. For cost estimating purposes, it is assumed that gravel would be obtained on-site from the southern side of Patton Road to construct the work platforms and access roads. If this gravel cannot be used, material costs would increase. These access roads would be temporary, and would be removed following completion of remedial activities at the landfill. The cost estimates include the cost to remove any temporary roads or work platforms at Area II.

Construction of a lined basin for dewatering sediment, a lined drum storage area for staging drums, small decontamination pads, a stockpile area approximately 1 acre in size for cover system materials, and a small parking area would be required.

Partial dewatering of Cold Spring Brook Pond may be required prior to cap construction.

Sediment removal and disposal at AOC 40 Sediment removal is proposed at AOC 40 for two hot spot locations producing elevated ecological risks due to arsenic and lead contamination in Cold Spring Brook Pond. The first location (Area I) is a small inlet east of monitoring well CSB-2 (see Figure 8-3). The second location (Area II) is at the pond outlet. For cost estimating purposes, the volume of sediment to be removed has been estimated to be 1,200 cy.

A silt fence or a floating boom weighted at its bottom would be placed around the two excavation areas to prevent sediment suspended during excavation from migrating to other locations in the pond. Sediment removal would be attempted by a long-stick hydraulic excavator or a crane with a watertight clamshell bucket to minimize the quantity of water and sediment spilling adjacent to the excavation. If access from the top of the landfill is not successful, a temporary access road would be constructed along the northern side of the landfill, and sediment would be removed with an excavator. Sediment would be placed in watertight dump trucks and transported to a lined dewatering basin constructed as close to the landfill area as practicable. For cost estimating purposes, the lined dewatering basin is proposed to be 100 by 100 ft with a 4 ft. depth, constructed with an impervious liner to temporarily store sediment and water.

As the sediment settles out, the supernatant water would be pumped into tanks and sampled. If analysis shows that the water will not cause Cold Spring Brook Pond to exceed AWQC, it would be discharged back to the pond. If water quality does not meet acceptable criteria, it would be treated on-site in a mobile clarifier before discharge to the pond. Sediments would be disposed at AOC 9. The addition of a sorbent or solidifying agent may be necessary to eliminate free water prior to transport and disposal. For cost estimating purposes, treatment of supernatant water is assumed.

Drum removal and disposal at AOC 40. At AOC 40, 14 55-gallon drums along the northern edge of Cold Spring Brook Landfill would be removed. Drums are located on the landfill bank, as well as partially submerged in the pond (see Figure 8-3). Drum removal would be attempted with a backhoe or hydraulic excavator working from cleared areas on top of the landfill.

Drums with contents would be lifted manually or by means of a sling, and overpacked into 85-gallon drums. These drums would then be removed and staged on a lined, bermed, on-site staging area approximately 400 square ft in size. Drum contents would be sampled and analyzed for TCLP constituents following drum staging. After TCLP results are obtained, the drums would be disposed at AOC 9 or an off-site RCRA Treatment, Storage, or Disposal (TSD) facility. Empty drums would be placed in polybags and taken to AOC 9.

Consolidate debris areas at AOC 9. AOC 9, shown on Figure 8-1, consists of five separate areas. In this alternative, the four smaller peripheral areas would be excavated using standard excavation equipment (e.g., hydraulic excavators) and spread and compacted over existing grades in the large area. Consolidation will minimize the size of the cap at AOC 9 and the corresponding costs. The debris from the peripheral AOC 9 areas, as well as the debris from the limited removal at AOC 11, can be used to minimize the amount of subgrade fill required to create the proper grades for the cap at AOC 9.

Cap Construction. To conform with the intent of regulations 310 CMR 19.112; a landfill cover must meet six general performance standards:

- minimize surface water infiltration to landfilled material
- promote surface water drainage
- minimize erosion
- facilitate venting and control of landfill gas
- isolate landfilled material from the environment
- accommodate settling and subsidence

The regulations also provide general design and component standards to achieve the performance standards. The conceptual cover system design for AOC 9 would conform to the general design standards in regard to final top slope, side slope and layer construction. Because of the age and nature of the landfill debris, landfill gas generation is not expected, and gas vents are not included. A cross section of the cap is shown on Figure 8-5.

The conceptual cover system design for AOC 40 is intended to achieve the performance standards, but varies slightly from the general design standards. A cross section of the cap is shown on Figure 8-4. Several factors combine to require a special approach to top slope and side slope design:

- the proximity of Patton Road

- the shallow slope of the existing landfill surface

- the interpreted northward flow of groundwater beneath the landfill and discharge to Cold Spring Brook Pond

- the landfilled debris that extend into the pond along much of the landfill's northern boundary

These factors create two special design constraints. The first constraint is the need to minimize the diversion of surface water from the landfill cover toward Patton Road, and the second is to not interrupt the continued discharge of groundwater to the pond. The closeness of the landfill to the road and the similarities in surface elevation make construction of drainage ditches, especially open, lined ditches, problematic. To minimize the southward diversion of surface water, this alternative proposes to hold cover system buildup to a minimum. It may also be necessary to incorporate surface slopes of less than 5 percent. The narrowness of the landfill will help promote adequate lateral drainage at shallow slopes. Minimizing the buildup of the landfill surface in the middle of the landfill and reducing final top slope can be achieved by increasing side slope and thereby reducing the volume of waste pullback. (It is assumed that material pulled back from the sides would be placed on top of the landfill). Side slope design to prevent instability will be considered as part of the design to address the second special design constraint, continued groundwater passage.

Maintenance of normal groundwater flow is an important design consideration. Construction of low permeability cap on the north side of the landfill would block groundwater discharge to the pond and could have several adverse effects.

- The water balance of the pond would change. A reduced groundwater discharge to the pond could result in lower water levels, reduced water quality, and adverse ecological effects.

- Buildup of groundwater behind low permeability side slope cover would result in unbalanced hydrostatic heads and could contribute to side slope cover failure.

- Buildup of groundwater behind low permeability side slope cover has the potential to increase contact between debris and groundwater and the possibility of leaching.

- The effect of raising the water table in the vicinity of the landfill on groundwater quality at Patton Well is not known.

To maintain undisturbed groundwater discharge to Cold Spring Brook Pond, it is proposed to construct a riprap side slope on the north side of the landfill. A trench would be excavated through the layer of sediment at the bottom of the pond to the underlying sand layer to provide a stable footing for the riprap. A representative cross section through the proposed cover system showing a conceptual layout of the cover system north side slope is shown in Figure 8-5. It is proposed that the riprap slope extend as high as possible, at a slope of 1.5 or 2 to 1 and that areas with 3 to 1 slope be held to a minimum. Use of riprap material should enable construction of a stable slope steeper than 3 to 1. During the cover system design, a natural filter should be designed to prevent siltation or erosion below the groundwater table. In addition, the weight of the cover system layers and the groundwater uplift pressures should be compared to determine if the cover system needs to be thicker or if the geomembrane requires anchoring.

The proposed design does not include a gas venting layer because the construction debris in the Cold Spring Brook Landfill is not anticipated to generate landfill gas. Furthermore, the proposed placement of riprap on the north side of the landfill would allow landfill gas to escape and prevent gas accumulation, achieving the intent of 310 CMR 19.112.

To meet the desired performance standards, the proposed cover system would consist of the following components from bottom to top:

- subgrade fill
- geomembrane
- drainage layer
- geotextile
- moisture retention layer
- vegetative cover layer

Prior to placement of cover system layers, trees on the landfill surface would be cleared. In addition, grading of the landfill material and surface soil and addition of clean subgrade fill would be required to achieve cover design slopes. Subgrade fill would be free of materials that may damage or abrade the geomembrane and be of sufficient thickness to collect all solid waste. Regulations 310 CMR 19.112 specify a minimum top slope of 5 percent, and a maximum side slope of three horizontal to one vertical. However, as discussed previously, a more shallow top slope and a steeper side slope are proposed for at Cold Spring Brook Landfill. In addition to achieving required slopes, grading would cover or move any pieces of concrete or metal protruding from the surface of the landfill, and would sufficiently fill void spaces in the upper portion of the debris to create a stable base on which to place the cover system. Because of the makeup and age of the landfill debris, problems are not expected from future settling and subsidence. To grade the landfill surface effectively, some of the larger pieces of concrete and asphalt pavement may need to be broken up.

The majority of the cover system can be placed with equipment working from the graded landfill surface. However, to complete the cover system at the toe of the slope, a temporary access road may be required along the northeastern edge of the landfill, within the limits of Cold Spring Brook Pond. To construct this access road, the pond may require partial dewatering, or, alternately, installation of coffer dams and groundwater pumping to enable access by construction equipment.

To promote stormwater runoff from the cover system, top slopes would be graded down to the north, east and west as much as feasible. Little stormwater run-on to the cover system is anticipated from Patton Road and areas south of the landfill because the soil in the vicinity is sandy. A shallow, unlined drainage swale could be constructed along the southern edge of the cover system to direct stormwater from Patton Road around the cover system to Cold Spring Brook Pond (see Figure 8-3). However, runoff from the cover would be expected to infiltrate rapidly, pre-empting the need for the drainage swale in the first place. Stormwater calculations would be conducted during design to determine the required extent of stormwater controls.

A textured geomembrane is proposed for the hydraulic barrier of the landfill cover. The hydraulic barrier would have a maximum in-place saturated hydraulic conductivity of 1×10^{-7} centimeter per second (cm/sec) and be placed above the subgrade fill.

A 12-inch minimum thickness drainage layer with a minimum hydraulic conductivity of 1×10^{-3} cm/sec would be placed above the geomembrane to promote lateral drainage and minimize accumulation of water above the geomembrane. The drainage layer would direct intercepted infiltration to the perimeter of the cover and ultimately to Cold Spring Brook Pond.

A layer of geotextile will be placed above the drainage layer to prevent the migration of fines to the drainage layer.

An 18-inch layer of moisture retention soil will be placed above the geotextile. The moisture retention layer will protect underlying layers from the adverse effects of desiccation, extreme temperatures, frost, and erosion.

A 6-inch layer of soil capable of supporting grass growth would be placed above the filter layer. This soil should contain some fines to improve its capacity to hold water, and it would be seeded, fertilized and mulched to promote a stable vegetative cover.

This cover system results in a total soil thickness of 36 inches above the hydraulic barrier layer. This is less than the estimated frost depth for central Massachusetts of approximately 4 feet (U.S. Navy, 1982); however, the performance of geomembrane layers is not as sensitive to frost as is clay or clay/soil barriers.

The Army believes this conceptual design meets the general performance standards of 310 CMR 19.112. The conceptual design would be reviewed and refined during the final design phase to optimize the balance between top/side slopes and runoff/drainage concerns.

For the cost estimating purposes of this FS, cover system material quantities have been estimated to include an extension of the cover system layers beyond the limits of landfill debris.

Site restoration. The AOC 9 and AOC 40 sites will be restored by seeding, mulching, and fertilizing the disturbed areas. Wetlands will be left for natural revegetation.

Wetlands Restoration. Remedial activities at AOC 9 and AOC 40 will occupy bordering wetland areas which would be restored in accordance with a Wetland Restoration Specification (WRS) prepared prior to any wetland restoration.

At AOC 40, the northern edge of the low-permeability cover system, and the additional length of access road proposed for this alternative would extend beyond the limits of the landfill into Cold Spring Brook Pond. Areas of sediment excavation, temporary access road construction, and ditch excavation at the toe of the cover system would be backfilled and graded, and some areas potentially revegetated. For cost estimating purposes, the extent of wetland restoration associated with landfill capping and sediment removal is assumed to be approximately 1.5 acres. This area would increase to an estimated 2.5 acres of the landfill was excavated for subsequent disposal/consolidation. The WRS would incorporate guidelines from the Massachusetts Wetland Protection Act and Regulations, specifically 310 CMR 10.55. The primary goal of wetland restoration activities at Cold Spring Brook Pond and the surrounding wetland area would be to restore self-sustaining freshwater wetlands in situ (i.e., in the same "footprint" as the altered wetlands).

Restoration of wetlands at Cold Spring Brook Pond would:

- reduce the long-term impacts of activities in and adjacent to the wetlands;

- compensate for losses of wetland habitats;

- restore or replace degraded wetlands; and

- meet state and federal permitting and regulatory guidelines and requirements.

At Cold Spring Brook Pond and the surrounding wetland area, it is anticipated that required wetland restoration would be relatively minor. The areas of sediment excavation within the pond would require backfilling to pre-remediation grade. Restoration in the wetland area on the northwest side of Cold Spring Brook Landfill, where an access road may be placed, would require removal of road materials, backfilling and grading to match the pre-remediation grade, and potentially revegetating the disturbed area.

Based on regulatory guidelines, including 310 CMR 10.55 and wetlands regulations regarding restoration, the WRS should include: careful consideration of Cold Spring Brook Pond hydrology, topography, vegetation, and soil characteristics; evaluation of wetlands functional assessment; examination of regional wetlands replacement literature; consultation with regulatory and technical authorities; and experience with similar wetland restoration projects. This WRS would be prepared in accordance with state and federal technical requirements for wetland alteration. Development of the WRS may depend on terms described in the IAG between the U.S. Army and the USEPA (USEPA, 1991b). The WRS would include a detailed description of all proposed activities, a discussion of goals based on wetland functional attributes, and a long-term monitoring plan (which would be combined with the proposed biomonitoring).

The goal of wetlands restoration would be to restore the wetland within the same footprint to achieve at a minimum, the same values and functions as determined by the evaluation used to assess the functions and values of the Cold Spring Brook wetland.

It is difficult to estimate the costs of implementing the WRS until it has been developed and approved, and state and federal regulatory requirements are better defined. For cost-estimating purposes of this FS, a cost of $50,000 per acre is assumed for wetland restoration activities, including soil replacement, revegetation, monitoring, and maintenance.

Institutional Controls. Institutional controls for AOC 9 and AOC 40 are proposed in the form of land use restrictions for any property released by the U.S. Army during Fort Devens base closure activities. The Devens Reuse Plan, Main and North Posts (VHB, 1994) has proposed that U.S. Army land north of Patton Road, including Cold Spring Brook Landfill and Cold Spring Brook Pond, would be zoned as open space.

By preempting residential use, these controls will help limit human exposure. In addition, the U.S. Army will place land use restrictions at AOCs 9, 11, and 40 in conformance with 310 CMR 19.141. This, in combination with long-term groundwater monitoring, would protect potential human receptors from potential future releases to groundwater. These controls would be drafted, implemented and enforced in cooperation with state and local government.

Cover System Monitoring and Maintenance. Massachusetts Solid Waste Management Regulations (310 CMR 19.142) require the post-closure monitoring period to extend a minimum of 30 years. Proposed cover system monitoring and maintenance at AOC 9 and AOC 40 would consist of conducting annual site inspections, performing needed cover system repairs, and mowing.

Inspections would be conducted to ensure the integrity of the landfill cover system layers, surface water diversion trenches, monitoring wells, access roads, and the general site conditions. Required maintenance activities would be proposed and conducted based on information from site inspections.

Groundwater monitoring is proposed to confirm that groundwater quality will remain acceptable over time. For AOC 9, a minimum of one upgradient and three downgradient monitoring wells is assumed for cost estimating. All monitoring wells would be sampled and analyzed semi-annually consistent with the monitoring requirements of 310 CMR 19.132 for a minimum of 30 years. Assumptions made for this monitoring plan are for cost estimating purposes only. A final detailed monitoring plan would be developed in conjunction with regulatory agency review and comment.

At Cold Spring Brook Landfill, AOC 40, extra monitoring wells would be used to detect potential contaminant migration toward Patton Well. Five existing monitoring wells, CSB-1, CSB-2, CSB-3, CSM-93-2A, and CSM-93-02B, plus the two newly installed downgradient wells, would be sampled and analyzed semi-annually.

Landfill gas monitoring is not proposed at Cold Spring Brook Landfill. The construction debris at the landfill is not expected to generate landfill gas, and ambient air monitoring during the RI did not identify VOCs above background at the landfill.

Five-year Site Reviews. Under CERCLA 121c, any remedial action (or lack thereof) that results in contaminants remaining on-site must be reviewed at least every five years. Data collected during the groundwater monitoring program would provide information for these reviews. The reviews would evaluate whether Alternative 2 is protective of human health and the environment and whether additional remedial actions should be initiated.

8.2.2 Detailed Evaluation of Alternative 2

The following subsections present an assessment of Alternative 2 according to the seven evaluation criteria.

8.2.2.1 Overall Protection of Human Health and the Environment. The following paragraphs assess how the proposed actions of Alternative 2 would provide protection of human health and the environment.

SA 6. Overall protection of human health and the environment is similar to that discussed for the NFA Alternative in Subsection 8.1.2.1.

AOC 9. Installation of a low permeability cover at AOC 9 would remove potential physical hazards to occasional site visitors, limit human and ecological exposure to surface soils, and reduce infiltration of precipitation which could potentially leach contaminants from landfill debris and contaminate groundwater. Implementation of a long-term groundwater monitoring program and five-year site review would provide a means to assess the affect of potential future releases of contaminants on groundwater. However, it is the Army's interpretation that there is no significant risk to human health and the environment posed by environmental contamination at AOC 9. Therefore, the risk reduction benefit from capping AOC 9 is considered low.

AOC 11. Removal and disposal of surface debris would remove potential physical hazards to occasional site visitors. Because potential human health risks were within or below the USEPA target values, the human health risk-reduction benefit is considered low. No actions would be included to reduce or monitor potential ecological risk from exposure to wetland soil/sediment or surface water.

SA 12. Similar to the NFA Alternative, this alternative would provide protection of human health. However, interpreted environmental risks would not be addressed.

SA 13. Similar to the NFA Alternative, this alternative would provide protection of human health and the environment. However, interpreted environmental risks would not be addressed.

AOC 40. Alternative 2 protects human health and the environment under both current and future land use conditions. As stated previously, no current residential groundwater exposure or risk exists at Cold Spring Brook Landfill.

This alternative relies on institutional controls in the form of land use restrictions to control potential future residential exposure to groundwater at Cold Spring Brook Landfill. Removal and disposal of discarded 55-gallon drums would remove associated physical hazards and prevent them from acting as a potential source of soil or water contamination.

Installation of a low permeability cover at AOC 40 would remove potential physical hazards to occasional site visitors, and reduce infiltration of precipitation which could potentially leach contaminants from landfill debris. However, the baseline human health risk assessment did not identify significant potential risk from exposure to surface soil, groundwater, surface water, and sediment. Alternative 2 would provide protection of the Patton Well by installing two additional monitoring wells between Patton Well and the landfill and providing long-term monitoring of these and other Cold Spring Brook Landfill monitoring wells. Implementation of a long-term groundwater monitoring program and five-year site reviews would provide a means to assess the affect of potential future releases of contaminants on groundwater as well as monitor potential migration of contaminants toward Patton Well.

Removing sediment from Cold Spring Brook Pond would reduce potential ecological risk from exposure to those sediments.

AOC 41. Similar to the NFA Alternative, this alternative would provide protection of human health and the environment.

8.2.2.2 Compliance with ARARs. Tables 8-2, 8-3, and 8-4 summarize how Alternative 2 will attain ARARs.

8.2.2.3 Long-term Effectiveness and Permanence. The following paragraphs assess the long-term effectiveness and permanence of the proposed actions of Alternative 2.

SA 6. The long-term effectiveness of this alternative is similar to that discussed for the NFA Alternative in Subsection 8.1.2.1.

AOC 9. The long-term effectiveness of a low permeability landfill cover at controlling potential future releases from the unsaturated zone beneath the landfill would depend on maintenance of cap integrity. If adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

A landfill cover system would not reduce potential future releases to groundwater from wastes located in the saturated zone.

AOC 11. Removal of surface debris would provide long-term and effective protection from existing physical hazards. The proposed action would not limit infiltration of precipitation with the potential benefit of reducing contaminant leaching. Portions of the landfill are subject to periodic flooding by the Nashua River which could expose expose currently buried debris, possibly transport it to new locations, and present new exposure hazards or pathways.

SA 12. Similar to the NFA Alternative, this alternative would provide long-term effectiveness at protecting human health. However, long-term environmental protection would not be addressed.

SA 13. Similar to the NFA Alternative, this alternative would provide long-term effectiveness at protecting human health. However, long-term environmental protection would not be addressed.

AOC 40. The long-term effectiveness of the low permeability cover system at controlling potential future releases from the unsaturated zone of the landfill would depend on maintenance of cap integrity. When adequately installed and maintained, low-permeability cover systems have a history of effectively reducing surface infiltration to landfilled waste, promoting surface water drainage, minimizing erosion, and isolating landfilled materials from the environment.

Along the northeastern toe of the Cold Spring Brook Landfill, debris can be seen in contact with water, and it is not known how much debris is in contact with groundwater within the landfill. A landfill cover system would not reduce potential future releases from the saturated zone. Consideration must be given during the design of the toe of the landfill cover system to ensure that groundwater flow to the pond is not interrupted by cover system layers. The long-term effectiveness of this alternative at preventing potential human exposure also depends on enforcement of institutional controls and the long-term groundwater monitoring program.

Excavation, removal, and disposal of hot spot sediments and drums from Cold Spring Brook Pond and the landfill area would eliminate current risk to aquatic and semi-aquatic receptors. Long-term sediment and biomonitoring programs would monitor potential future releases to the pond.

AOC 41. Similar to the NFA Alternative, this alternative would provide long-term effectiveness at protecting human health and the environment.

8.2.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment. The following paragraphs assess the reduction of toxicity, mobility, and volume of contaminants through treatment offered by the proposed actions of Alternative 2.

SA 6. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

AOC 9. Reduction of toxicity, mobility, or volume of contaminants through treatment would not be achieved. By reducing the potential for contaminant leaching in the unsaturated zone, the potential for contaminant migration to groundwater would be reduced.

AOC 11. Reduction of toxicity, mobility, or volume of contaminants through treatment would not be achieved. Removal of surface debris would reduce waste volume at AOC 11; this volume would be transferred to another disposal site, however.

SA 12. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

SA 13. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

AOC 40. Reduction of toxicity, mobility, or volume of landfill contaminants through treatment would not be achieved. By reducing the potential for leaching of landfill materials in the unsaturated zone, the potential for contaminant migration to groundwater would be reduced. No reduction of toxicity, mobility, or volume of groundwater contaminants would be achieved. Sediment and drum removal would not reduce the toxicity or volume of associated contaminants. Disposal of drums and dewatered sediments under the low permeability cover at AOC 9 or at another approved disposal facility would reduce contaminant mobility.

AOC 41. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

8.2.2.5 Short-term Effectiveness. The following paragraphs assess the short-term effectiveness of the actions proposed at each of the landfills.

SA 6. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

AOC 9. This alternative would present minimal short-term risks to workers, the community, and the environment. Risk to the community would be minimal because residences are not close enough to the site to be impacted by noise or dust potentially generated from cover system placement activities. It is anticipated that deliveries can be planned to avoid creating traffic congestion and hazards.

Grading the landfill prior to capping could present potential risk to workers if hazardous materials are uncovered. Exposure to potentially contaminated soil and debris could be reduced to a safe level by worker adherence to general health and safety practices, and use of personnel monitoring during any intrusive activities at the landfill.

AOC 11. This alternative would be expected to present minimal short-term risks to workers, the community, and the environment. Risk to the community would be minimal because residences are not close enough to the site to be impacted by noise or dust potentially generated from debris removal activities. It is anticipated that debris removal activities can be planned to avoid creating traffic congestion and hazards.

Grading the landfill prior to capping could present potential risk to workers if hazardous materials are uncovered. Exposure to potentially contaminated soil and debris could be reduced to a safe level by worker adherence to general health and safety practices, and use of personnel monitoring during any intrusive activities at the landfill.

SA 12. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

SA 13. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

AOC 40. This alternative would present minimal short-term risks to workers and the community, but would present some short-term risks to the environment. Risk to the community would be minimal because residences are not close enough to the site to be impacted by noise or dust potentially generated from cover system placement activities. Several routes and entry points to Devens exist, and it is anticipated that delivery of construction materials can be planned to avoid creating traffic congestion and hazards. In addition, rerouting of traffic on the section of Patton Road south of the Cold Spring Brook Landfill would be evaluated. Inclusion of this section of the road and an area to the south of Patton Road included in the exclusion zone used during cover system placement and sediment and drum removal would facilitate remedial activities.

Grading the landfill prior to capping could present potential risk to workers if hazardous materials are uncovered. Exposure to potentially contaminated soil and debris could be reduced to a safe level by worker adherence to general health and safety practices, and use of personnel monitoring during any intrusive activities at the landfill.

Implementation of Alternative 2 will result in several short-term adverse effects to the environment. The installation of the proposed cover system would require cutting and clearing the established tree and grassed areas. This would temporarily displace current biota and destroy their habitat. Reconstruction of the landfill slope leading down to Cold Spring Brook Pond would require some excavation in the pond and possibly the construction of a temporary access road along the edge of the pond. This and proposed sediment removal activity would destroy existing wetland habitat. The vegetation of the landfill cover and wetland restoration program would restore/replace these affected areas.

No endangered species or species of special concern are known to occur at Cold Spring Brook Pond. However, silt fence or a floating boom weighted at the bottom and placed around the areas of sediment excavation would minimize sediment contaminant migration beyond the excavation boundaries. Wetland restoration in disturbed areas would mitigate short-term impact and minimize long-term impact to the environment. Because the disturbed areas would be relatively small compared to Cold Spring Brook Pond and bordering wetland, adverse community effects, although possible, are unlikely.

AOC 41. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

8.2.2.6 Implementability. The following paragraphs assess the implementability of the actions proposed at each of the landfills.

SA 6. Similar to the NFA Alternative, this alternative is readily implementable at SA 6.

AOC 9. Placement of land use restrictions on property currently owned by the U.S. Army would be easily implemented upon property transfer. The filing of a Record Notice of Landfill Operation, in conformance with 310 CMR 19.141, is an easily implementable land use restriction.

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Materials required to construct a low-permeability cover system are readily available. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

According to the NCP, no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA, although coordination with review agencies is recommended. Placement of the cover system would not require any permits, because it is an on-site activity. During construction of the cover system, stormwater runoff would be controlled to minimize erosion and potential surface water contamination.

Compliance with the post-closure long-term monitoring and maintenance requirements of 310 CMR 19.000 increases the administrative burden and complexity of this alternative and makes implementation more difficult.

AOC 11. Placement of restrictions on property currently owned by the U.S. Army would be easily implemented in the event of property transfer. The filing of a Record Notice of Landfill Operation, in conformance with 310 CMR 19.141, is an easily implementable land use restriction.

Debris removal would not increase the scope of potential future remedial actions at the site.

According to the NCP, no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA, although coordination with review agencies is recommended. Debris removal would not require any permits, because it is an on-site activity. During debris removal, stormwater runoff would be controlled to minimize erosion and potential surface water contamination.

SA 12. Similar to the NFA Alternative, this alternative is readily implementable at SA 12.

SA 13. Similar to the NFA Alternative, this alternative is readily implementable at SA 13.

AOC 40. Placement of land use restrictions on property currently owned by the U.S. Army would be easily implemented upon property transfer. The filing of a Record Notice of Landfill Operation, in conformance with 310 CMR 19.141, is an easily implementable land use restriction. Equipment required to excavate and handle sediment, remove and handle 55-gallon drums and potentially construct a temporary access road at the Cold Spring Brook Landfill is conventional in nature, and contractors are readily available. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions.

Discarded 55-gallon drums would be disposed of at AOC 9 or at an off-site TSD facility if drum contents displayed hazardous characteristics. Sediment would require dewatering to eliminate free water prior to disposal at AOC 9. Some sediments may exhibit hazardous characteristics, and would require disposal at a licensed landfill or incinerator. Off-site services should have sufficient capacity for the relatively small volume of sediments requiring disposal.

According to the NCP, no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA, although coordination with review agencies is recommended. Because remedial actions for this alternative will be conducted on-site, permits would not be required for sediment dredging or discharge of water from dewatered sediment to Cold Spring Brook Pond. However, consultation with the local conservation commission in accordance with Massachusetts Wetlands Protection Regulations (310 CMR 10.000) may be required prior to constructing an access road at the northwestern toe of the landfill. In addition, dredging of sediment in Cold Spring Brook Pond will have to be done in accordance with the technical requirements of the Massachusetts Water Quality Certification for Dredging (314 CMR 9.00).

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Materials required to construct a low-permeability cover system include approximately 14,200 cy of sand, 9,600 cy of common borrow, 7,100 cy of vegetative soil, 2,250 cy of riprap, and 192,000 sf of geomembrane, all of which are readily available. Post-closure monitoring and maintenance are easily implementable.

Partial dewatering of the Cold Spring Brook Pond, and construction of a temporary access road are implementable, but would require extra engineering precautions and time to create a stable work platform and cover footing while minimizing impacts to the pond and associated wetland. To stabilize the toe of the slope of the cover system, it would most likely be necessary to excavate to stable sands beneath the sediment.

Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

Placement of the cover system would not require any permits, because it is an on-site activity. During construction of the cover system, stormwater runoff would be controlled to minimize the quantity of sediments and contaminants entering the pond.

Compliance with the post-closure long-term monitoring and maintenance requirements of 310 CMR 19.000 increases the administrative burden and complexity of this alternative and makes implementation more difficult.

AOC 41. Similar to the NFA Alternative, this alternative is readily implementable at AOC 41.

8.2.2.7 Cost. The cost estimate for Alternative 2 includes estimates of direct and indirect capital costs and O&M costs. Direct capital costs for this alternative include site preparation, debris and sediment excavation, drum removal, cap construction, site restoration and monitoring wells installation. A 25 percent contingency is included in direct cost items to account for unforeseen project complexities (e.g., adverse weather conditions and inadequate site characterization).

O&M costs include landfill cover maintenance, and environmental monitoring for groundwater, wetlands and sediment.

Table 8-5 summarizes the cost estimate for Alternative 2. The total capital cost (direct plus indirect costs) is estimated to be $6,633,000. O&M costs are estimated to be $89,000 per year.

To enable evaluation of costs that would occur over different time periods, the table also includes a present worth analysis. Present worth represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 7 percent before taxes and after inflation is used as recommended in USEPA's Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-20. Unless noted otherwise, costs are based on a 30-year time frame. Cost calculations are included in Appendix D.

8.3 ALTERNATIVE 3: NO FURTHER ACTION AT AOC 41, AND SAS 6, 12, AND 13; AND CAP-IN-PLACE AT AOCS 9, 11, AND 40

This subsection describes Alternative 3, evaluates the alternative using the seven evaluation criteria, and provides a cost estimate.

8.3.1 Description of Alternative 3

This alternative includes different types of management at the seven disposal sites. At AOC 41, and SAs 6, 12, and 13 NFA is taken. At AOCs 9, 11, and 40 a cap is placed over the debris. AOC 9 will have some consolidation of debris to minimize the size of the cap. Alternative 3 also includes removing exposed drums at AOC 40 to remove a potential source of contamination, and excavation of sediment from two hot spots in Cold Spring Brook Pond, to reduce ecological risk from exposure to contaminated sediments. These actions at AOC 40 were described previously in the FS for AOC 40 (ABB-ES, 1994b).

Key components of Alternative 3 include:

No Further Action at AOC 41, SAs 6, 12, 13

- No action

Cap-in-Place AOCs 9, 11, 40

- Mobilization/demobilization;
- Site preparation;
- Sediment removal and disposal at AOC 40;
- Drum removal and disposal; at AOC 40;
- Consolidate debris areas at AOC 9;
- Cap construction;
- Site restoration;
- Wetland restoration;
- Institutional controls;
- Cover system monitoring and maintenance; and

- Five-year site reviews.

8.3.1.1 Description of No Further Action Components for Alternative 3. The NFA is similar to that discussed for Alternative 1, Subsection 8.1.1.

8.3.1.2 Description of Cap-In-Place Components for Alternative 3.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site Preparation. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Sediment removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Drum removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Consolidate debris areas at AOC 9. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cap construction. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3. The cap for AOC 11 is similar to that described for AOC 9 and will include riprap for erosion control over the portion of the cap along the Nashua River. a plan view of AOC 11 is shown on Figure 8-6.

Site restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Wetland restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Institutional controls. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cover system monitoring and maintenance. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Five-year site reviews. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.3.2 Detailed Evaluation of Alternative 3

The following subsections present an assessment of Alternative 3 according to the seven evaluation criteria.

8.3.2.1 Overall Protection of Human Health and the Environment. The following paragraphs assess how the proposed actions of this alternative would provide protection of human health and the environment.

SA 6. Overall protection of human health and the environment is similar to that discussed for the NFA Alternative in Subsection 8.1.2.1.

AOC 9. Overall protection of human health and the environment is similar to that discussed in Subsection 8.2.2.1.

AOC 11. Installation of a low permeability cover at AOC 11 would remove potential physical hazards to occasional site visitors, limit human and ecological exposure to surface soils, and reduce infiltration of precipitation which could potentially leach contaminants from landfill debris and contaminate groundwater. Implementation of a long-term groundwater monitoring program and five-year site review would provide a means to assess the affect of potential future releases of contaminants on groundwater.

SA 12. Similar to the NFA Alternative, this alternative would provide protection of human health. However, interpreted environmental risks would not be addressed.

SA 13. Similar to the NFA Alternative, this alternative would provide protection of human health. However, interpreted environmental risks would not be addressed.

AOC 40. Overall protection of human health and the environment is similar to that discussed in Subsection 8.2.2.1.

AOC 41. Similar to the NFA Alternative, this alternative would provide protection of human health and the environment.

8.3.2.2 Compliance with ARARs. Tables 8-6, 8-7, and 8-8 summarize how Alternative 3 will attain ARARs.

8.3.2.3 Long-term Effectiveness and Permanence. The following paragraphs assess the long-term effectiveness and permanence of the proposed actions of this alternative.

SA 6. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.1.1.3.

AOC 9. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.2.2.3.

AOC 11. The long-term effectiveness of a low permeability landfill cover at controlling potential future releases from the unsaturated zone beneath the landfill would depend on the maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment. Portions of the low permeability cover would likely be subject to periodic flooding by the Nashua River and could be washed away.

SA 12. Similar to the NFA Alternative, this alternative would provide long-term effectiveness at protecting human health. However, long-term environmental protection would not be addressed.

SA 13. Similar to the NFA Alternative, this alternative would provide long-term effectiveness at protecting human health. However, long-term environmental protection would not be addressed.

AOC 40. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.2.2.3.

AOC 41. Similar to the NFA Alternative, this alternative would provide long-term effectiveness at protecting human health and the environment.

8.3.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment. The following paragraphs assess the reduction of toxicity, mobility, and volume of contaminants through treatment offered by the proposed actions of this alternative.

SA 6. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

AOC 9. The reduction in toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.2.2.4.

AOC 11. Reduction of toxicity, mobility, or volume of contaminants through treatment would not be achieved. By reducing the potential for contaminant leaching in the unsaturated zone, the potential for contaminant migration to groundwater would be reduced.

SA 12. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

SA 13. Similar to the NFA Alternative, no reduction of toxicity, mobility, or volume of contaminants would be achieved through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

AOC 40. The reduction in toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.2.2.4.

AOC 41. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

8.3.2.5 Short-term Effectiveness. The following paragraphs assess the short-term effectiveness of the actions proposed at each of the landfills.

SA 6. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

AOC 9. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.2.2.5.

AOC 11. This alternative would be expected to present minimal short-term risks to workers, the community, and the environment. Risk to the community would be minimal because residences are not close enough to the site to be impacted by noise or dust potentially generated from cover system placement activities. It is anticipated that deliveries can be planned to avoid creating traffic congestion and hazards.

Grading the landfill prior to capping could present potential risk to workers if hazardous materials are uncovered. Exposure to potentially contaminated soil and debris could be reduced to a safe level by worker adherence to general health and safety practices, and use of personnel monitoring during any intrusive activities at the landfill.

SA 12. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

SA 13. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

AOC 40. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.2.2.5.

AOC 41. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

8.3.2.6 Implementability. The following paragraphs assess the implementability of the actions proposed at each of the landfills.

SA 6. Similar to the NFA Alternative, this alternative is readily implementable at SA 6.

AOC 9. The implementability of this alternative is similar to that discussed in Subsection 8.2.2.6.

AOC 11. Placement of land use restrictions on property currently owned by the U.S. Army would be easily implemented upon property transfer. The filing of a Record Notice of Landfill Operation, in conformance with 310 CMR 19.141, is an easily implementable land use restriction.

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Materials required to construct a low-permeability cover system are readily available. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

According to the NCP, no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA, although coordination with review agencies is recommended. Placement of the cover system would not require any permits, because it is an on-site activity. During construction of the cover system, stormwater runoff would be controlled to minimize erosion and potential surface water contamination.

Compliance with the post-closure long-term monitoring and maintenance requirements of 310 CMR 19.000 increases the administrative burden and complexity of this alternative and makes implementation more difficult.

SA 12. Similar to the NFA Alternative, this alternative is readily implementable at SA 12.

SA 13. Similar to the NFA Alternative, this alternative is readily implementable at SA 13.

AOC 40. The implementability of this alternative is similar to that discussed in Subsection 8.2.2.6.

AOC 41. Similar to the NFA Alternative, this alternative is readily implementable at AOC 41.

8.3.2.7 Cost. The cost estimate for Alternative 3 includes estimates of direct and indirect capital costs and O&M costs. Direct capital costs included for this alternative include site preparation, sediment and debris excavation, drum removal, cap construction, site restoration and monitoring well installation. A 25 percent contingency is included in direct cost items to account for unforeseen project complexities (e.g., adverse weather conditions and inadequate site characterization).

O&M costs include landfill cover maintenance, and environmental monitoring of groundwater, wetlands and sediment.

Table 8-9 summarizes the cost estimate for Alternative 3. The total capital cost (direct plus indirect costs) is estimated to be $8,226,000. O&M costs are estimated to be $112,000 per year.

To enable evaluation of costs that would occur over different time periods, the table also includes a present worth analysis. Present worth represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 7 percent before taxes and after inflation is used as recommended in USEPA's OSWER Directive 9355.3-20.

Unless noted otherwise, costs are based on a 30-year time frame. The estimated total present worth is $9,507,000. Cost calculations are included in Appendix D.

8.4 ALTERNATIVE 4: NO FURTHER ACTION AT AOC 41, AND SAS 6, 12, AND 13; LIMITED REMOVAL AT AOC 11 (DISPOSAL IN CONSOLIDATION LANDFILL); AND EXCAVATION AND CONSOLIDATION OF AOCS 9 AND 40

8.4.1 Description of Alternative 4

Alternative 4 proposes removal of surface debris from AOC 11, excavating construction/demolition debris from AOC 9 and AOC 40, and consolidating the debris in a proposed secure landfill near Shepley's Hill Landfill. Based on available information, these areas contain non-hazardous debris only. The AOCs will be treated as construction debris landfills.

Alternative 4 also includes removing exposed drums at Cold Spring Brook Landfill (AOC 40) to remove a potential source of contamination, and excavating sediment from two hot spots in Cold Spring Brook Pond, to reduce ecological risk from exposure to contaminated sediments. These actions were described previously in the FS for AOC 40 (ABB-ES, 1994b).

The key components of Alternative 4 include:

<u>No Further Action at AOC 41, SAs 6, 12, 13</u>

- No action

<u>Limited Removal at AOC 11</u>

- Mobilization/demobilization;
- Excavation of debris and transportation to the Consolidation Landfill;
- Backfilling site; and
- Site restoration.

Excavation and Consolidation of AOCs 9 and 40

- Mobilization/demobilization;
- AOC 40 sediment removal and disposal;
- AOC 40 drum removal and disposal;
- Debris excavation and backfill at AOCs 9 and 40;
- Wetlands restoration;
- Consolidation of excavated debris at consolidation landfill;
- Institutional controls;
- Cover system monitoring and maintenance at consolidation landfill; and
- Five-year site reviews;

8.4.1.1 Description of No Further Action Components for Alternative 4. NFA is similar to that discussed for Alternative 1, Subsection 8.1.1.

8.4.1.2 Description of Limited Removal Components for Alternative 4.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Excavation of debris and transportation to the Consolidated Landfill. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Backfilling site. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.4.1.3 Description of Excavate and Consolidate AOC 9 and AOC 40 Components for Alternative 4.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site Preparation. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Sediment Removal and Disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Drum Removal and Disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Debris Excavation and Backfill at AOCs 9 and 40. A total debris volume of approximately 222,000 cy will be generated by excavation from AOC 9 (112,000 cy) and AOC 40 (110,000 cy). The basis of the debris volumes is presented in Appendix B.

As presented in Section 1, the estimated volumes are based primarily on observations during test pit/trench excavations. Debris will be removed with excavators with the possible necessity of specialized equipment for AOC 40, due to the steep slopes at these areas. Erosion control measures will be used at all excavations, especially those adjacent to wetlands, to prevent impacts to surrounding areas. These measures may include silt fences, hay bales, and polystyrene covers for soil piles left on-site during excavation.

Subsequent to debris removal, the excavation at AOC 9 will be backfilled to correspond to existing topography which existed prior to removal. AOC 40 will be backfilled to match a 2:1 slope from Patton Road down to Cold Spring Brook Pond. The required backfill will be from an off-site borrow source.

Wetlands Restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Consolidation of Excavated Debris at Consolidation Landfill. The preferred site for the Consolidation Landfill is an open, sandy borrow area east of Shepley's Hill Landfill (see Figure 8-8). The site covers approximately 12 acres, bounded on the north by Plow Shop

Pond, on the west and south by Shepley's Hill Landfill, and on the east by the Army reservation boundary.

This area was selected because of its large size and favorable location in an area that would have minimal impact on human health. The area is not visible from main roads or public areas, so it would not adversely impact the aesthetic value of the surrounding property. The Shepley's Hill Landfill site is accessible off Carey Street on the Main Post. However, access to the site would need to be significantly improved for truck traffic, because the current access road is narrow and unpaved. Utilities are not available on site. A drainage swale from the existing landfill crosses the site and would require rerouting and culvert installations to permit facility construction.

Hydrogeology at the Shepley's Hill area has been studied extensively, and much information has been documented in previous reports. A compilation of this data is provided in Appendix E consistent with the requirements for a Hydrogeological Study derived in the Massachusetts Solid Waste Regulation (310 CMR 19.104.(3)).

The Consolidation Landfill would be constructed near Shepley's Hill Landfill to accommodate debris from the disposal areas at Devens. Design for construction, operation, and closure of the landfill would be carried out in accordance with the Massachusetts Solid Waste Management Facility Regulations 310 CMR 19.000 Parts I and II. This alternative assumes that the Consolidation Landfill would be constructed prior to excavation at the debris areas.

The conceptual design for the Consolidation Landfill complies with the requirements of 310 CMR 19.110 and 19.112. If this alternative is selected, alternative design components and methodologies to improve performance and/or reduce costs should be evaluated during the design phase.

The cost estimate for this alternative, presented in Appendix D, is based on construction of an approximately 7-acre landfill with enough capacity for the estimated 222,000 cy of debris from AOCs 9 and 40. For estimating purposes, the daily cover was estimated to be

10 percent of the total volume to be landfilled and the final cover would be 5 ft thick. The estimated volume would be approximately 304,000 cy.

The conceptual Consolidation Landfill used for cost estimating is, approximately 550 ft by 550 ft, and has three-horizontal to one-vertical side slopes maximum, 5 percent top slope minimum, and 2 percent bottom slope. The landfill height would be approximately 50 ft above existing grade. Figures 8-9 and 8-10 show the plan and cross-sectional views of the Consolidation Landfill, respectively. The basis for the Consolidation Landfill footprint and elevations is presented in Appendix B. A geotechnical evaluation was made for settlement, slope stability under static and seismic conditions, and for geosynthetic-soil interface stability. The geotechnical evaluation is presented in Appendix F.

The conceptual Consolidation Landfill includes a groundwater protection system to: (1) provide an effective hydraulic barrier preventing leachate from reaching groundwater, and (2) to collect landfill leachate for disposal. The groundwater protection system would consist of a composite hydraulic barrier layer (low permeable soil layer and geomembrane), a drainage layer with leachate collection pipes, a buffer soil layer, and a geotextile fabric. The purpose of the fabric is to prevent clogging of the leachate collection soil layers caused by potential migration of fine particles contained within the landfilled debris. The composite hydraulic barrier would consist of 24 inches of compacted soil with a maximum in-place saturated hydraulic conductivity of $1x10^{-7}$ cm/sec, overlain by a 60-mil geomembrane (Figure 8-11). A 12-inch sand drainage layer is proposed above the geomembrane. The drainage layer would have a minimum hydraulic conductivity of $1x10^{-2}$ cm/sec with leachate collection pipes spaced 50 ft on center. The sand drainage layer and the leachate collection pipes would provide a high permeability pathway for leachate collection. The 12-inch buffer soil layer above the sand layer would have a minimum hydraulic conductivity of $1x10^{-3}$ cm/sec. Leachate collected in the landfill could be removed by pumping the leachate directly from the leachate collection system into tanker trucks for transport to an approved wastewater treatment facility for disposal.

When debris disposal is complete, the landfill will be closed and a low-permeability cover system constructed. Figure 8-11 shows the groundwater protection and cover system build-up used for cost estimating. A 12-inch minimum subgrade buffer soil will be placed over the debris to prevent penetration of the overlying geomembrane. A 12-inch sand drainage layer with a minimum hydraulic conductivity of 1×10^{-3} cm/sec would overlay the geomembrane. An 18-inch common borrow soil with 15-35 percent fines would overlay the drainage soil for moisture retention and protection of the geomembrane against heaving from frost. A geotextile fabric would separate the moisture retention soil layer from the drainage soil layer. The vegetative topsoil layer would be approximately 6 inches cover thick and the moisture retention soil.

Institutional Controls. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cover System Monitoring and Maintenance at Consolidation Landfill. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Five-year Site Reviews. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.4.2 Detailed Evaluation of Alternative 4

The following subsections present an assessment of Alternative 4 according to the seven evaluation criteria.

8.4.2.1 Overall Protection of Human Health and the Environment. The following paragraphs assess how the proposed actions of this alternative would provide protection of human health and the environment.

SA 6. Overall protection of human health and the environment is similar to that discussed for the NFA Alternative in Subsection 8.1.2.1.

AOC 9. This alternative would provide protection of human health and the environment by excavating landfill materials and then disposing of them at the consolidation facility. This would prevent potential future exposure to surface soil and sediment and would prevent potential future releases from landfill debris to groundwater. However, moving the landfill debris to a separate consolidation facility would transfer the risk of potential releases to another location. However, it is the Army's interpretation that there is no significant risk to human health and the environment posed by environmental contamination at AOC 9. Therefore, the risk reduction benefit from excavating and consolidating AOC 9 is considered low.

AOC 11. Similar to Alternative 2, removal and disposal of surface debris would remove potential physical hazards to occasional site visitors. This alternative differs from Alternative 2 in that removed surface debris would be disposed of at the consolidation facility rather than under a low permeability cover at AOC 9. Because the consolidation facility would be lined, disposal at the consolidation facility is theoretically more protective. However, because potential human health risks at AOC 11 were within or below the USEPA target values, the human health risk reduction benefit is considered low. No actions would be included to reduce or monitor potential ecological risk from exposure to wetland soil/sediment or surface water.

SA 12. Similar to the NFA Alternative, this alternative would provide protection of human health. However, interpreted environmental risks would not be addressed.

SA 13. Similar to the NFA Alternative, this alternative would provide protection of human health. However, interpreted environmental risks would not be addressed.

AOC 40. This alternative achieves an acceptable level of risk for human and ecological receptors. The drum and sediment removal components of this alternative would provide the same protectiveness as in Alternative 2; this alternative would prevent potential future releases from landfill debris to groundwater and Cold Spring Brook Pond sediment by excavating the soil and debris from the Cold Spring Brook Landfill, and disposing it in the Consolidation Landfill. However, moving the landfill debris to a separate consolidation facility would transfer the risk of potential releases to another location.

AOC 41. Similar to the NFA Alternative, this alternative would provide protection of human health and the environment.

8.4.2.2 Compliance with ARARs. Tables 8-10, 8-11, and 8-12 summarize how Alternative 4 will attain ARARs.

8.4.2.3 Long-term Effectiveness and Permanence. The following paragraphs assess the long-term effectiveness and permanence of the proposed actions of this alternative.

SA 6. The long-term effectiveness of this alternative is similar to that discussed for the NFA Alternative in Subsection 8.1.2.3.

AOC 9. Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

AOC 11. The long-term effectiveness of this alternative is similar to that discussed in Subsection 8.2.2.3.

SA 12. Similar to the NFA Alternative, this alternative would provide long-term effectiveness at protecting human health. However, long-term environmental protection would not be addressed.

SA 13. Similar to the NFA Alternative, this alternative would not provide long-term effectiveness at protecting human health. However, long-term, environmental protection would not be addressed.

AOC 40. Removal of the landfill as a potential source of future groundwater contamination, and removal of hot spot sediments and drums would effectively prevent human and ecological exposure. The effectiveness of the consolidation facility at isolating Cold Spring Brook Landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

AOC 41. Similar to the NFA Alternative, this alternative would provide long-term effectiveness at protecting human health and the environment.

8.4.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment. The following paragraphs assess the reduction of toxicity, mobility, and volume of contaminants through treatment offered by the proposed actions of this alternative.

SA 6. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

AOC 9. Reduction of toxicity, mobility, or volume of landfill contaminants through treatment would not be achieved. By removing landfill debris, the potential for leaching of landfill materials and contamination of groundwater would be reduced. No reduction of toxicity, mobility, or volume of groundwater contaminants would be achieved. Disposal of excavated landfill debris at a consolidation facility with low permeability liner, leachate collection, and low permeability cover would reduce contaminant mobility.

AOC 11. The reduction in toxicity, mobility, and volume would be similar to that discussed in Subsection 8.2.2.4.

SA 12. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

SA 13. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

AOC 40. Reduction of toxicity, mobility, or volume of landfill contaminants through treatment would not be achieved. By removing landfill debris, the potential for leaching of landfill materials and contamination of groundwater would be reduced. No reduction of toxicity, mobility, or volume of groundwater contaminants would be achieved. Sediment and drum removal would not reduce the toxicity or volume of associated contaminants. Disposal of excavated landfill debris, drums, and dewatered sediments at a consolidation facility with low permeability liner, leachate collection, and low permeability cover would reduce contaminant mobility.

AOC 41. Similar to the NFA Alternative, there would be no reduction of toxicity, mobility, or volume of contaminants through treatment. This alternative would not satisfy the statutory preference for treatment as a component of remedial actions.

8.4.2.5 Short-term Effectiveness. The following paragraphs assess the short-term effectiveness of the actions proposed at each of the landfills.

SA 6. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

AOC 9. This alternative is expected to present minimal risks to workers, the community, and the environment. Transportation of excavated materials would be planned to avoid creating traffic congestion and hazards to the community.

Available information does not suggest the presence of hazardous substances which would present a risk to workers during excavation. Worker adherence to general health and safety practices, and use of personnel monitoring would reduce potential exposure to potentially hazardous substances to a safe level. Excavation of landfilled debris and construction of the consolidation facility could generate dust. Dust suppression techniques would reduce potential risk to workers and the community.

AOC 11. The short-term risks associated are the same as discussed for Alternative 2 in Subsection 8.2.2.5. This alternative differs from Alternative 2 in that removed surface debris would be disposed of at the consolidation facility. This would be expected to present minimal short-term risks, and the overall short-term risk associated with this alternative at AOC 11 would be expected to be minimal.

SA 12. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

SA 13. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

AOC 40. This alternative is expected to present minimal risks to workers, the community, and the environment. Transportation of excavated materials would be planned to avoid creating traffic congestion and hazards to the community. To further protect the community, traffic on Patton Road could be rerouted during removal of soil and debris from the Cold Spring Brook Landfill.

Available information does not suggest the presence of hazardous substances that would present a risk to workers during excavation. Worker adherence to general health and safety practices, and use of personnel monitoring would reduce potential exposure to potentially hazardous substances to a safe level. Excavation of landfilled debris and construction of the consolidation facility could generate dust. Dust suppression techniques would reduce potential risk to workers and the community.

Excavation activities at the Cold Spring Brook Landfill would be conducted to minimize adverse affects on the environment. Excavation would be conducted to minimize pond water entering the excavation. In addition, stormwater runoff and groundwater flow into the excavation would be controlled to minimize the quantity of sediment and contaminants entering the pond. Construction of the temporary access road along the northwest toe of the landfill may adversely affect the environment, but wetland restoration activities would minimize any permanent effect. The consolidation facility would be located and constructed according to regulations to minimize adverse affects on the environment.

AOC 41. Similar to the NFA Alternative, no action would be taken which would present short-term risks to workers, the community, or the environment.

8.4.2.6 Implementability. The following paragraphs assess the implementability of the actions proposed at each of the landfills.

SA 6. Similar to the NFA Alternative, this alternative is readily implementable at SA 6.

AOC 9. Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate debris excavated from AOC 9. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at AOC 9.

All activities to excavate AOC 9 would be conducted on-site, and permits would not be required. Design, construction, operation, closure, and post-closure monitoring and maintenance of the consolidation facility would be conducted according to the technical requirements of Massachusetts 310 CMR 19.000.

Consolidation of this disposal area with others reduce the administrative burden and complexity of implementing the long-term monitoring and maintenance requirements of 310 CMR 19.000 at separate disposal areas.

AOC 11. Similar to Alternative 2 discussed in Subsection 8.2.2.6, this alternative is readily implementable.

SA 12. Similar to the NFA Alternative, this alternative is readily implementable at SA 6.

SA 13. Similar to the NFA Alternative, this alternative is readily implementable at SA 6.

AOC 40. The implementability of sediment and drum removal, and installation and monitoring of groundwater monitoring wells, is similar to that discussed for Alternative 2 in Subsection 8.2.2.6.

Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate Cold Spring Brook Landfill debris. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at Cold Spring Brook Landfill.

All activities to excavate Cold Spring Brook Landfill for this alternative would be conducted on-site, and permits would not be required. At the Cold Spring Brook Landfill, stormwater runoff would be controlled to minimize the quantity of sediments and contaminants entering the pond. Design, construction, operation, closure, and post-closure monitoring and maintenance of the consolidation facility would be conducted according to the technical requirements of Massachusetts 310 CMR 19.000.

Consolidation of this disposal area with others reduce the administrative burden and complexity of implementing the long-term monitoring and maintenance requirements of 310 CMR 19.000 at separate disposal areas.

AOC 41. Similar to the NFA Alternative, this alternative is readily implementable at SA 6.

8.4.2.7 Cost. The cost estimate for Alternative 4 includes estimates of direct and indirect capital costs and O&M costs. Direct capital costs included for this alternative include site preparation, sediment and debris excavation, drum removal, cap construction, site restoration and monitoring well installation. A 25 percent contingency is included in direct cost items to account for unforeseen project complexities (e.g., adverse weather conditions and inadequate site characterization).

O&M costs include landfill cover maintenance, and environmental monitoring of groundwater, wetlands, and sediment.

Table 8-13 summarizes the cost estimate for Alternative 5. The total capital cost (direct plus indirect costs) is estimated to be $16,235,000. O&M costs are estimated to be $56,000 per year.

To enable evaluation costs that would occur over different time periods, the table also includes a present worth analysis. Present worth represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 7 percent before taxes and after inflation is used as recommended in OSWER Directive 9355.3-20. Unless noted

otherwise, costs are based on a 30-year time frame. The estimated total present worth is $16,646,000. Cost calculations are included in Appendix D.

8.5 ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11 (DISPOSAL IN CONSOLIDATION LANDFILL); CAP-IN-PLACE AT AOC 41 AND SAs 6, 12, AND 13; AND EXCAVATION AND CONSOLIDATION OF AOCs 9 AND 40

This subsection describes Alternative 5, evaluates the alternative using the seven evaluation criteria, and provides a cost estimate.

8.5.1 Description Of Alternative 5

Alternative 5 proposes limited removal of debris from AOC 11; capping AOC 41, SAs 6, 12, 13; excavating construction/demolition debris from AOCs 9 and 40; and consolidating the excavated debris in a proposed secure landfill near Shepley's Hill Landfill. Based on available information, these areas contain non-hazardous debris only. The SA/AOCs will be treated as construction debris landfills.

Alternative 5 also includes removing exposed drums at Cold Spring Brook Landfill (AOC 40) to remove a potential source of contamination, and excavating sediment from two hot spots in Cold Spring Brook Pond, to reduce ecological risk from exposure to contaminated sediments. These actions were described previously in the FS for AOC 40 (ABB-ES, 1994b).

The key components of Alternative 5 include:

<u>Limited Removal at AOC 11</u>

- Mobilization/demobilization;
- Excavation of debris and transportation to the Consolidation Landfill;
- Backfilling site; and

- Site restoration.

Cap-in-Place AOC 41, SAs 6, 12, 13

- Mobilization/demobilization;
- Site preparation;
- UXO Monitoring at SAs 6, 12, and AOC 41;
- Cap construction;
- Site restoration;
- Wetland restoration;
- Institutional controls;
- Cover system monitoring and maintenance; and
- Five-year site reviews.

Excavation and Consolidation at AOC 9 and AOC 40

- Mobilization/demobilization;
- AOC 40 sediment removal and disposal;
- AOC 40 drum removal and disposal;
- Debris excavation and backfill at AOCs 9 and 40;
- Wetlands restoration;
- Consolidation of excavated debris at Consolidation Landfill;
- Institutional controls;
- Cover system monitoring and maintenance at Consolidation Landfill; and
- Five-year site reviews;

8.5.1.1 Description of Limited Removal Components for Alternative 5.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Excavation of debris and transportation to the Consolidated Landfill. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Backfilling site. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.5.1.2 Description of Cap-In-Place Components for Alternative 5.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site Preparation. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

UXO Monitoring at SAs 6, 12 and AOC 41. UXO monitoring by professionals trained and experienced in this work is included during excavation at the SAs 6, 12 and AOC 41 debris areas. Indications of spent ordnance (e.g. 45 ACP Ammunition Can and Crate, 40mm Grenade Bandoleer Cups, MK 2 Grenade Fuses, M 14 Stripper Clips) were found during the 1994 test trench investigation at SA 12. SA 12 was used as a Range Control Landfill, and it is uncertain whether other debris areas may contain ordnance. UXO clearance and monitoring would be the responsibility of the remediation contractor.

Cap construction. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3. Plan views of AOC 41, SAs 6, 12 and 13 are shown on Figures 8-12 through 8-18.

Site restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Wetland restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Institutional controls. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cover system monitoring and maintenance. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Five-year site reviews. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.5.1.3 Description of Excavate and Consolidate AOC 9 and AOC 40 Components for Alternative 5.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site preparation. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Sediment removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Drum removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Debris excavation and backfill at AOCs 9 and 40. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3.

Wetlands restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Consolidation of excavated debris at Consolidation Landfill. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3.

Institutional controls. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cover system monitoring and maintenance at Consolidation Landfill. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3.

Five-year site reviews. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.5.2 Detailed Evaluation of Alternative 5

The following subsections present an assessment of Alternative 5 according to the seven evaluation criteria.

8.5.2.1 Overall Protection of Human Health and the Environment. The following paragraphs assess how the proposed actions of this alternative would provide protection of human health and the environment.

SA 6. Installation of a low permeability cover at SA 6 would remove potential physical hazards to occasional site visitors, and reduce infiltration of precipitation which could potentially leach contaminants from landfill debris and contaminate groundwater. Implementation of a long-term groundwater monitoring program and five-year site review would provide a means to assess the affect of potential future releases of contaminants on groundwater. These actions would provide protection of human health and the environment. However, although potential human health and environmental risks at SA 6 have not been evaluated in a PRE or baseline risk assessment, there is no reason to expect risk to human health and the environment at SA 6. Therefore, this alternative is considered to provide little increased protection from the NFA Alternative, and the risk reduction benefit from capping SA 6 is considered low.

AOC 9. Overall protection of human health and the environment is similar to that discussed in Subsection 8.4.2.1.

AOC 11. Overall protection of human health and the environment is similar to that discussed in Subsection 8.4.2.1.

SA 12. Installation of a low permeability cover at SA 12 would remove potential physical hazards to occasional site visitors, limit human and ecological exposure to surface soils, and reduce infiltration of precipitation which could potentially leach contaminants from landfill debris and contaminate groundwater. Implementation of a long-term groundwater monitoring program and five-year site review would provide a means to assess the affect of potential future releases of contaminants on groundwater. These actions would provide protection of human health and the environment.

SA 13. Installation of a low permeability cover at SA 13 would remove potential physical hazards to occasional site visitors, limit human and ecological exposure to surface soils, and reduce infiltration of precipitation, which could potentially leach contaminants from landfill debris and contaminate groundwater. Implementation of a long-term groundwater monitoring program and five-year site review would provide a means to assess the affect of potential future releases of contaminants on groundwater. These actions would provide protection of human health and the environment.

AOC 40. Overall protection of human health and the environment is similar to that discussed in Subsection 8.4.2.1.

AOC 41. Installation of a low permeability cover at AOC 41 would remove potential physical hazards to occasional site visitors, limit human and ecological exposure to surface soils, and reduce infiltration of precipitation which could potentially leach contaminants from landfill debris and contaminate groundwater. Implementation of a long-term groundwater monitoring program and five-year site review would provide a means to assess the affect of potential future releases of contaminants on groundwater. These actions would provide protection of human health and the environment.

8.5.2.2 Compliance with ARARs. Tables 8-14, 8-15, and 8-16 summarize how Alternative 5 will attain ARARs.

8.5.2.3 Long-term Effectiveness and Permanence. The following paragraphs assess the long-term effectiveness and permanence of the proposed actions of this alternative.

SA 6. The long-term effectiveness of a low permeability landfill cover at controlling potential future releases from the unsaturated zone beneath the landfill would depend on maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

AOC 9. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.4.2.3.

AOC 11. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.4.2.3.

SA 12. The long-term effectiveness of a low permeability landfill cover at controlling exposure to surface soil and potential future releases from the unsaturated zone beneath the landfill would depend on maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

SA 13. The long-term effectiveness of a low permeability landfill cover at controlling exposure to surface soil and potential future releases from the unsaturated zone beneath the landfill would depend on the maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

AOC 40. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.4.2.3.

AOC 41. The long-term effectiveness of a low permeability landfill cover at controlling exposure to surface soil and potential future releases from the unsaturated zone beneath the landfill would depend on the maintenance of cap integrity. When adequately installed and maintained, low permeability cover systems have a history of effectively reducing surface infiltration to landfill materials, promoting surface water drainage, minimizing erosion, and isolating landfill materials from the environment.

8.5.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment. The following paragraphs assess the reduction of toxicity, mobility, and volume of contaminants through treatment offered by the proposed actions of this alternative.

SA 6. Reduction of toxicity, mobility, or volume of contaminants through treatment would not be achieved. By reducing the potential for contaminant leaching in the unsaturated zone, the potential for contaminant migration to groundwater would be reduced.

AOC 9. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.4.2.4.

AOC 11. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.4.2.4.

SA 12. Reduction of toxicity, mobility, or volume of contaminants through treatment would not be achieved. By reducing the potential for contaminant leaching in the unsaturated zone, the potential for contaminant migration to groundwater would be reduced.

SA 13. Reduction of toxicity, mobility, or volume of contaminants through treatment would not be achieved. By reducing the potential for contaminant leaching in the unsaturated zone, the potential for contaminant migration to groundwater would be reduced.

AOC 40. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.4.2.4.

AOC 41. Reduction of toxicity, mobility, or volume of contaminants through treatment would not be achieved. By reducing the potential for contaminant leaching in the unsaturated zone, the potential for contaminant migration to groundwater would be reduced.

8.5.2.5 Short-term Effectiveness. The following paragraphs assess the short-term effectiveness of the actions proposed at each of the landfills.

SA 6. This alternative would be expected to present minimal short-term risks to workers, the community, and the environment. Risk to the community would be minimal because residences are not close enough to the site to be impacted by noise or dust potentially generated from cover system placement activities. It is anticipated that delivery of construction of materials can be planned to avoid creating traffic congestion and hazards.

Grading the landfill prior to capping could present potential risk to workers if hazardous materials are uncovered. Exposure to potentially contaminated soil and debris could be reduced to a safe level by worker adherence to general health and safety practices, and use of personnel monitoring during any intrusive activities at the landfill.

AOC 9. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.4.2.5.

AOC 11. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.4.2.5.

SA 12. This alternative would be expected to present minimal short-term risks to workers, the community, and the environment. Risk to the community would be minimal because residences are not close enough to the site to be impacted by noise or dust potentially generated from cover system placement activities. It is anticipated that delivery of construction materials can be planned to avoid creating traffic congestion and hazards.

Grading the landfill prior to capping could present potential risk to workers if hazardous materials are uncovered. Exposure to potentially contaminated soil and debris could be reduced to a safe level by worker adherence to general health and safety practices, and use of personnel monitoring during any intrusive activities at the landfill.

SA 13. This alternative would be expected to present minimal short-term risks to workers, the community, and the environment. Risk to the community would be minimal because residences are not close enough to the site to be impacted by noise or dust potentially generated from cover system placement activities. It is anticipated that delivery of construction can be planned to avoid creating traffic congestion and hazards.

Grading the landfill prior to capping could present potential risk to workers if hazardous materials are uncovered. Exposure to potentially contaminated soil and debris could be reduced to a safe level by worker adherence to general health and safety practices, and use of personnel monitoring during any intrusive activities at the landfill.

AOC 40. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.4.2.5.

AOC 41. This alternative would be expected to present minimal short-term risks to workers, the community, and the environment. Risk to the community would be minimal because residences are not close enough to the site to be impacted by noise or dust potentially generated from cover system placement activities. It is anticipated that delivery of construction materials can be planned to avoid creating traffic congestion and hazards.

Grading the landfill prior to capping could present potential risk to workers if hazardous materials are uncovered. Exposure to potentially contaminated soil and debris could be reduced to a safe level by worker adherence to general health and safety practices, and use of personnel monitoring during any intrusive activities at the landfill.

8.5.2.6 Implementability. The following paragraphs assess the implementability of the actions proposed at each of the landfills.

SA 6. Placement of land use restrictions on property currently owned by the U.S. Army would be easily implemented upon property transfer. The filing of a Record Notice of Landfill Operation, in conformance with 310 CMR 19.141, is an easily implementable land use restriction.

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Materials required to construct a low-permeability cover system are readily available. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

According to the NCP, no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA, although coordination with review agencies is recommended. Placement of the cover system would not require any permits, because it is an on-site activity. Post-closure technical requirements of the Massachusetts Solid Waste Management Regulations (310 CMR 19.000) would be met by this alternative. During construction of the cover system, stormwater runoff would be controlled to minimize erosion and potential surface water contamination.

AOC 9. The implementability of this alternative is similar to that discussed in Subsection 8.4.2.6.

AOC 11. The implementability of this alternative is similar to that discussed in Subsection 8.4.2.6.

SA 12. Placement of land use restrictions on property currently owned by the U.S. Army would be easily implemented upon property transfer. The filing of a Record Notice of Landfill Operation, in conformance with 310 CMR 19.141, is an easily implementable land use restriction.

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Materials required to construct a low-permeability cover system are readily available. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

According to the NCP, no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA, although coordination with review agencies is recommended. Placement of the cover system would not require any permits, because it is an on-site activity. Post-closure technical requirements of the Massachusetts Solid Waste Management Regulations (310 CMR 19.000) would be met by this alternative. During construction of the cover system, stormwater runoff would be controlled to minimize erosion and potential surface water contamination.

SA 13. Placement of land use restrictions on property currently owned by the U.S. Army would be easily implemented upon property transfer. The filing of a Record Notice of Landfill Operation, in conformance with 310 CMR 19.141, is an easily implementable land use restriction.

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Materials required to construct a low-permeability cover system are readily available. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

According to the NCP, no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA, although coordination with review agencies is recommended. Placement of the cover system would not require any permits, because it is an on-site activity. Post-closure technical requirements of the Massachusetts Solid Waste Management Regulations (310 CMR 19.000) would be met by this alternative. During construction of the cover system, stormwater runoff would be controlled to minimize erosion and potential surface water contamination.

AOC 40. The implementability of this alternative is similar to that discussed in Subsection 8.4.2.6.

AOC 41. Placement of land use restrictions on property currently owned by the U.S. Army would be easily implemented upon property transfer.

Cover system construction can be accomplished using standard construction procedures and conventional earthmoving equipment. Many engineering and construction companies are qualified to design and construct a landfill cover system. Materials required to construct a low-permeability cover system are readily available. Post-closure monitoring and maintenance are easily implementable. Installation of the cover system could increase the scope of potential future remedial actions at the site, if these actions required access to the debris.

According to the NCP, no federal, state, or local permits are required for on-site response actions conducted pursuant to CERCLA, although coordination with review agencies is recommended. Placement of the cover system would not require any permits, because it is an on-site activity. Post-closure technical requirements of the Massachusetts Solid Waste Management Regulations (310 CMR 19.000) would be met by this alternative. During construction of the cover system, stormwater runoff would be controlled to minimize erosion and potential surface water contamination.

8.5.2.7 Cost. The cost estimate for Alternative 5 includes estimates of direct and indirect capital costs and O&M costs. Direct capital costs included for this alternative include site preparation, excavation of sediment and debris, drum removal, cap construction, site restoration and monitoring well installation. A 25 percent contingency is included in direct cost items to account for unforeseen project complexities (e.g., adverse weather conditions and inadequate site characterization).

O&M costs include landfill cover maintenance, and environmental monitoring for groundwater, wetlands, and sediment.

Table 8-17 summarizes the cost estimate for Alternative 5. The total capital cost (direct plus indirect costs) is estimated to be $17,843,000. O&M costs are estimated to be $165,000 per year.

To enable evaluation costs that would occur over different time periods, the table also includes a present worth analysis. Present worth represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 7 percent before taxes and after inflation is used as recommended in OSWER Directive 9355.3-20. Unless noted otherwise, costs are based on a 30-year time frame. The estimated total present worth is $19,607,000. Cost calculations are included in Appendix D.

8.6 Alternative 6: Cap-In-Place at AOC 41 and SAs 6, 12, and 13; and Excavation and Consolidation of AOCs 9, 11, and 40

This subsection describes Alternative 6, evaluates the alternative using the seven evaluation criteria, and provides a cost estimate.

8.6.1 Description of Alternative 6

Alternative 6 proposes capping at AOC 41 and SAs 6, 12, 13; excavating debris from AOCs 9, 11, and 40; and consolidating the excavated debris in a proposed secure landfill near Shepley's Hill Landfill. Based on available information, these areas contain non-hazardous debris only. The SA/AOCs will be treated as construction debris landfills.

Alternative 6 also includes removing exposed drums at Cold Spring Brook Landfill (AOC 40) to remove a potential source of contamination, and excavating sediment from two hot spots in Cold Spring Brook Pond, to reduce ecological risk from exposure to contaminated sediments. These actions were described previously in the FS for AOC 40 (ABB-ES, 1994b).

Key components of Alternative 6 include:

Cap-in-Place AOC 41, SAs 6, 12, 13

- Mobilization/demobilization;
- Site preparation;
- UXO monitoring at SAs 6, 12 and AOC 41;

- Cap construction;
- Site restoration;
- Wetland restoration;
- Institutional controls;
- Cover system monitoring and maintenance; and
- Five-year site reviews.

Excavation and Consolidation at AOCs 9, 11 and 40

- Mobilization/demobilization;
- AOC 40 sediment removal and disposal;
- AOC 40 drum removal and disposal;
- Debris excavation and backfill at AOCs 9, 11 and 40;
- Wetlands restoration;
- Consolidation of excavated debris at Consolidation Landfill;
- Institutional controls;
- Cover system monitoring and maintenance at Consolidation Landfill; and
- Five-year Site Reviews;

8.6.1.2 Description of Cap-In-Place Components for Alternative 6.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site preparation. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

UXO monitoring at SAs 6, 12 and AOC 41. This component is similar to that discussed in Alternative 5, Subsection 8.5.1.2.

Cap construction. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Wetland restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Institutional controls. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cover system monitoring and maintenance. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Five-year site reviews. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.6.1.3 Description of Excavate and Consolidate AOCs 9, 11 and AOC 40 Components for Alternative 6.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site preparation. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Sediment removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Drum removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Debris excavation and backfill at AOCs 9, 11 and 40. This component for AOC 9 and AOC 40 is similar to that discussed in Alternative 4, Subsection 8.4.1.3.

At AOC 11, excavation of debris would be accomplished in phases because some debris is buried below the groundwater table. The site is between wetlands to the north and south, and adjacent to the Nashua River to the east. A natural 40 ft wide berm along the Nashua River separates the debris from the river water. This berm is 8 to 10 feet above normal river elevations, but still below flood stage. Excavation would be planned for the low-flow summer months. The first phase would be to excavate all of the debris above the watertable utilizing a backhoe, bulldozer and trucks. The estimated volume of debris above groundwater is about 90 percent of the total amount of AOC 11. The second phase, removing the debris (about 10 percent) from below groundwater, would require dewatering of one limited area at a time, then excavating and immediately backfilling. Dewatering would consist of a two rows of individual sumps either side of the debris to intercept groundwater from the river and from the upland hill. The length of the dewatered excavation would vary from 50 to 100 ft. After one 100-ft long section is excavated and backfilled, the operation would move along until all of the 500-ft long excavation of debris is removed. Additional soils investigation would be necessary during design to determine soil properties and limits of debris.

Wetlands restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Consolidation of excavated debris at Consolidation Landfill. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3. In Alternative 6, the Consolidation Landfill volume would be 343,000 cy.

Institutional controls. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cover system monitoring and maintenance at Consolidation Landfill. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3.

Five-year site reviews. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.6.2 Detailed Evaluation of Alternative 6

The following subsections present an assessment of Alternative 6 according to the seven evaluation criteria.

8.6.2.1 Overall Protection of Human Health and the Environment. The following paragraphs assess how the proposed actions of this alternative would provide protection of human health and the environment.

SA 6. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

AOC 9. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

AOC 11. This alternative would provide protection of human health and the environment by excavating landfill materials and then disposing of them at the consolidation facility. This would prevent potential future exposure to surface soil and sediment and would prevent potential future releases from landfill debris to groundwater. However, moving the landfill debris to a separate consolidation facility would transfer the risk of potential releases to another location. The baseline human health and ecological risk assessments did not identify unacceptable risks from wastes at AOC 11. Therefore, the risk reduction benefit from excavating and consolidating AOC 11 is considered low.

SA 12. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

SA 13. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

AOC 40. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

AOC 41. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

8.6.2.2 Compliance with ARARs. Tables 8-18, 8-19, and 8-20 summarize how Alternative 6 will attain ARARs.

8.6.2.3 Long-term Effectiveness and Permanence. The following paragraphs assess the long-term effectiveness and permanence of the proposed actions of this alternative.

SA 6. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

AOC 9. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

AOC 11. Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris, would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

SA 12. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

SA 13. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

AOC 40. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

AOC 41. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

8.6.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment. The following paragraphs assess the reduction of toxicity, mobility, and volume of contaminants through treatment offered by the proposed actions of this alternative.

SA 6. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

AOC 9. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

AOC 11. Reduction of toxicity, mobility, or volume of landfill contaminants through treatment would not be achieved. By removing landfill debris, the potential for leaching of landfill materials and contamination of groundwater would be reduced. No reduction of toxicity, mobility, or volume of groundwater contaminants would be achieved. Disposal of excavated landfill debris at a consolidation facility with low permeability liner, leachate collection, and low permeability cover would reduce contaminant mobility.

SA 12. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

SA 13. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

AOC 40. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

AOC 41. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

8.6.2.5 Short-term Effectiveness. The following paragraphs assess the short-term effectiveness of the actions proposed at each of the landfills.

SA 6. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

AOC 9. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

AOC 11. This alternative is expected to present minimal risks to workers, the community, and the environment. Transportation of excavated materials would be planned to avoid creating traffic congestion and hazards to the community.

Available information does not suggest the presence of hazardous substances that would present a risk to workers during excavation. Worker adherence to general health and safety practices, and use of personnel monitoring would reduce potential exposure to potentially hazardous substances to a safe level. Excavation of landfilled debris and construction of the consolidation facility could generate dust. Dust suppression techniques would reduce potential risk to workers and the community.

SA 12. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

SA 13. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

AOC 40. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

AOC 41. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

8.6.2.6 Implementability. The following paragraphs assess the implementability of the actions proposed at each of the landfills.

SA 6. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

AOC 9. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

AOC 11. Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate debris excavated from AOC 11. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at AOC 11.

All activities to excavate AOC 11 would be conducted on-site, and permits would not be required. Design, construction, operation, closure, and post-closure monitoring and maintenance of the consolidation facility would be conducted according to the technical requirements of Massachusetts 310 CMR 19.000.

Consolidation of this disposal area with others reduce the administrative burden and complexity of implementing the long-term monitoring and maintenance requirements of 310 CMR 19.000 at separate disposal areas.

SA 12. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

SA 13. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

AOC 40. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

AOC 41. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

8.6.2.7 Cost. The cost estimate for Alternative 6 includes estimates of direct and indirect capital costs and O&M costs. Direct capital costs included for this alternative include site preparation, sediment and debris excavation, drum removal, cap construction site restoration and monitoring well installation. A 25 percent contingency is included in direct cost items to account for unforeseen project complexities (e.g., adverse weather conditions and inadequate site characterization).

O&M costs include landfill cover maintenance, and environmental monitoring for groundwater, wetlands, and sediment.

Table 8-21 summarizes the cost estimate for Alternative 6. The total capital cost (direct plus indirect costs) is estimated to be $19,828,000. O&M costs are estimated to be $161,000 per year.

To enable evaluation costs that would occur over different time periods, the table also includes a present worth analysis. Present worth represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 7 percent before taxes and after inflation is used as recommended in OSWER Directive 9355.3-20. Unless noted otherwise, costs are based on a 30-year time frame. The estimated total present worth is $21,585,00. Cost calculations are included in Appendix D.

8.7 ALTERNATIVE 7: CAP-IN-PLACE AT ALL SEVEN DISPOSAL AREAS

This subsection describes Alternative 7, evaluates the alternative using the seven evaluation criteria, and provides a cost estimate.

This alternative includes construction of a cap over each of the seven disposal sites. Alternative 7 also includes removing exposed drums at AOC 40 to remove a potential source of contamination, and excavation of sediment from two hot spots in Cold Spring Brook Pond, to reduce ecological risk from exposure to contaminated sediments. These actions at AOC 40 were described previously in the FS for AOC 40 (ABB-ES, 1994b).

8.7.1 Description Of Alternative 7

Key components of Alternative 7 include:

Cap-in-Place AOCs 9, 11, 40, 41 and SAs 6, 12, 13

- Mobilization/demobilization;
- Site preparation;
- AOC 40 sediment removal and disposal;
- AOC 40 drum removal and disposal;
- UXO monitoring;
- Cap construction;
- Site restoration;
- Wetland restoration;
- Institutional controls;
- Cover system monitoring and maintenance; and
- Five-year site reviews.

8.7.1.1 Description of Cap-In-Place Components for Alternative 7.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site preparation. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Sediment removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Drum removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

UXO monitoring. This component is similar to that discussed in Alternative 5, Subsection 8.5.1.2.

Cap construction. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3..

Site restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Wetland restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Institutional controls. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cover system monitoring and maintenance. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3, and

Five-year site reviews. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.7.2 Detailed Evaluation of Alternative 7

The following subsections present an assessment of Alternative 7 according to the seven evaluation criteria.

8.7.2.1 Overall Protection of Human Health and the Environment. The following paragraphs assess how the proposed actions of this alternative would provide protection of human health and the environment.

SA 6. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

AOC 9. Overall protection of human health and the environment is similar to that discussed in Subsection 8.2.2.1.

AOC 11. Overall protection of human health and the environment is similar to that discussed in Subsection 8.3.2.1.

SA 12. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

SA 13. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

AOC 40. Overall protection of human health and the environment is similar to that discussed in Subsection 8.2.2.1.

AOC 41. Overall protection of human health and the environment is similar to that discussed in Subsection 8.5.2.1.

8.7.2.2 Compliance with ARARs. Tables 8-22, 8-23, and 8-24 summarize how Alternative 7 will attain ARARs.

8.7.2.3 Long-term Effectiveness and Permanence. The following paragraphs assess the long-term effectiveness and permanence of the proposed actions of this alternative.

SA 6. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

AOC 9. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.2.2.3.

AOC 11. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.3.2.3.

SA 12. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

SA 13. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

AOC 40. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.2.2.3.

AOC 41. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.5.2.3.

8.7.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment. The following paragraphs assess the reduction of toxicity, mobility, and volume of contaminants through treatment offered by the proposed actions of this alternative.

SA 6. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

AOC 9. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.2.2.4.

AOC 11. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.3.2.4.

SA 12. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

SA 13. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

AOC 40. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.2.2.4.

AOC 41. The reduction of toxicity, mobility, and volume through treatment is similar to that discussed in Subsection 8.5.2.4.

8.7.2.5 Short-term Effectiveness. The following paragraphs assess the short-term effectiveness of the actions proposed at each of the landfills.

SA 6. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

AOC 9. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.2.2.5.

AOC 11. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.3.2.5.

SA 12. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

SA 13. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

AOC 40. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.2.2.5.

AOC 41. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.5.2.5.

8.7.2.6 Implementability. The following paragraphs assess the implementability of the actions proposed at each of the landfills.

SA 6. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

AOC 9. The implementability of this alternative is similar to that discussed in Subsection 8.2.2.6.

AOC 11. The implementability of this alternative is similar to that discussed in Subsection 8.3.2.6.

SA 12. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

SA 13. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

AOC 40. The implementability of this alternative is similar to that discussed in Subsection 8.2.2.6.

AOC 41. The implementability of this alternative is similar to that discussed in Subsection 8.5.2.6.

8.7.2.7 Cost. The cost estimate for Alternative 7 includes estimates of direct and indirect capital costs and O&M costs. Direct capital costs included for this alternative include site preparation, sediment and debris excavation, drum removal, cap construction, site restoration and monitoring well installation. A 25 percent contingency is included in direct cost items to account for unforeseen project complexities (e.g., adverse weather conditions and inadequate site characterization).

O&M costs include landfill cover maintenance and environmental monitoring for groundwater, wetlands and sediment.

Table 8-25 summarizes the cost estimate for Alternative 7. The total capital cost (direct plus indirect costs) is estimated to be $9,832,000. O&M costs are estimated to be $221,000 per year.

To enable evaluation costs which would occur over different time periods, the table also includes a present worth analysis. Present worth represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 7 percent before taxes and after inflation is used as recommended in OSWER Directive 9355.3-20. Unless noted

otherwise, costs are based on a 30-year time frame. The estimated total present worth is $12,466,000. Cost calculations are included in Appendix D.

8.8 ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11 (DISPOSAL IN CONSOLIDATION LANDFILL); AND EXCAVATION AND CONSOLIDATION OF AOCs 9, 40, AND 41, AND SAs 6, 12, AND 13

This subsection describes and evaluates Alternative 8 using the seven evaluation criteria, and provides a cost estimate.

8.8.1 Description Of Alternative 8

Alternative 8 proposes limited removal of debris from AOC 11; excavating debris from AOCs 9, 40, 41 and SAs 6, 12, 13; and consolidating the excavated debris in a proposed secure landfill near Shepley's Hill Landfill. Based on available information, these areas contain non-hazardous debris only. The SA/AOCs will be treated as construction debris landfills.

Based on archeological monitoring conducted during predesign investigations at SA 6, further study is assumed to be warranted prior to disturbance of waste at this site. Work at this site would need to comply with the requirements of the National Historical Preservation Act which establishes procedures to provide for preservation of historical and archeological data which might be destroyed through alteration of terrain as a result of a Federal construction project. Archeological monitoring at the remaining six SA/AOCs is not anticipated.

Alternative 8 also includes removing exposed drums at Cold Spring Brook Landfill (AOC 40) to remove a potential source of contamination, and excavating sediment from two hot spots in Cold Spring Brook Pond, to reduce ecological risk from exposure to contaminated sediments. These actions were described previously in the FS for AOC 40 (ABB-ES, 1994b).

The key components of Alternative 8 include:

Limited Removal at AOC 11

- Mobilization/demobilization;
- Excavation of debris and transportation to the Consolidation Landfill;
- Backfilling site; and
- Site restoration.

Excavation and Consolidation at AOCs 9, 40, 41 and SAs 6, 12, 13

- Mobilization/demobilization;
- AOC 40 sediment removal and disposal;
- AOC 40 drum removal and disposal;
- UXO monitoring at SAs 6, 12 and AOC 41;
- Debris excavation and backfill;
- Wetlands restoration;
- Consolidation of excavated debris at Consolidation Landfill;
- Institutional controls;
- Cover system monitoring and maintenance at Consolidation Landfill; and
- Five-year site reviews;

8.8.1.1 Description of Limited Removal Components for Alternative 8.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.2.

Excavation of debris and transportation to the Consolidation Landfill. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.2.

Backfilling site. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.2.

Site restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.2.

8.8.1.2 Description of Excavation and Consolidation Components for Alternative 8.

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site preparation. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Sediment removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Drum removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

UXO monitoring. This component is similar to that discussed in Alternative 2, Subsection 8.5.1.2.

Debris excavation and backfill at AOCs 9 and 40. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3.

Wetlands restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Consolidation of excavated debris at Consolidation Landfill. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3. The Consolidation Landfill volume for Alternative 8 is 327,000 cy.

Institutional controls. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cover system monitoring and maintenance at Consolidation Landfill. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3.

Five-year site reviews. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.8.2 Detailed Evaluation of Alternative 8

The following subsections present an assessment of Alternative 8 according to the seven evaluation criteria.

8.8.2.1 Overall Protection of Human Health and the Environment. The following paragraphs assess how the proposed actions of this alternative would provide protection of human health and the environment.

SA 6. This alternative would provide protection of human health and the environment by excavating landfill materials and then disposing of them at the consolidation facility. This would prevent potential future exposure to surface soil and sediment and would prevent potential future releases from landfill debris to groundwater. However, moving the landfill debris to a separate consolidation facility would transfer the risk of potential releases to another location. But even though potential human health and environmental risks at SA 6 have not been evaluated in a PRE or baseline risk assessment, there is no reason to expect risk to human health and the environment at SA 6. Therefore, the risk reduction benefit from excavating and consolidating SA 6 is considered low.

AOC 9. Overall protection of human health and the environment is similar to that discussed Subsection 8.4.2.1.

AOC 11. Overall protection of human health and the environment is similar to that discussed Subsection 8.4.2.1.

SA 12. This alternative would provide protection of human health and the environment by excavating landfill materials and then disposing of them at the consolidation facility. This would prevent potential future exposure to surface soil and sediment and would prevent potential future releases from landfill debris to groundwater. However, moving the landfill debris to a separate consolidation facility would transfer the risk of potential releases to another location. But because the consolidation facility would be lined, potential risk would be less than if the landfill materials were left in place. Since the potential risk is low to begin with, potential risk reduction benefits are considered low.

SA 13. This alternative would provide protection of human health and the environment by excavating landfill materials and then disposing of them at the consolidation facility. This would prevent potential future exposure to surface soil and sediment and would prevent potential future releases from landfill debris to groundwater. However, moving the landfill debris to a separate consolidation facility would transfer the risk of potential releases to another location. But because the consolidation facility would be lined, potential risk would be less than if the landfill materials were left in place. Since the potential risk is low to begin with, potential risk reduction benefits are considered low.

AOC 40. Overall protection of human health and the environment is similar to that discussed Subsection 8.4.2.1.

AOC 41. This alternative would provide protection of human health and the environment by excavating landfill materials and then disposing of them at the consolidation facility. This would prevent potential future exposure to surface soil and sediment and would prevent potential future releases from landfill debris to groundwater. However, moving the landfill debris to a separate consolidation facility would transfer the risk of potential releases to another location. But because the consolidation facility would be lined, potential risk would be less than if the landfill materials were left in place. Since the potential risk is low to begin with, potential risk reduction benefits are considered low.

8.8.2.2 Compliance with ARARs. Tables 8-26, 8-27, and 8-28 summarize how Alternative 8 will attain ARARs.

8.8.2.3 Long-term Effectiveness and Permanence. The following paragraphs assess the long-term effectiveness and permanence of the proposed actions of this alternative.

SA 6. Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

AOC 9. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.4.2.3.

AOC 11. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.4.2.3.

SA 12. Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

SA 13. Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris, would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems, with leachate collection, cover systems and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

AOC 40. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.4.2.3.

AOC 41. Excavation of landfill debris would effectively prevent human and ecological exposure and would prevent the landfill from being a potential source of future groundwater contamination. The effectiveness of the consolidation facility at isolating landfill debris would depend on the quality of construction and proper maintenance of cover and leachate collection systems. Landfills that include groundwater protection systems with leachate collection, cover systems, and long-term monitoring and maintenance have a history of effectively isolating wastes from the environment.

8.8.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment. The following paragraphs assess the reduction of toxicity, mobility, and volume of contaminants through treatment offered by the proposed actions of this alternative.

SA 6. Reduction of toxicity, mobility, or volume of landfill contaminants through treatment would not be achieved. By removing landfill debris, the potential for leaching of landfill materials and contamination of groundwater would be reduced. No reduction of toxicity, mobility, or volume of groundwater contaminants would be achieved. Disposal of excavated landfill debris at a consolidation facility with low permeability liner, leachate collection, and low permeability cover would reduce contaminant mobility.

AOC 9. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.4.2.4.

AOC 11. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.4.2.4.

SA 12. Reduction of toxicity, mobility, or volume of landfill contaminants through treatment would not be achieved. By removing landfill debris, the potential for leaching of landfill materials and contamination of groundwater would be reduced. No reduction of toxicity, mobility, or volume of groundwater contaminants would be achieved. Disposal of excavated landfill debris at a consolidation facility with low permeability liner, leachate collection, and low permeability cover would reduce contaminant mobility.

SA 13. Reduction of toxicity, mobility, or volume of landfill contaminants through treatment would not be achieved. By removing landfill debris, the potential for leaching of landfill materials and contamination of groundwater would be reduced. No reduction of toxicity, mobility, or volume of groundwater contaminants would be achieved. Disposal of excavated landfill debris at a consolidation facility with low permeability liner, leachate collection, and low permeability cover would reduce contaminant mobility.

AOC 40. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.4.2.4.

AOC 41. Reduction of toxicity, mobility, or volume of landfill contaminants through treatment would not be achieved. By removing landfill debris, the potential for leaching of landfill materials and contamination of groundwater would be reduced. No reduction of toxicity, mobility, or volume of groundwater contaminants would be achieved. Disposal of excavated landfill debris at a consolidation facility with low permeability liner, leachate collection, and low permeability cover would reduce contaminant mobility.

8.8.2.5 Short-term Effectiveness. The following paragraphs assess the short-term effectiveness of the actions proposed at each of the landfills.

SA 6. This alternative is expected to present minimal risks to workers, the community, and the environment. Transportation of excavated materials would be planned to avoid creating traffic congestion and hazards to the community.

Available information does not suggest the presence of hazardous substances which would present a risk to workers during excavation. Worker adherence to general health and safety practices, and use of personnel monitoring would reduce potential exposure to potentially hazardous substances to a safe level. Excavation of landfilled debris and construction of the consolidation facility could generate dust. Dust suppression techniques would reduce potential risk to workers and the community.

AOC 9. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.4.2.5.

AOC 11. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.4.2.5.

SA 12. This alternative is expected to present minimal risks to workers, the community, and the environment. Transportation of excavated materials would be planned to avoid creating traffic congestion and hazards to the community.

Available information does not suggest the presence of hazardous substances which would present a risk to workers during excavation. Worker adherence to general health and safety practices, and use of personnel monitoring would reduce potential exposure to potentially hazardous substances to a safe level. Excavation of landfilled debris and construction of the consolidation facility could generate dust. Dust suppression techniques would reduce potential risk to workers and the community.

SA 13. This alternative is expected to present minimal risks to workers, the community, and the environment. Transportation of excavated materials would be planned to avoid creating traffic congestion and hazards to the community.

Available information does not suggest the presence of hazardous substances which would present a risk to workers during excavation. Worker adherence to general health and safety practices, and use of personnel monitoring would reduce potential exposure to potentially hazardous substances to a safe level. Excavation of landfilled debris and construction of the consolidation facility could generate dust. Dust suppression techniques would reduce potential risk to workers and the community.

AOC 40. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.4.2.5.

AOC 41. This alternative is expected to present minimal risks to workers, the community, and the environment. Transportation of excavated materials would be planned to avoid creating traffic congestion and hazards to the community.

Available information does not suggest the presence of hazardous substances which would present a risk to workers during excavation. Worker adherence to general health and safety practices, and use of personnel monitoring would reduce potential exposure to potentially hazardous substances to a safe level. Excavation of landfilled debris and construction of the consolidation facility could generate dust. Dust suppression techniques would reduce potential risk to workers and the community.

8.8.2.6 Implementability. The following paragraphs assess the implementability of the actions proposed at each of the landfills.

SA 6. Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate debris excavated from SA 6. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at SA 6.

All activities to excavate SA 6 would be conducted on site, and permits would not be required. Design, construction, operation, closure, and post-closure monitoring and maintenance of the consolidation facility would be conducted according to the technical requirements of Massachusetts 310 CMR 19.000.

Consolidation of this disposal area with others reduce the administrative burden and complexity of implementing the long-term monitoring and maintenance requirements of 310 CMR 19.000 at separate disposal areas.

AOC 9. The implementability of this alternative is similar to that discussed in Subsection 8.4.2.6.

AOC 11. The implementability of this alternative is similar to that discussed in Subsection 8.4.2.6.

SA 12. Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate debris excavated from SA 12. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at SA 12.

All activities to excavate SA 12 would be conducted on site, and permits would not be required. Design, construction, operation, closure, and post-closure monitoring and maintenance of the consolidation facility would be conducted according to the technical requirements of Massachusetts 310 CMR 19.000.

Consolidation of this disposal area with others reduce the administrative burden and complexity of implementing the long-term monitoring and maintenance requirements of 310 CMR 19.000 at separate disposal areas.

SA 13. Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate debris excavated from SA 13. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at SA 13.

All activities to excavate SA 13 would be conducted on-site, and permits would not be required. Design, construction, operation, closure, and post-closure monitoring and maintenance of the consolidation facility would be conducted according to the technical requirements of Massachusetts 310 CMR 19.000.

Consolidation of this disposal area with others reduce the administrative burden and complexity of implementing the long-term monitoring and maintenance requirements of 310 CMR 19.000 at separate disposal areas.

AOC 40. The implementability of this alternative is similar to that discussed in Subsection 8.4.2.6.

AOC 41. Landfill excavation and construction can be accomplished using standard construction procedures and conventional earthmoving equipment, and many engineering and construction companies are qualified and available. Successful implementation of this alternative is contingent on the approval and construction of a consolidation facility to accept the excavated debris. The consolidation facility would be constructed and maintained to effectively isolate debris excavated from AOC 41. Implementation of this alternative would not limit or interfere with the ability to perform future remedial actions at AOC 41.

All activities to excavate AOC 41 would be conducted on site, and permits would not be required. Design, construction, operation, closure, and post-closure monitoring and maintenance of the consolidation facility would be conducted according to the technical requirements of Massachusetts 310 CMR 19.000.

Consolidation of this disposal area with others reduce the administrative burden and complexity of implementing the long-term monitoring and maintenance requirements of 310 CMR 19.000 at separate disposal areas.

8.8.2.7 Cost. The cost estimate for Alternative 8 includes estimates of direct and indirect capital costs and O&M costs. Direct capital costs included for this alternative include site preparation, sediment and debris excavation, drum removal, cap construction, site restoration and monitoring well installation. A 25 percent contingency is included in direct cost items to account for unforeseen project complexities (e.g., adverse weather conditions and inadequate site characterization).

O&M costs include landfill maintenance and environmental monitoring for groundwater, wetlands and sediment.

Table 8-29 summarizes the cost estimate for Alternative 8. The total capital cost (direct plus indirect costs) is estimated to be $17,730,000. O&M costs are estimated to be $56,000 per year.

To enable evaluation costs which would occur over different time periods, the table also includes a present worth analysis. Present worth represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 7 percent before taxes and after inflation is used as recommended in OSWER Directive 9355.3-20. Unless noted otherwise, costs are based on a 30-year time frame. The estimated total present worth is $18,141,000. Cost calculations are included in Appendix D.

8.9 ALTERNATIVE 9: EXCAVATION AND CONSOLIDATION OF ALL SEVEN DISPOSAL AREAS

This subsection describes Alternative 9, evaluates the alternative using the seven evaluation criteria, and provides a cost estimate.

8.9.1 Description Of Alternative 9

Alternative 9 proposes excavating construction/demolition debris from SAs 6, 12, 13, AOCs 9, 11, 40 and 41, and consolidating the excavated debris in a proposed secure landfill near Shepley's Hill Landfill. Based on available information, these areas contain non-hazardous debris only. The SA/AOCs will be treated as construction debris landfills.

Based on archeological monitoring conducted during the predesign investigations at SA 6, further study is assumed to be warranted prior to disturbance of waste at this site. Work at this site would need to comply with the requirements of the National Historical Preservation Act which establishes procedures to provide for preservation of historical and archeological data which might be destroyed through alteration of terrain as a result of a federal construction project. Archeological monitoring at the remaining six SA/AOCs is not anticipated.

Alternative 9 also includes removing exposed drums at Cold Spring Brook Landfill (AOC 40) to remove a potential source of contamination, and excavating sediment from two hot spots in Cold Spring Brook Pond, to reduce ecological risk from exposure to contaminated sediments. These actions were described previously in the FS for AOC 40 (ABB-ES, 1994b).

The key components of Alternative 9 include:

Excavation and Consolidation at AOCs 9,11, 40, 41 and SAs 6, 12, 13

- Mobilization/demobilization;
- AOC 40 sediment removal and disposal;
- AOC 40 drum removal and disposal;
- UXO monitoring at SAs 6, 12 and AOC 41;
- Debris excavation and backfill;
- Wetlands restoration;
- Consolidation of excavated debris at Consolidation Landfill;
- Institutional controls;
- Cover system monitoring and maintenance at Consolidation Landfill; and
- Five-year site reviews;

8.9.1.1 Description of Excavate and Consolidate Components for Alternative 9

Mobilization/demobilization. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Site preparation. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Sediment removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Drum removal and disposal at AOC 40. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

UXO monitoring. This component is similar to that discussed in Alternative 5, Subsection 8.5.1.2.

Debris excavation and backfill. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3.

Wetlands restoration. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Consolidation of excavated debris at Consolidation Landfill. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3. The Consolidation Landfill volume for Alternative 9 is 366,000 cy.

Institutional controls. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

Cover system monitoring and maintenance at Consolidation Landfill. This component is similar to that discussed in Alternative 4, Subsection 8.4.1.3.

Five-year site reviews. This component is similar to that discussed in Alternative 2, Subsection 8.2.1.3.

8.9.2 Detailed Evaluation of Alternative 9

The following subsections present an assessment of Alternative 9 according to the seven evaluation criteria.

8.9.2.1 Overall Protection of Human Health and the Environment. The following paragraphs assess how the proposed actions of this alternative would provide protection of human health and the environment.

SA 6. Overall protection of human health and the environment is similar to that discussed Subsection 8.8.2.1.

AOC 9. Overall protection of human health and the environment is similar to that discussed Subsection 8.4.2.1.

AOC 11. Overall protection of human health and the environment is similar to that discussed Subsection 8.6.2.1.

SA 12. Overall protection of human health and the environment is similar to that discussed Subsection 8.8.2.1.

SA 13. Overall protection of human health and the environment is similar to that discussed Subsection 8.8.2.1.

AOC 40. Overall protection of human health and the environment is similar to that discussed Subsection 8.4.2.1.

AOC 41. Overall protection of human health and the environment is similar to that discussed Subsection 8.8.2.1.

8.9.2.2 Compliance with ARARs. Tables 8-30, 8-31, and 8-32 summarize how Alternative 9 will attain ARARs.

8.9.2.3 Long-term Effectiveness and Permanence. The following paragraphs assess the long-term effectiveness and permanence of the proposed actions of this alternative.

SA 6. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.8.2.3.

AOC 9. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.4.2.3.

AOC 11. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.6.2.3.

SA 12. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.8.2.3.

SA 13. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.8.2.3.

AOC 40. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.4.2.3.

AOC 41. The long-term effectiveness and permanence of this alternative is similar to that discussed in Subsection 8.8.2.3.

8.9.2.4 Reduction of Toxicity, Mobility, and Volume Through Treatment. The following paragraphs assess the reduction of toxicity, mobility, and volume of contaminants through treatment offered by the proposed actions of this alternative.

SA 6. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.8.2.4.

AOC 9. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.4.2.4.

AOC 11. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.6.2.4.

SA 12. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.8.2.4.

SA 13. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.8.2.4.

AOC 40. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.4.2.4.

AOC 41. The reduction in toxicity, mobility, and volume is similar to that discussed in Subsection 8.8.2.4.

8.9.2.5 Short-term Effectiveness. The following paragraphs assess the short-term effectiveness of the actions proposed at each of the landfills.

SA 6. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.8.2.5.

AOC 9. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.4.2.5.

AOC 11. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.6.2.5.

SA 12 The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.8.2.5.

SA 13. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.8.2.5.

AOC 40. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.4.2.5.

AOC 41. The short-term effectiveness of this alternative is similar to that discussed in Subsection 8.8.2.5.

8.9.2.6 Implementability. The following paragraphs assess the implementability of the actions proposed at each of the landfills.

SA 6. The implementability of this alternative is similar to that discussed in Subsection 8.8.2.6.

AOC 9. The implementability of this alternative is similar to that discussed in Subsection 8.4.2.6.

AOC 11. The implementability of this alternative is similar to that discussed in Subsection 8.6.2.6.

SA 12. The implementability of this alternative is similar to that discussed in Subsection 8.8.2.6.

SA 13. The implementability of this alternative is similar to that discussed in Subsection 8.8.2.6.

AOC 40. The implementability of this alternative is similar to that discussed in Subsection 8.4.2.6.

AOC 41. The implementability of this alternative is similar to that discussed in Subsection 8.8.2.6.

8.9.2.7 Cost. The cost estimate for Alternative 9 includes estimates of direct and indirect capital costs and O&M costs. Direct capital costs included for this alternative include site preparation, sediment and debris excavation, drum removal, cap construction, site restoration and monitoring well installation. A 25 percent contingency is included in direct cost items to account for unforeseen project complexities (e.g., adverse weather conditions and inadequate site characterization).

O&M costs include landfill cover maintenance and environmental monitoring for groundwater, wetlands and sediment.

Table 8-33 summarizes the cost estimate for Alternative 9. The total capital cost (direct plus indirect costs) is estimated to be $19,715,000. O&M costs are estimated to be $52,000 per year.

To enable evaluation costs which would occur over different time periods, the table also includes a present worth analysis. Present worth represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of 7 percent before taxes and after inflation is used as recommended in OSWER Directive 9355.3-20. Unless noted

otherwise, costs are based on a 30-year time frame. The estimated total present worth is $20,195,000. Cost calculations are included in Appendix D.

9.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section compares relative advantages and disadvantages of the landfill management alternatives. The alternatives are complex, because each involves seven sites with various remedial actions. Table 9-1 presents a comparison of the alternatives with regard to the relative degree (i.e., low, medium, high) of conformance to the evaluation criteria. In general, the alternatives offer a higher degree of criteria conformance as they progress in numerical order. For example, Alternative 1 offers a low degree of overall protection of human health and the environment, while Alternative 9 offers a high degree. To further assist in alternatives comparison, distinguishing features of each alternative are discussed in Subsection 9.1.

9.1 ALTERNATIVES COMPARISON

Alternative 1. MADEP landfill closure requirements would not be met for disposal areas at AOC 9, AOC 11, or SA 12. The site investigation, remedial investigation, and feasibility study reports, and records of decision would be submitted to satisfy 310 CMR 19.021 (4)(b) at SA 6, SA 13, AOC 40, and AOC 41.

Alternative 2. This alternative offers a significant amount of protection of human health and the environment at relatively low cost.

Alternative 3. An approximately 20% increase in cost over Alternative 2 offers relatively little increase in overall protection of human health and the environment at AOC 11.

Alternative 4. The effectiveness of Alternative 4 is roughly similar to that of Alternative 2, with the difference being that AOCs 9 and 40 are excavated and consolidated in Alternative 4 rather than being capped. Both alternatives have significant potential to achieve acceptable risk levels for human and ecological receptors. The cost of Alternative 4 is $16.6 million compared to $7.6 million for Alternative 2.

Alternative 5. The effectiveness of Alternative 5 can be directly compared to Alternative 4, with the difference being that AOC 41 and SAs 6, 12, and 13 are capped in place in Alternative 5 rather than being subjected to no further action. This results in a relatively significant increase in protection of human health and the environment for Alternative 5.

Alternative 6. Alternative 6, the most costly of the alternatives, can be directly compared to Alternative 5, with the difference being that AOC 11 is excavated and consolidated in Alternative 6 rather than being subjected to limited removal. The cost of Alternative 6 is \$21.6 million, compared to \$19.6 million for Alternative 5. Alternative 6 offers relatively little increase in protection of human health and the environment, because the PRE did not identify significant potential for human or ecological risk at AOC 11.

Alternative 7. At \$12.5 million, Alternative 7 offers as much protection of human health and the environment as Alternative 6, which costs \$21.6 million. The capped landfills of Alternative 7 would preclude the seven disposal sites from future re-use, and may impact choices for re-development at Devens with regard to water supply and wastewater resources.

Alternative 8. Because wastes at AOC 11 would undergo only surface removal, Alternative 8 is considered to be less compliant with ARARs than Alternatives 7 or 9, but would offer essentially the same degree of protection of human health and the environment.

Alternative 9. Of the alternatives, Alternative 9 offers the greatest amount of former landfill area to be reused, because wastes at all sites are relocated to the consolidation landfill. No further environmental monitoring would be required at the seven landfills after waste removal. Thus, Alternative 9 offers the least impact on water supply and wastewater resources at Devens.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
ACEC	area of critical environmental concern
AOC	Area of Contamination
ARARs	Applicable or Relevant and Appropriate Requirements
AREE	Area Requiring Environmental Evaluation
ASL	above sea level
AWQC	Ambient Water Quality Criteria
BCT	BRAC Cleanup Team
BEHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
cm/sec	centimeter per second
COC	contaminant of concern
CPC	chemical of potential concern
cy	cubic yards
DCA	dichloroethane
DDD	2,2-bis(para-chlorophenyl)-1,1-dichloroethane
DDE	2,2-bis(para-chlorophenyl)-1,1-dichloroethene
DDT	2,2-bis(para-chlorophenyl)-1,1,1-trichloroethane
DOT	Department of Transportation
E&E	Ecology of Environment, Inc.
ft	feet
FORSCOM	U.S. Army Forces Command
FS	Feasibility Study
gpm	gallons per minute
HI	hazard index

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

IAG	Interagency Agreement
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
mg/L	milligrams per liter
MEP	Master Environmental Plan
MEPA	Massachusetts Environmental Protection Act
MGLB	Massachusetts Government Land Bank
MNHP	Massachusetts Natural Heritage Program
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbon
PAL	Project Analyte List
PCB	polychlorinated biphenyl
POTW	publicly owned treatment works
PP	proposed plan
PRE	Preliminary Risk Evaluation
PRG	Preliminary Remediation Goal
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RFTA	Reserve Forces Training Area
RI	Remedial Investigation
ROD	Record of Decision
SA	Study Area
SARA	Superfund Amendments and Reauthorization Act
SEA	SEA Consultants

sf	square feet
SHL	Shepley's Hill Landfill
SI	Site Investigation
SMCL	Secondary Maximum Contaminant Level
SSI	Supplemental Site Investigation
SVOC	semivolatile organic compound
TAL	Target Analyte List
TBC	to-be-considered
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
TPHC	total petroleum hydrocarbon compounds
TSS	total suspended solids
µg/g	micrograms per gram
µg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
USAEHA	U.S. Army Environmental Hygiene Agency
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	unexploded ordinance
VOC	volatile organic compound
WRS	Wetland Restoration Specification

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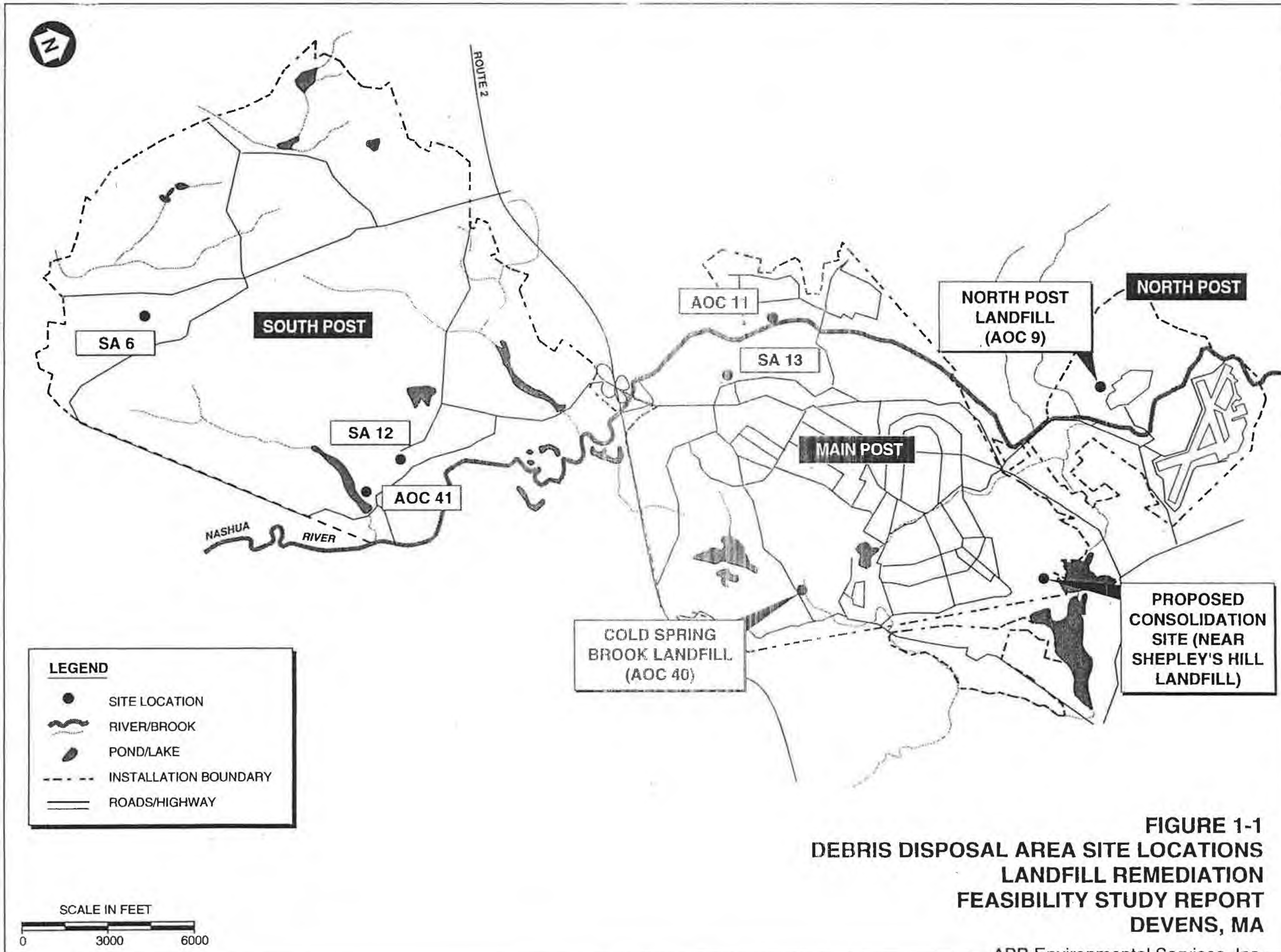


FIGURE 1-1
DEBRIS DISPOSAL AREA SITE LOCATIONS
LANDFILL REMEDIATION
FEASIBILITY STUDY REPORT
DEVENS, MA

ABB Environmental Services, Inc.

9507028D(h)

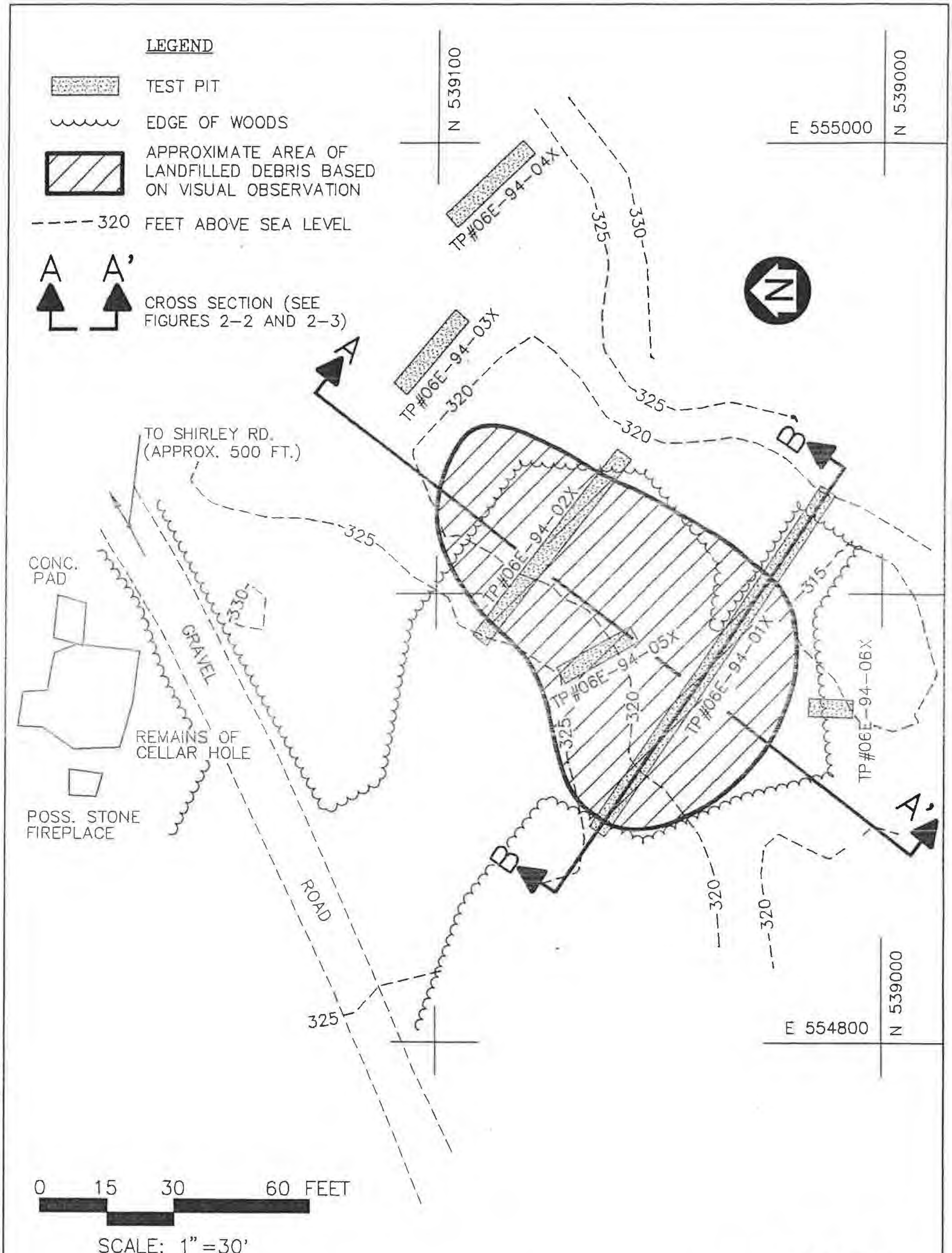
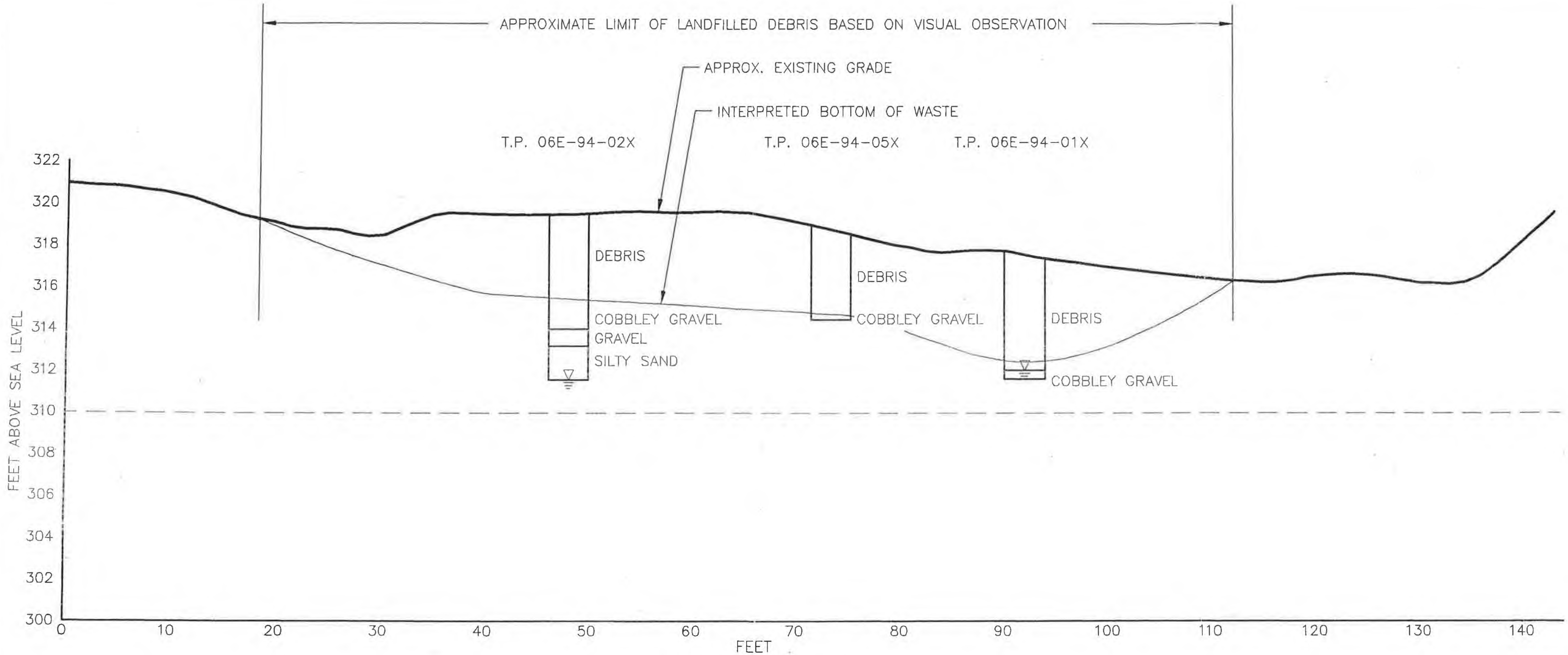


FIGURE 2-1
SA 6 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F013.DWG 1"=30' 1/07/97



NORTHEAST

Cross Section A-A'

SOUTHWEST

0 5 10 20 FEET

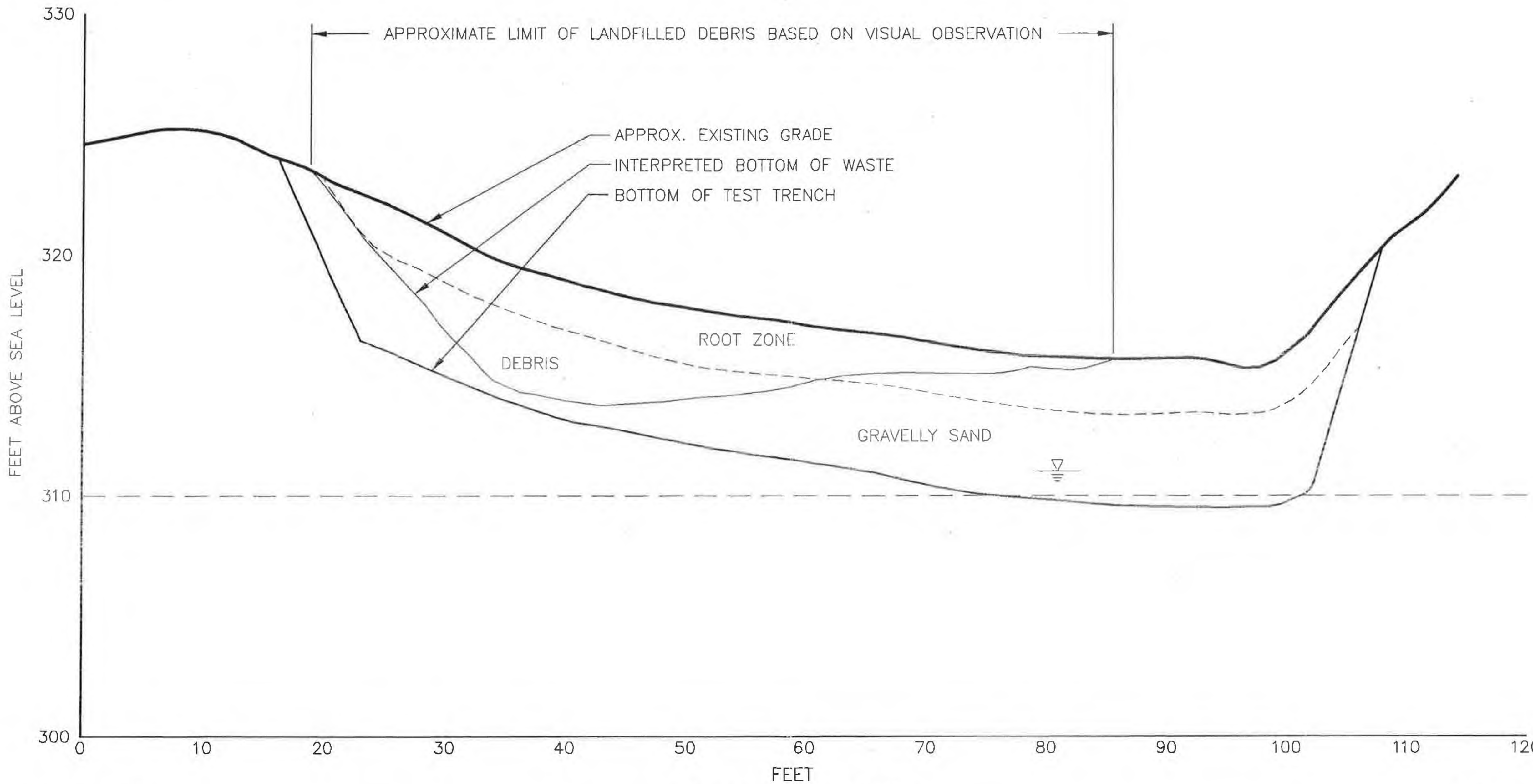
SCALE: 1"=10' HORIZONTAL
SCALE: 1"=5' VERTICAL

NOTE:

1. GEOLOGY BASED ON TEST TRENCH LOGS.
2. SEE FIGURE 2-1 FOR CROSS SECTION ORIENTATION.
3. T.P. = TEST PIT

FIGURE 2-2
SA 6 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA
ABB Environmental Services, Inc.

:\8712-04\8712F014.DWG 1"=10' 1/07/97



Cross Section B-B'

0 5 10 20 FEET

SCALE: 1"=10' HORIZONTAL
SCALE: 1"=5' VERTICAL

NOTES:

1. THIS CROSS-SECTION HAS BEEN CUT ALONG THE CENTERLINE OF TP#06E-94-01X.
2. GEOLOGIC DESCRIPTIONS BASED ON TEST TRENCH LOGS.
3. SEE FIGURE 2-1 FOR CROSS SECTION ORIENTATION.

FIGURE 2-3
SA 6 CROSS SECTION B-B'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

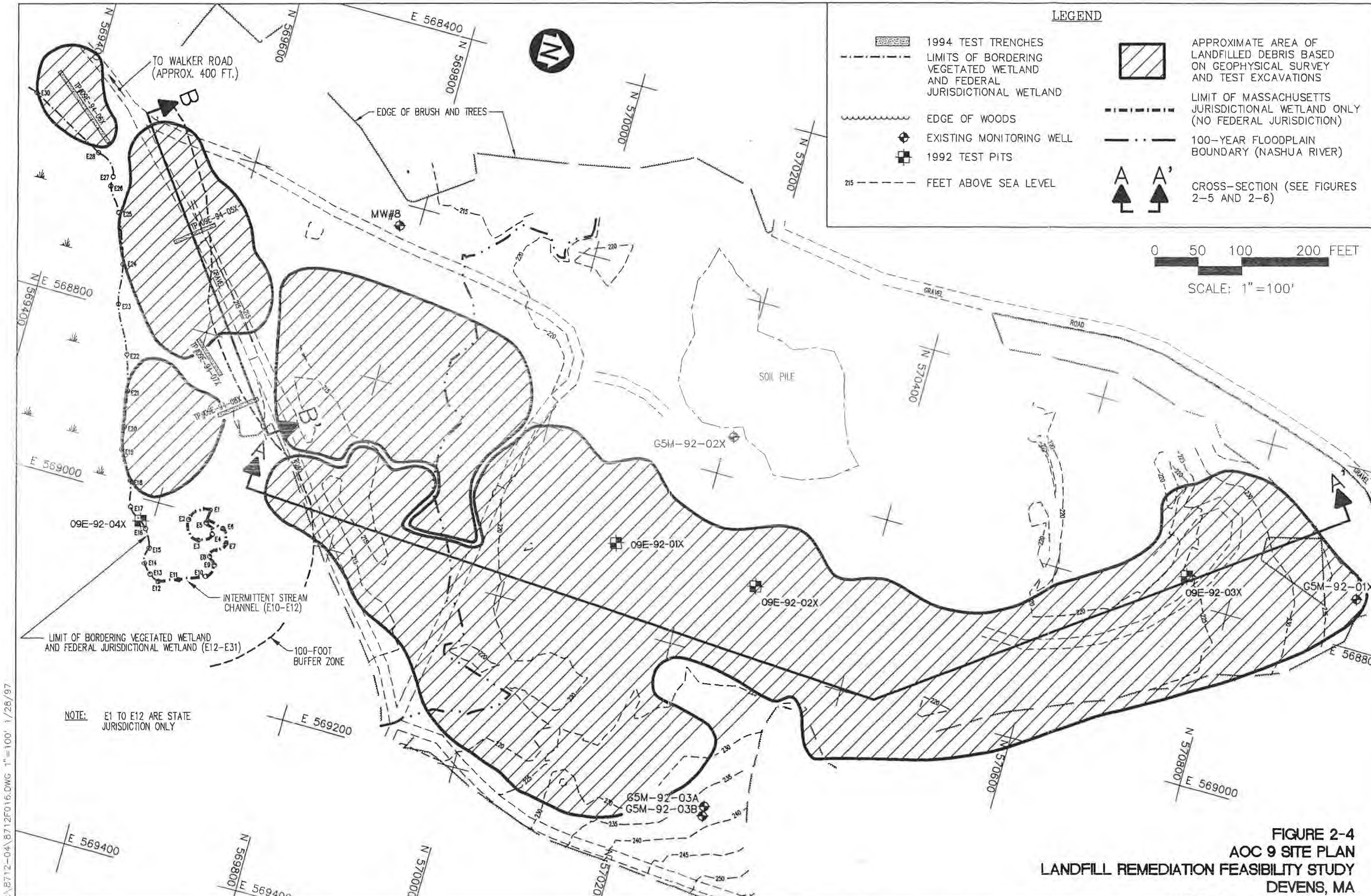
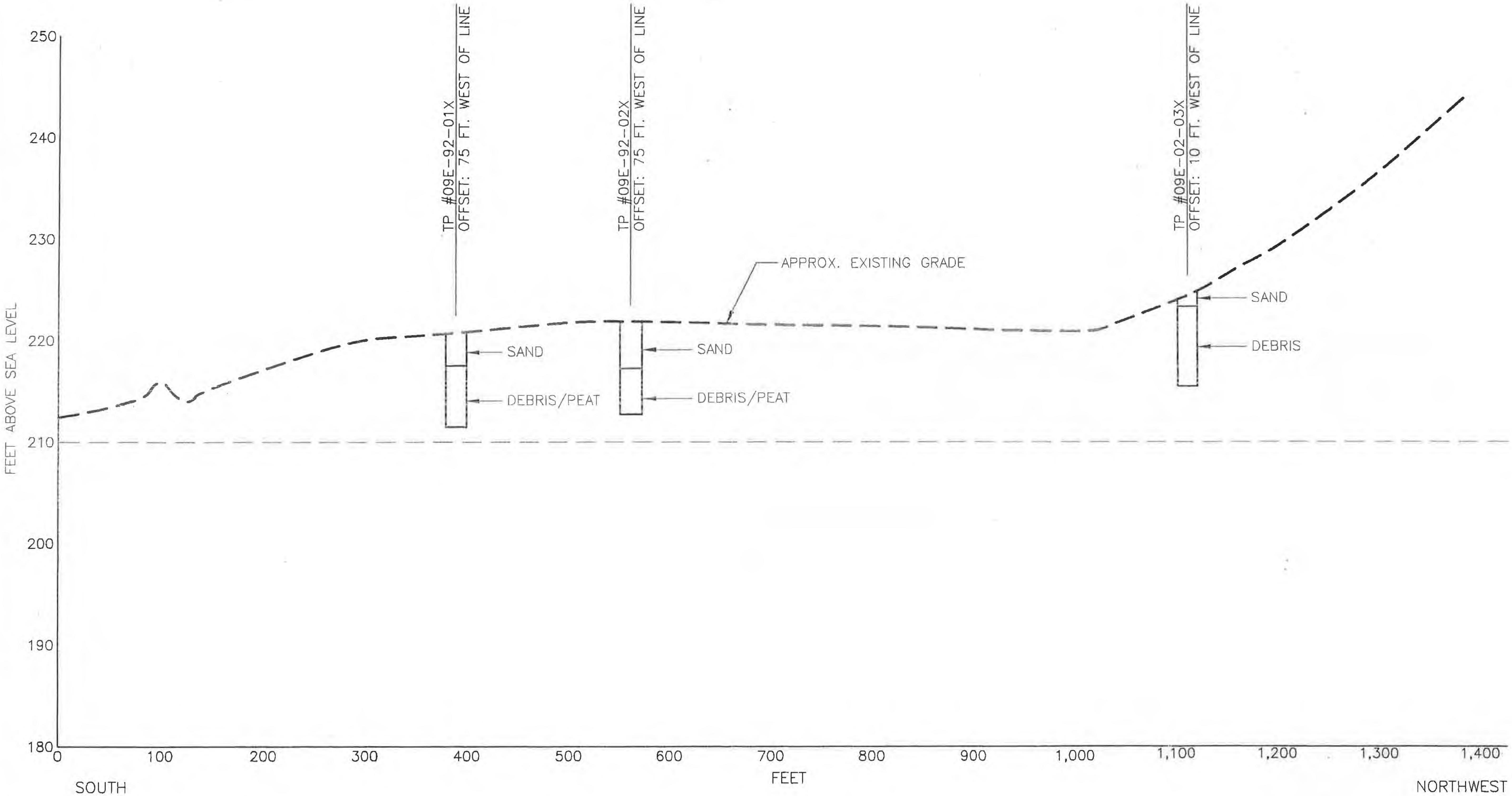


FIGURE 2-4
AOC 9 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.



NOTES:

1. BOTTOM OF TEST PITTS (PERFORMED IN 1992) DO NOT IMPLY BOTTOM OF DEBRIS. DEBRIS EXTENDS DEEPER THAN TEST PIT BOTTOMS.
2. NO WATER WAS ENCOUNTERED DURING TEST PITTING.
3. SEE FIGURE 2-4 FOR CROSS SECTION ORIENTATION.

Cross Section A-A'

0 50 100 200 FEET

SCALE: 1"=100' HORIZONTAL
SCALE: 1"=10' VERTICAL

FIGURE 2-5
AOC 9 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA
ABB Environmental Services, Inc.

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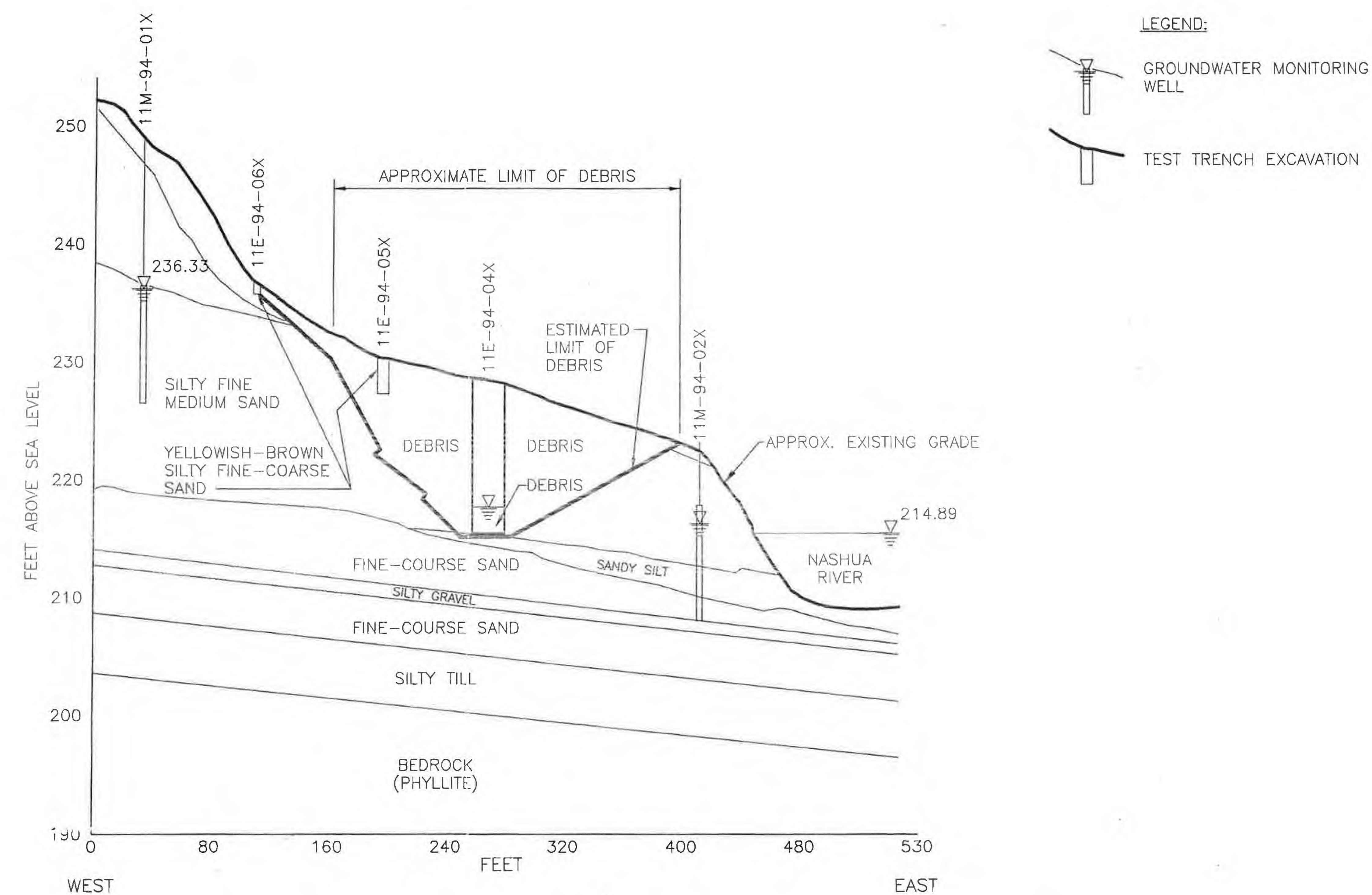


Cross Section A-A'

0 40 80 160 FEET

SCALE: 1"=80' HORIZONTAL
SCALE: 1"=10' VERTICAL

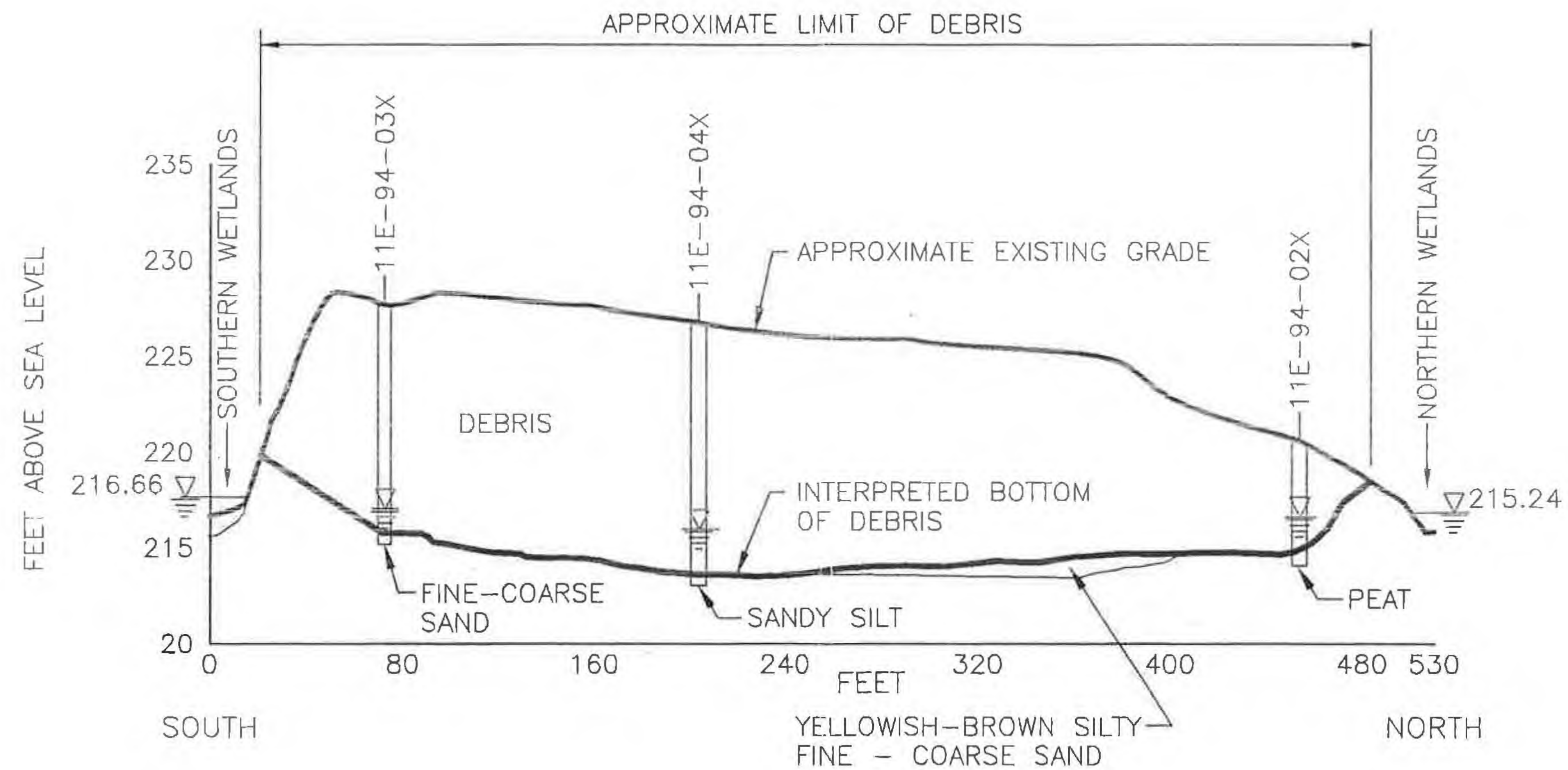
NOTES:

1. GEOLOGIC DESCRIPTIONS BASED ON TEST PIT LOGS.
2. CROSS SECTION TAKEN FROM FIGURE 3-2, DRAFT RI REPORT, ARTHUR D. LITTLE, APRIL 1995.
3. SEE FIGURE 2-7 FOR CROSS SECTION ORIENTATION.

FIGURE 2-8
AOC 11 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F020.DWG 1"=80' 1/07/97



Cross Section B-B'

NOTES:

1. GEOLOGIC DESCRIPTIONS BASED ON TEST PIT LOGS.
2. CROSS SECTION TAKEN FROM FIGURE 3-3, DRAFT RI REPORT, AUTHUR D. LITTLE, APRIL 1995.
3. SEE FIGURE 2-7 FOR CROSS SECTION ORIENTATION.

0 40 80 160 FEET

SCALE: 1"=80' HORIZONTAL
SCALE: 1"=10' VERTICAL

FIGURE 2-9
AOC 11 CROSS SECTION B-B'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

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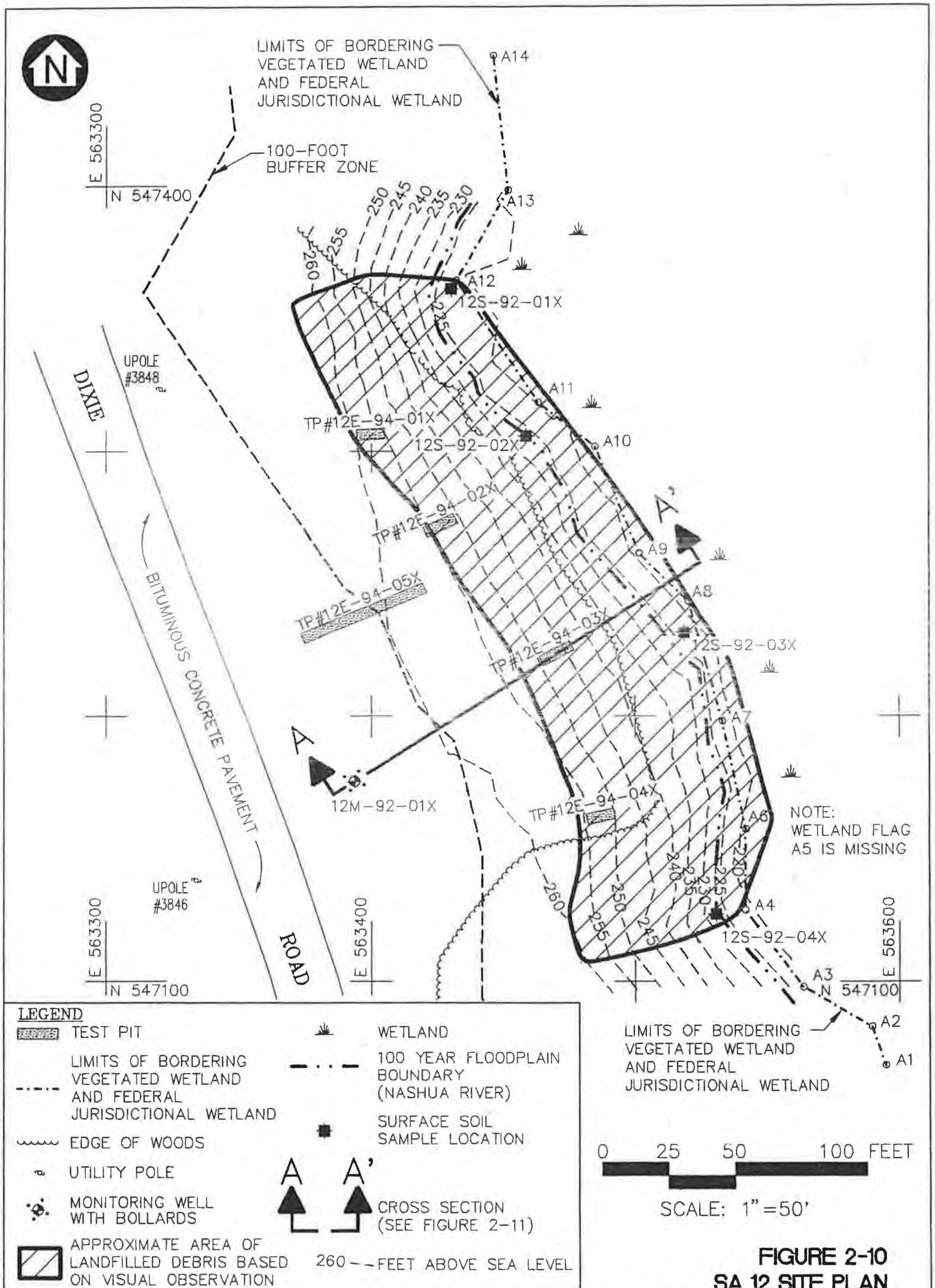
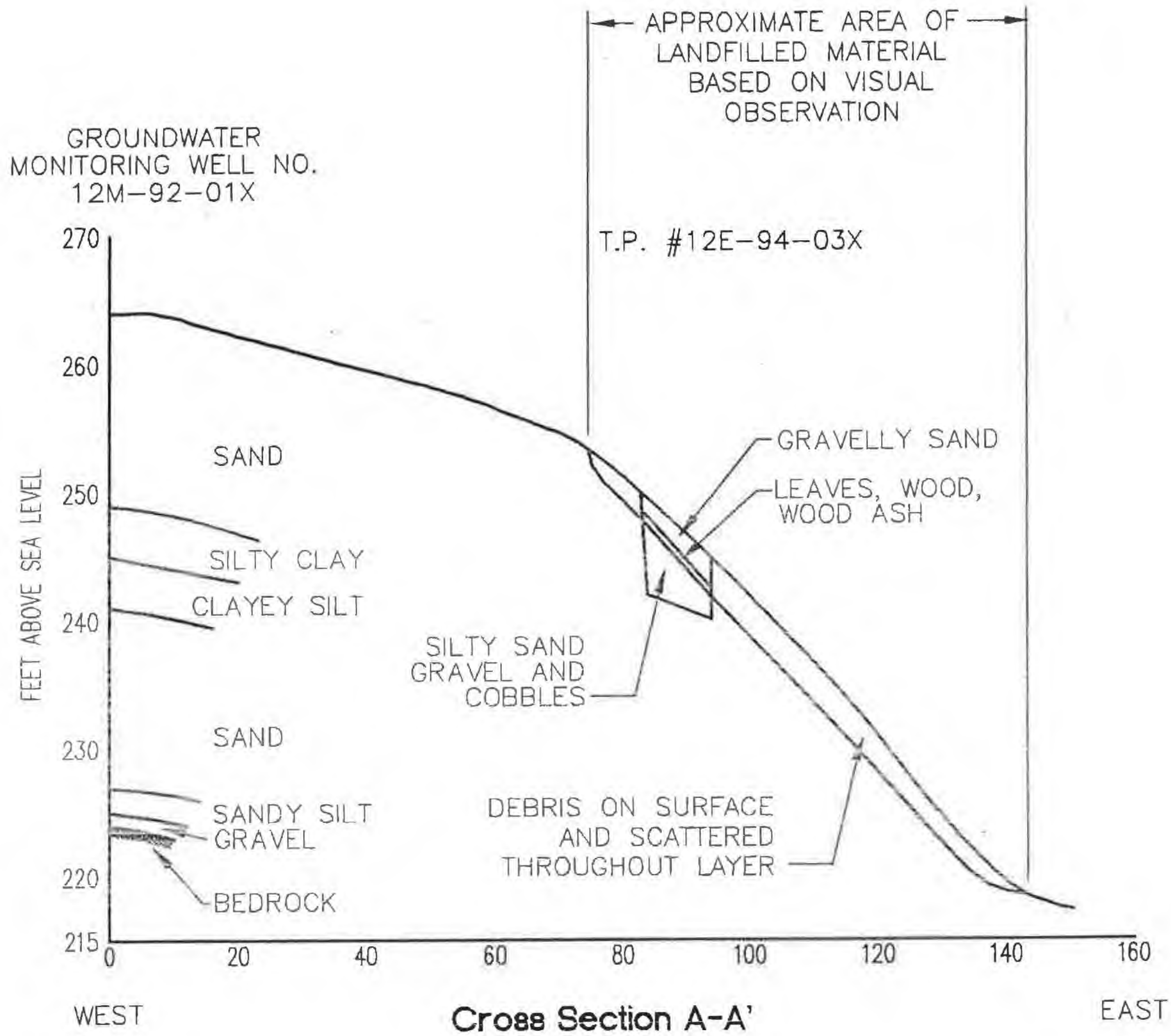


FIGURE 2-10
SA 12 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F022.DWG 1"=50' 1/28/97



Cross Section A-A'

NOTES:

1. GEOLOGIC DESCRIPTIONS ARE BASED ON BORING AND TEST PIT LOGS.
2. DEPTH OF DEBRIS INTERPRETED FROM TEST PIT LOGS.
3. SEE FIGURE 2-10 FOR CROSS SECTION ORIENTATION.
4. T.P. = TEST PIT

SCALE: 1"=30' HORIZONTAL

SCALE: 1"=15' VERTICAL

J:\8712-04\8712F023.DWG 1"=30' 1/07/97

FIGURE 2-11
SA 12 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

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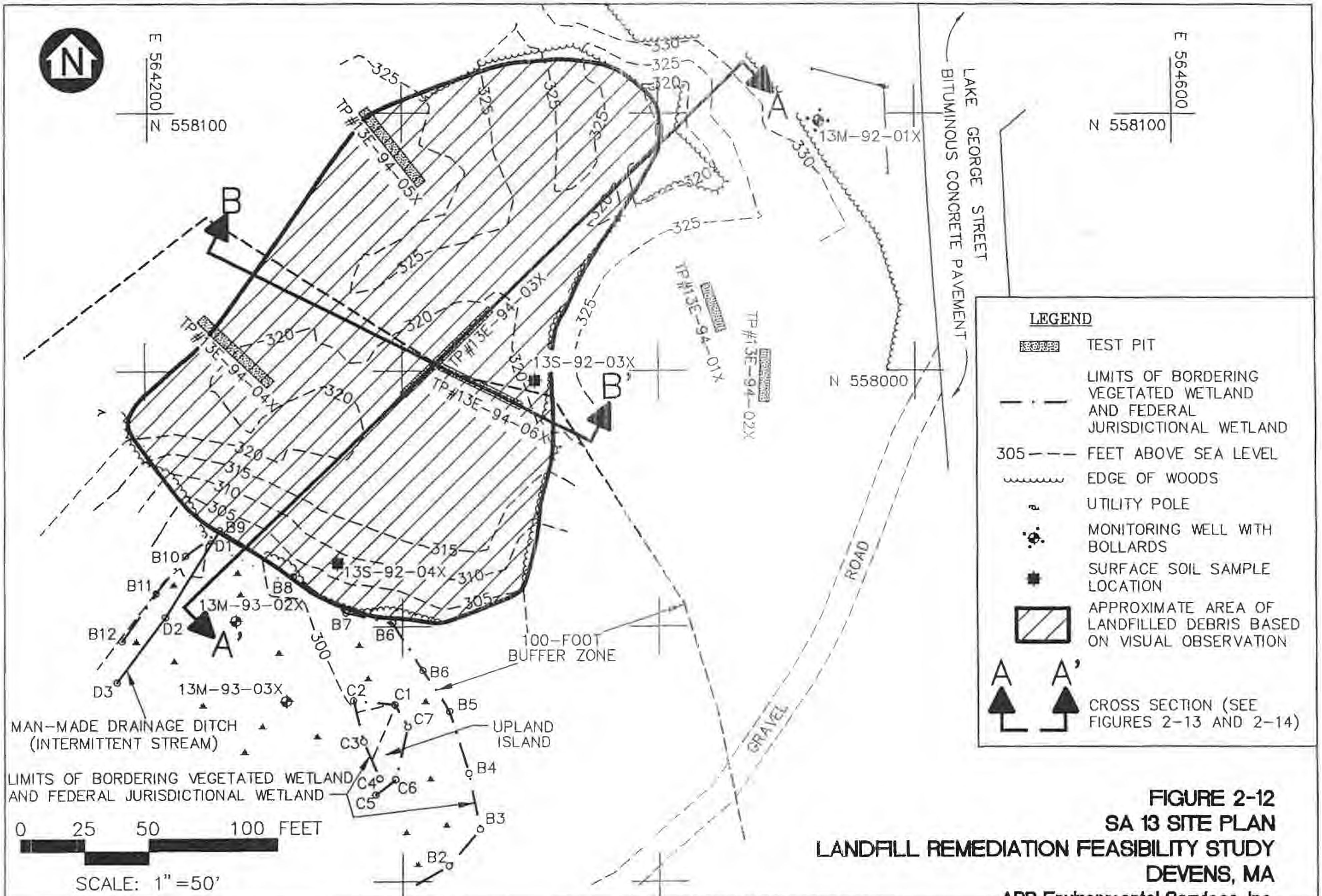
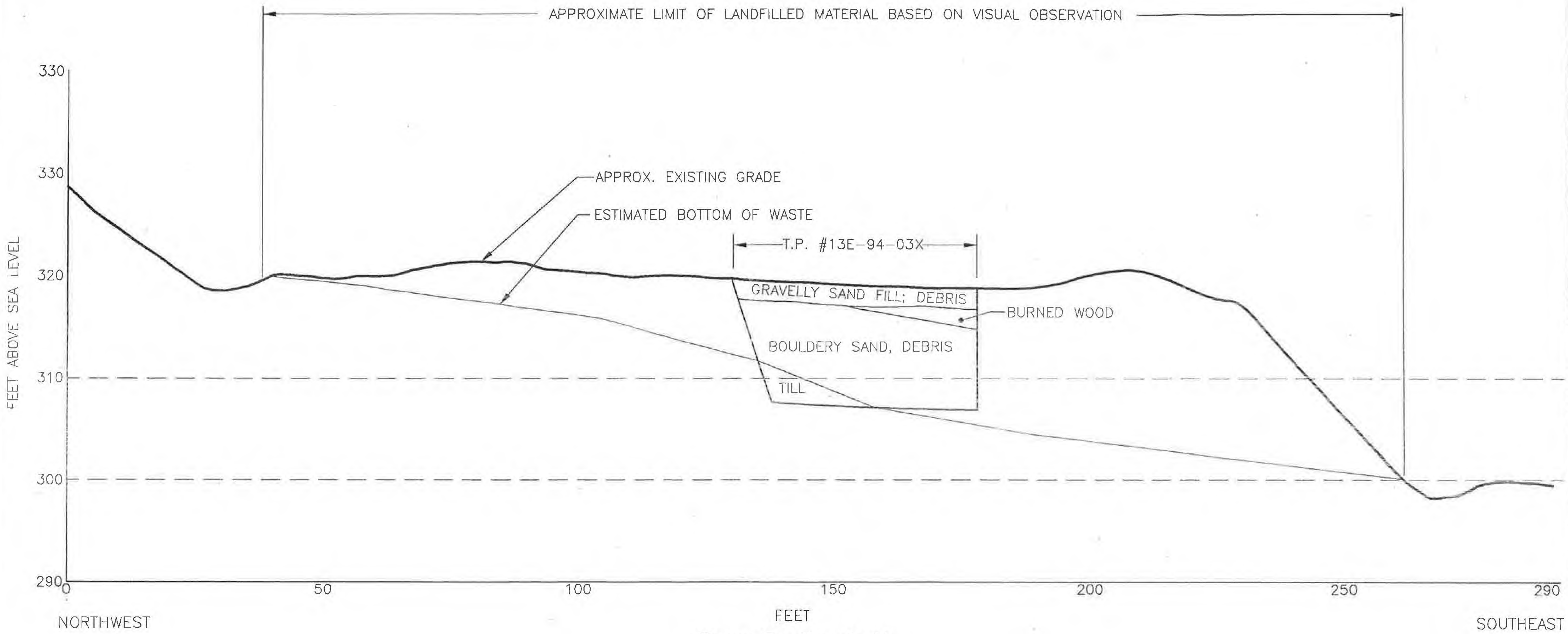


FIGURE 2-12
SA 13 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.



Cross Section A-A'

0 10 20 40 FEET

SCALE: 1"=20' HORIZONTAL
SCALE: 1"=10' VERTICAL

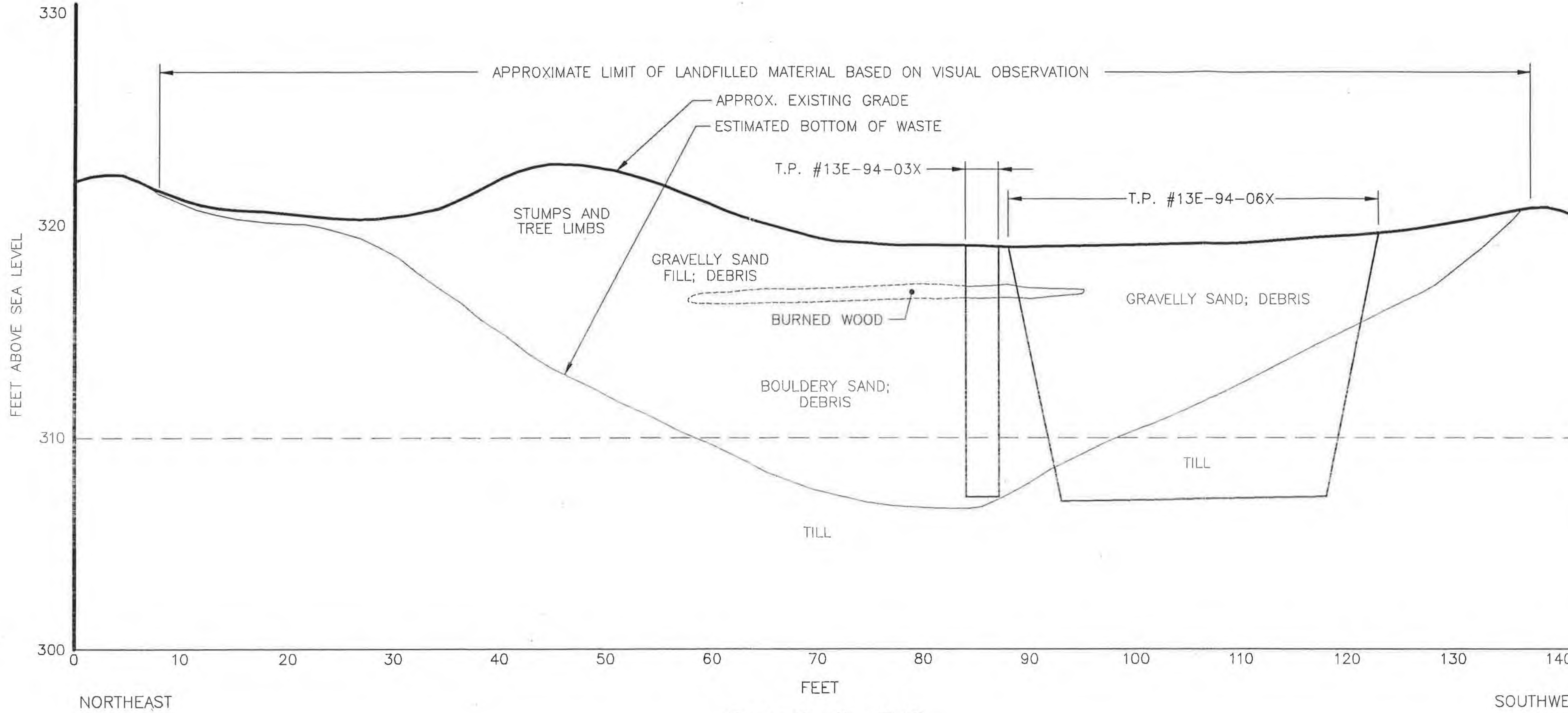
NOTES:

1. BOTTOM OF WASTE INTERPOLATED FROM TEST PIT LOGS AND PRE-LANDFILL TOPOGRAPHIC MAP.
2. GEOLOGIC DESCRIPTIONS BASED ON TEST PIT LOGS.
3. SEE FIGURE 2-12 FOR CROSS SECTION ORIENTATION.
4. T.P. = TEST PIT

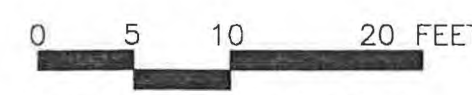
FIGURE 2-13
SA 13 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F025.DWG 1'=10' 1/07/97



Cross Section B-B'



SCALE: 1"=10' HORIZONTAL
SCALE: 1"=5' VERTICAL

NOTES:

1. BOTTOM OF WASTE INTERPOLATED FROM TEST PIT LOGS AND PRE-LANDFILL TOPOGRAPHIC MAP.
2. GEOLOGIC DESCRIPTIONS BASED ON TEST PIT LOGS.
3. SEE FIGURE 2-12 FOR CROSS SECTION ORIENTATION.
4. T.P. = TEST PIT

FIGURE 2-14
SA 13 CROSS SECTION B-B'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F026.DWG 1"=10' 1/07/97

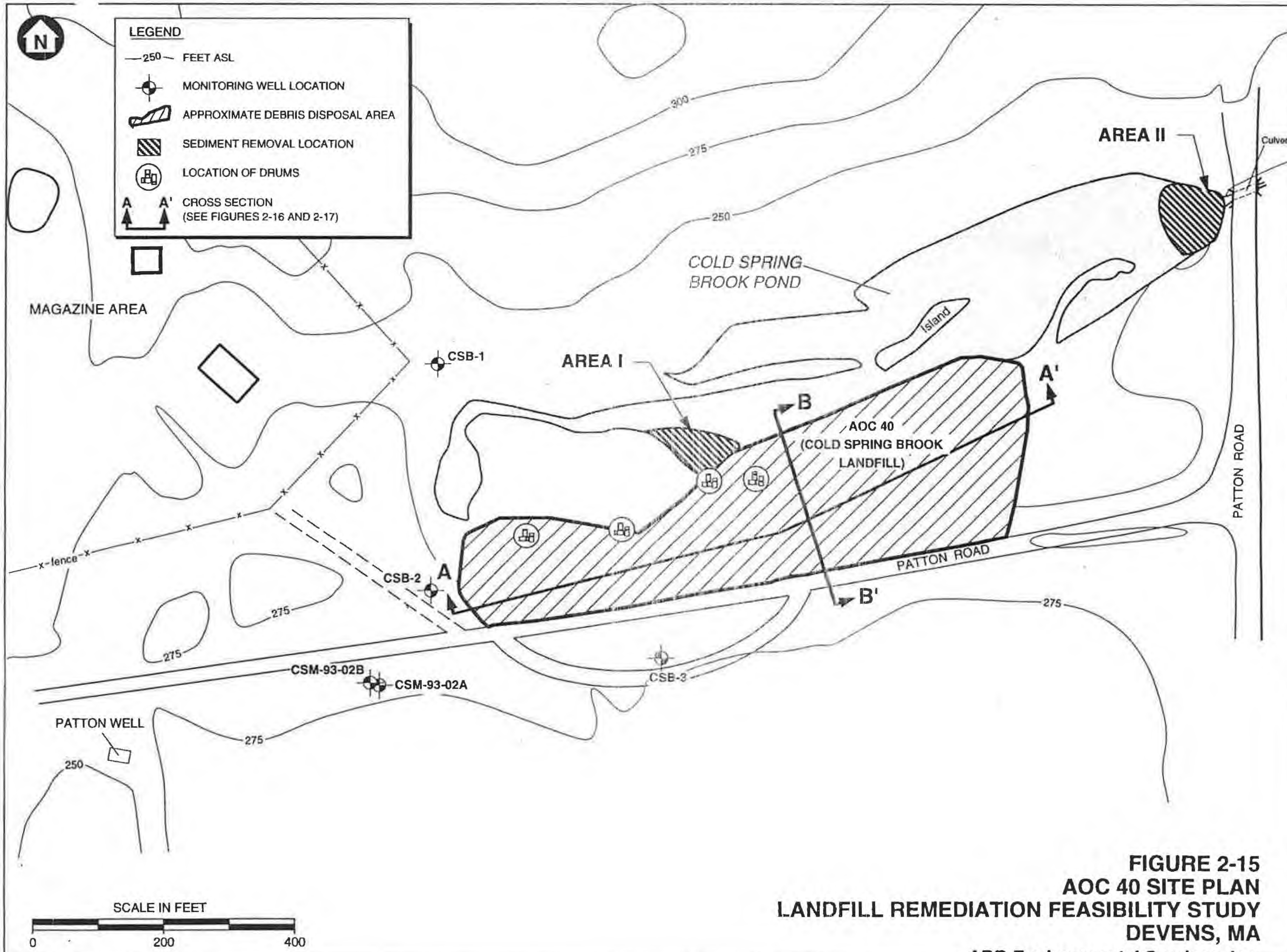


FIGURE 2-15
AOC 40 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

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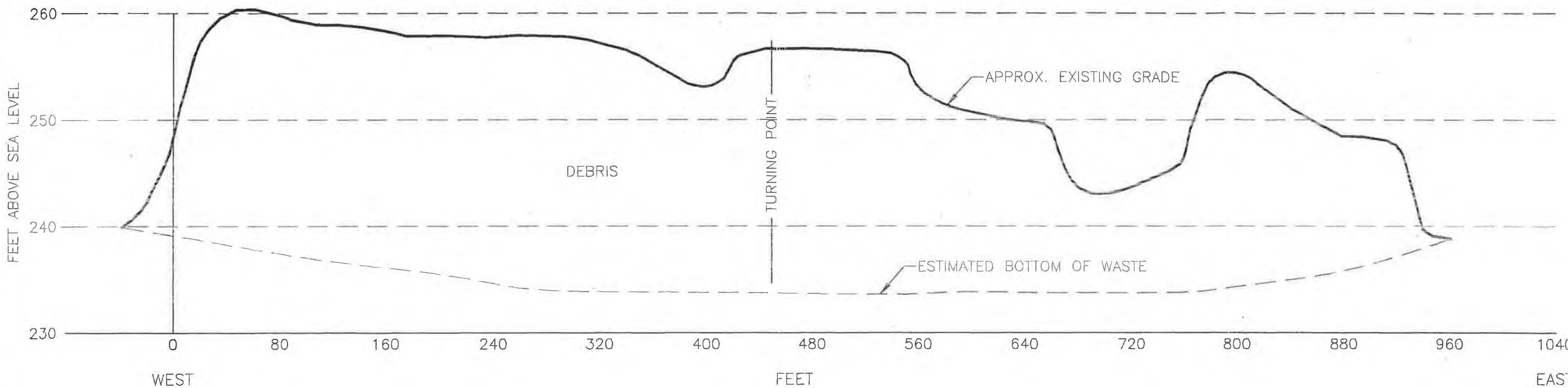


Cross Section A-A'

0 40 80 160 FEET

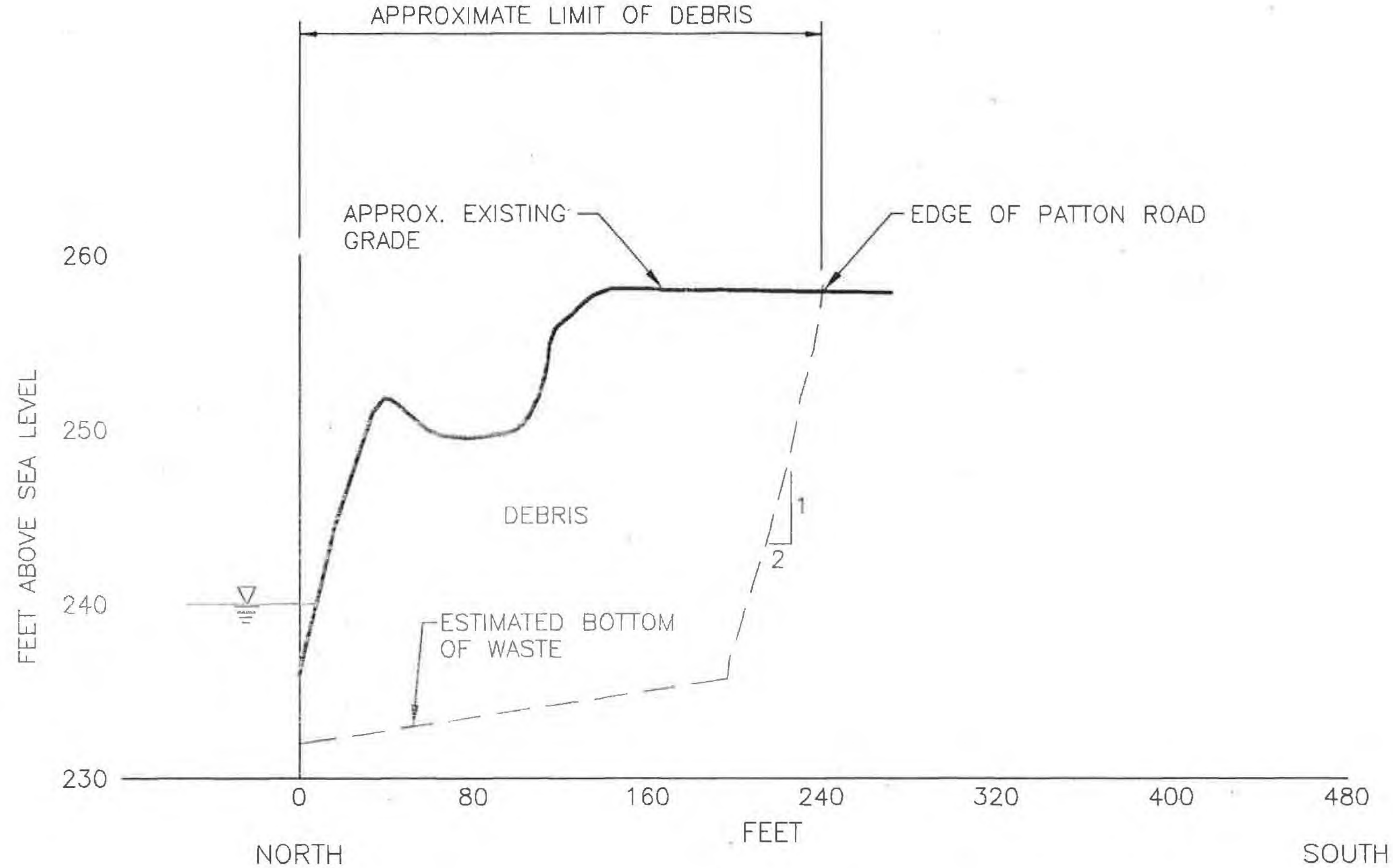
SCALE: 1"=80' HORIZONTAL
SCALE: 1"=10' VERTICAL

NOTES:

1. BOTTOM OF WASTE IS ESTIMATED BASED ON ELEVATIONS FROM SEA CONSULTANTS, INC. TEST PIT LOGS.
2. SEE FIGURE 2-15 FOR CROSS SECTION ORIENTATION.

J:\8712-04\8712F027.DWG 1"=40' 1/07/97

FIGURE 2-16
AOC 40 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA
ABB Environmental Services, Inc.



Cross Section B-B'

0 40 80 160 FEET

SCALE: 1"=80' HORIZONTAL
SCALE: 1"=10' VERTICAL

NOTES:

1. BOTTOM OF WASTE IS ESTIMATED BASED ON ELEVATIONS FROM SEA CONSULTANTS, INC. TEST PIT LOGS, AND THAT NO DEBRIS IS BENEATH PATTON ROAD.

2. SEE FIGURE 2-15 FOR CROSS SECTION ORIENTATION.

FIGURE 2-17
AOC 40 CROSS SECTION B-B'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F028.DWG 1"=80' 1/07/97

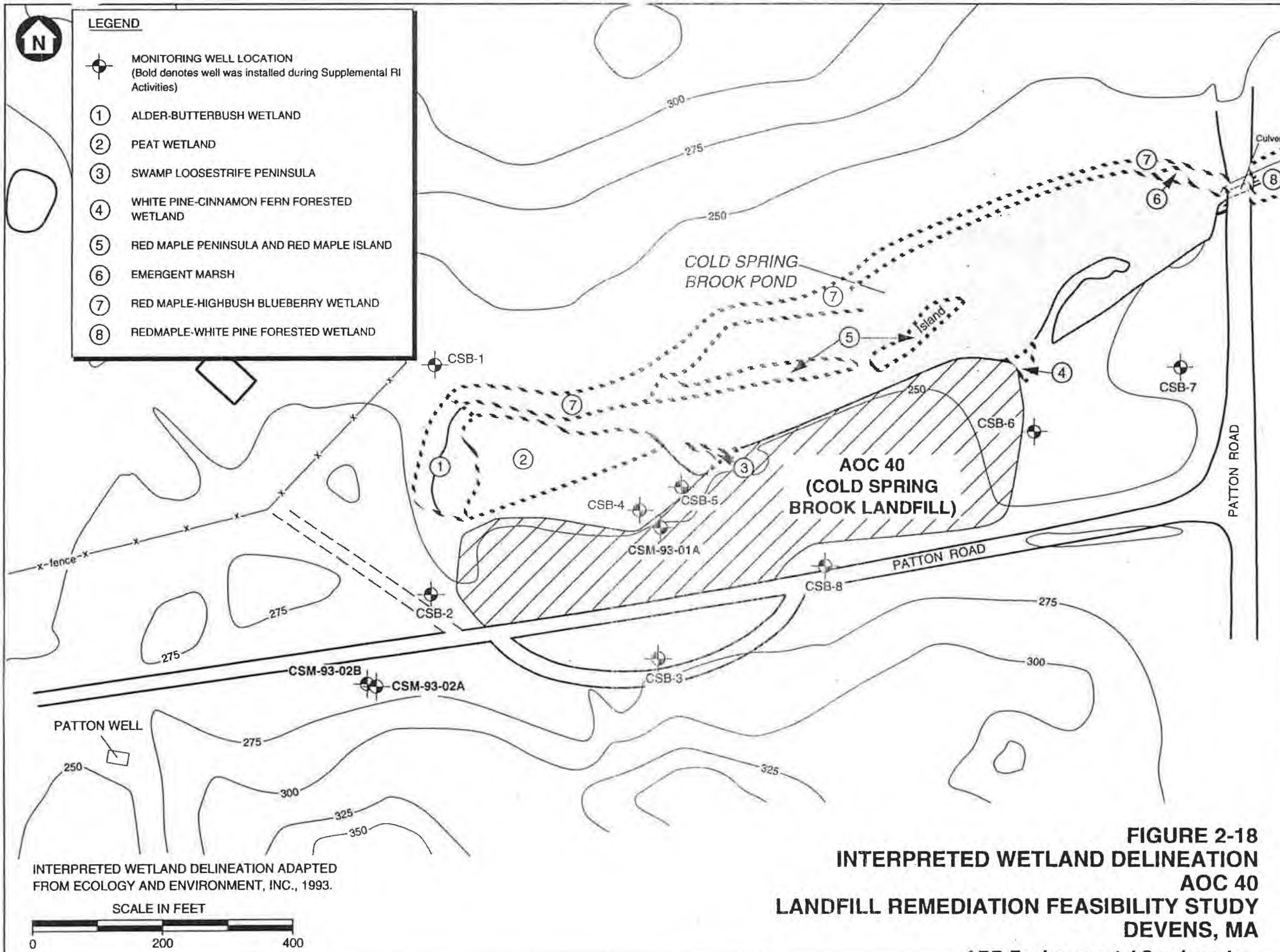


FIGURE 2-18
INTERPRETED WETLAND DELINEATION
AOC 40
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

9507028D 2 45 HN

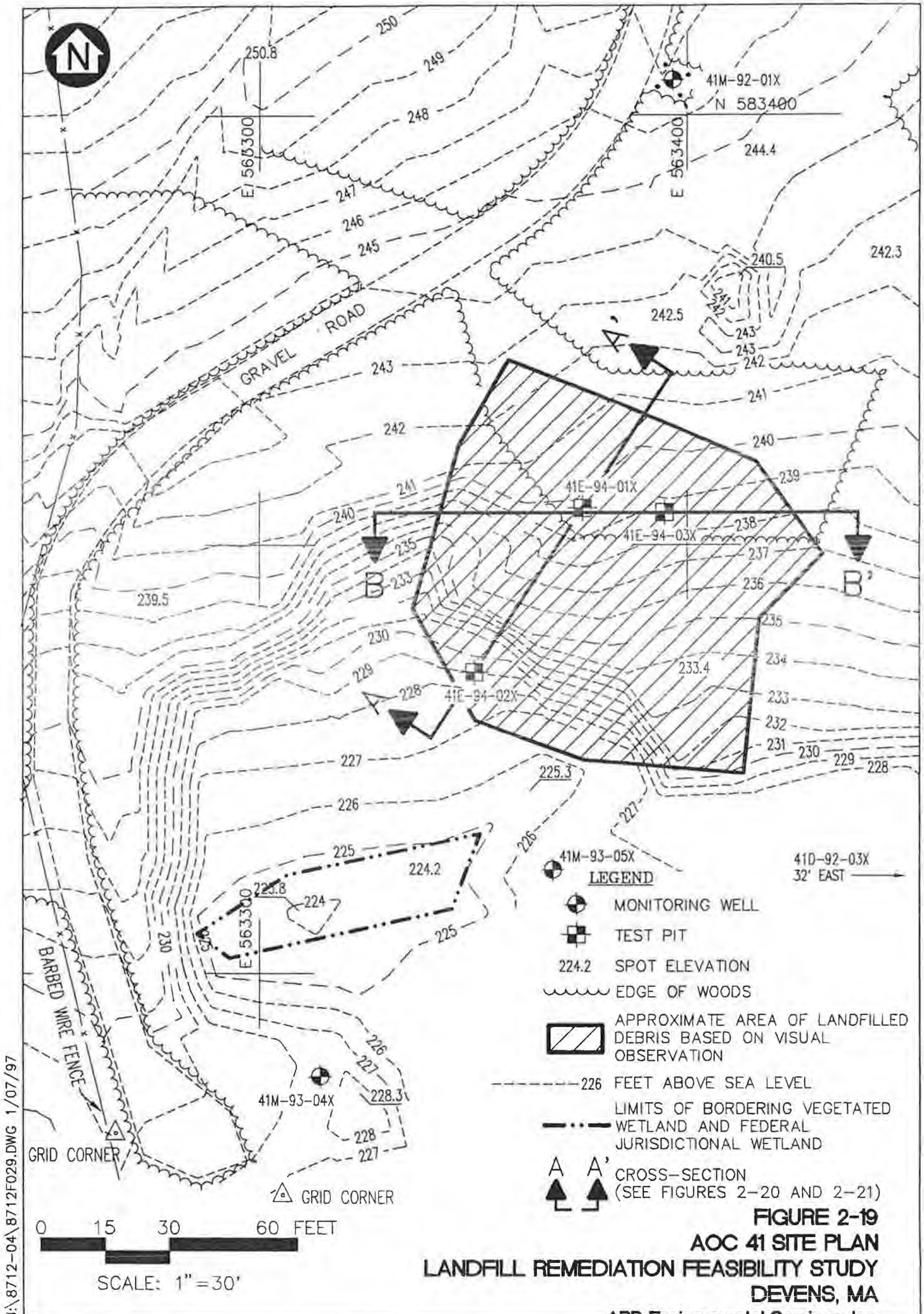
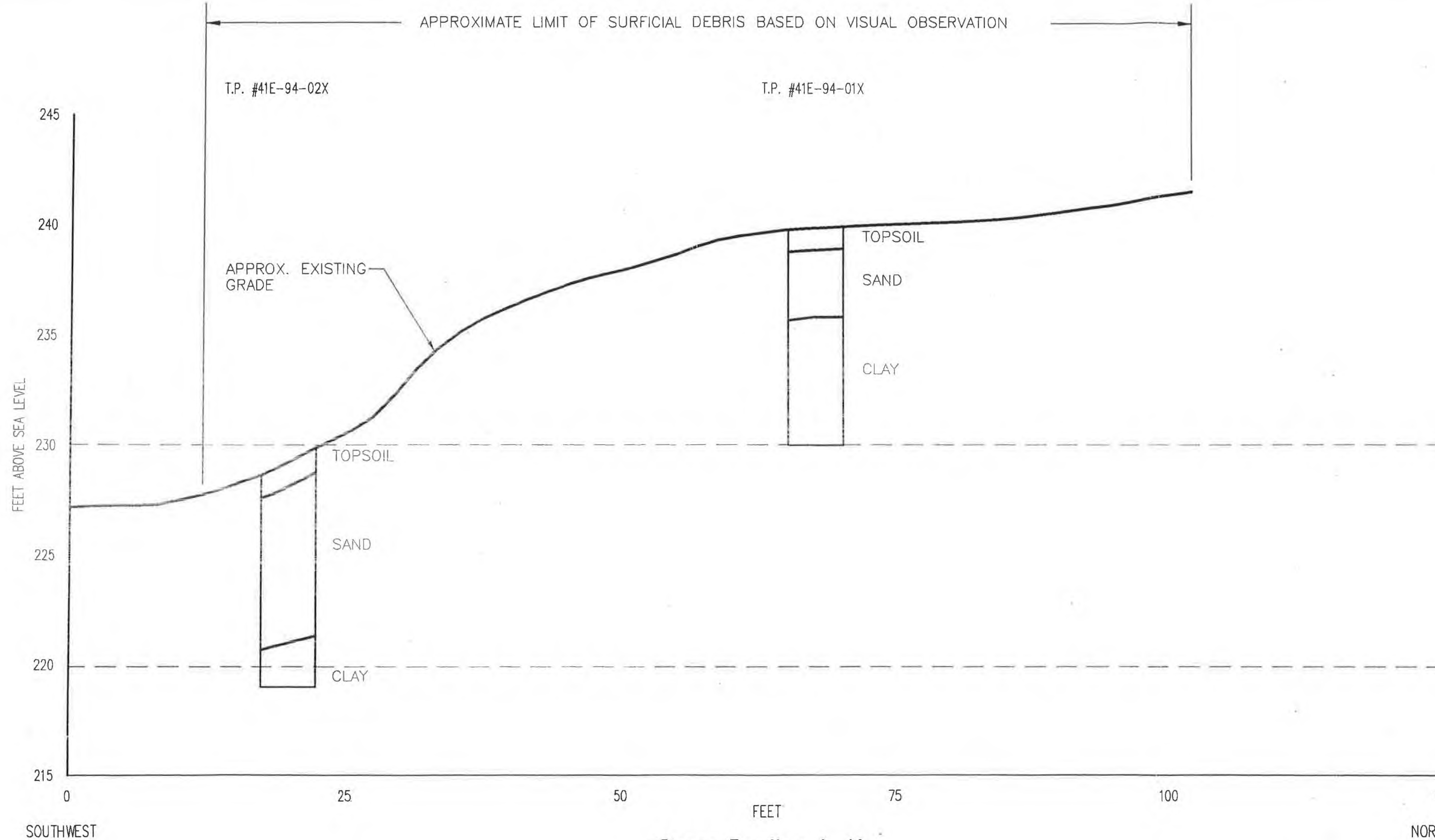


FIGURE 2-19
AOC 41 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.



Cross Section A-A'

0 5 10 20 FEET

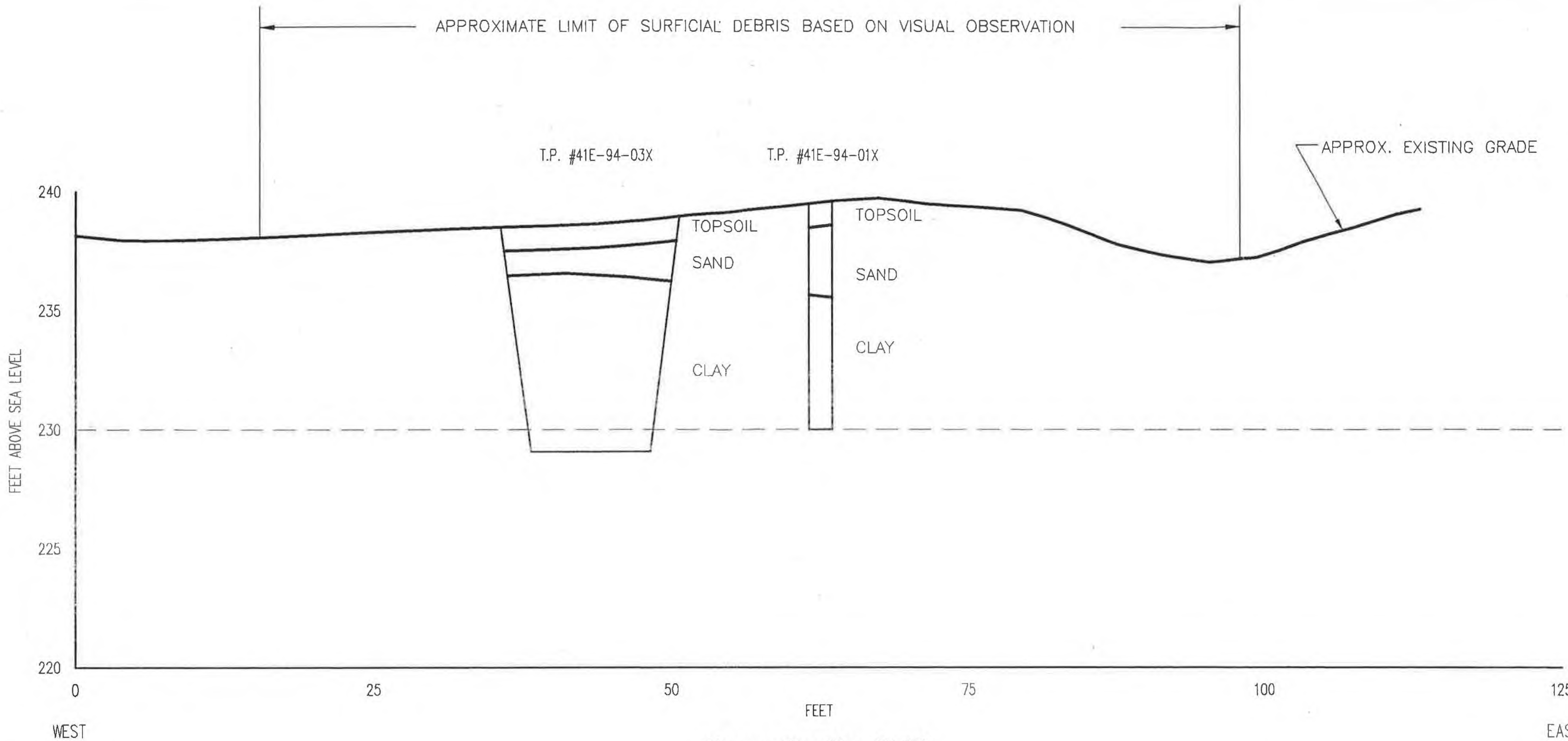
SCALE: 1"=10' HORIZONTAL
SCALE: 1"=5' VERTICAL

NOTES:

1. GEOLOGIC DESCRIPTIONS BASED ON TEST PIT LOGS.
2. DEBRIS NOTED AS SURFICIAL IN ALL TEST PIT LOGS.
3. SEE FIGURE 2-19 FOR CROSS SECTION ORIENTATION.
4. T.P. = TEST PIT

FIGURE 2-20
AOC 41 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA
ABB Environmental Services, Inc.

J:\8712-04\8712F030.DWG 1"=10' 1/07/97



Cross Section B-B'

0 5 10 20 FEET

SCALE: 1"=10' HORIZONTAL
SCALE: 1"=5' VERTICAL

NOTES:

1. GEOLOGIC DESCRIPTIONS BASED ON TEST PIT LOGS.
2. DEBRIS NOTED AS SURFICIAL IN ALL TEST PIT LOGS.
3. SEE FIGURE 2-19 FOR CROSS SECTION ORIENTATION.
4. T.P. = TEST PIT

J:\8712-04\8712F031.DWG 1/07/97

FIGURE 2-21
AOC 41 CROSS SECTION B-B'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA
ABB Environmental Services, Inc.

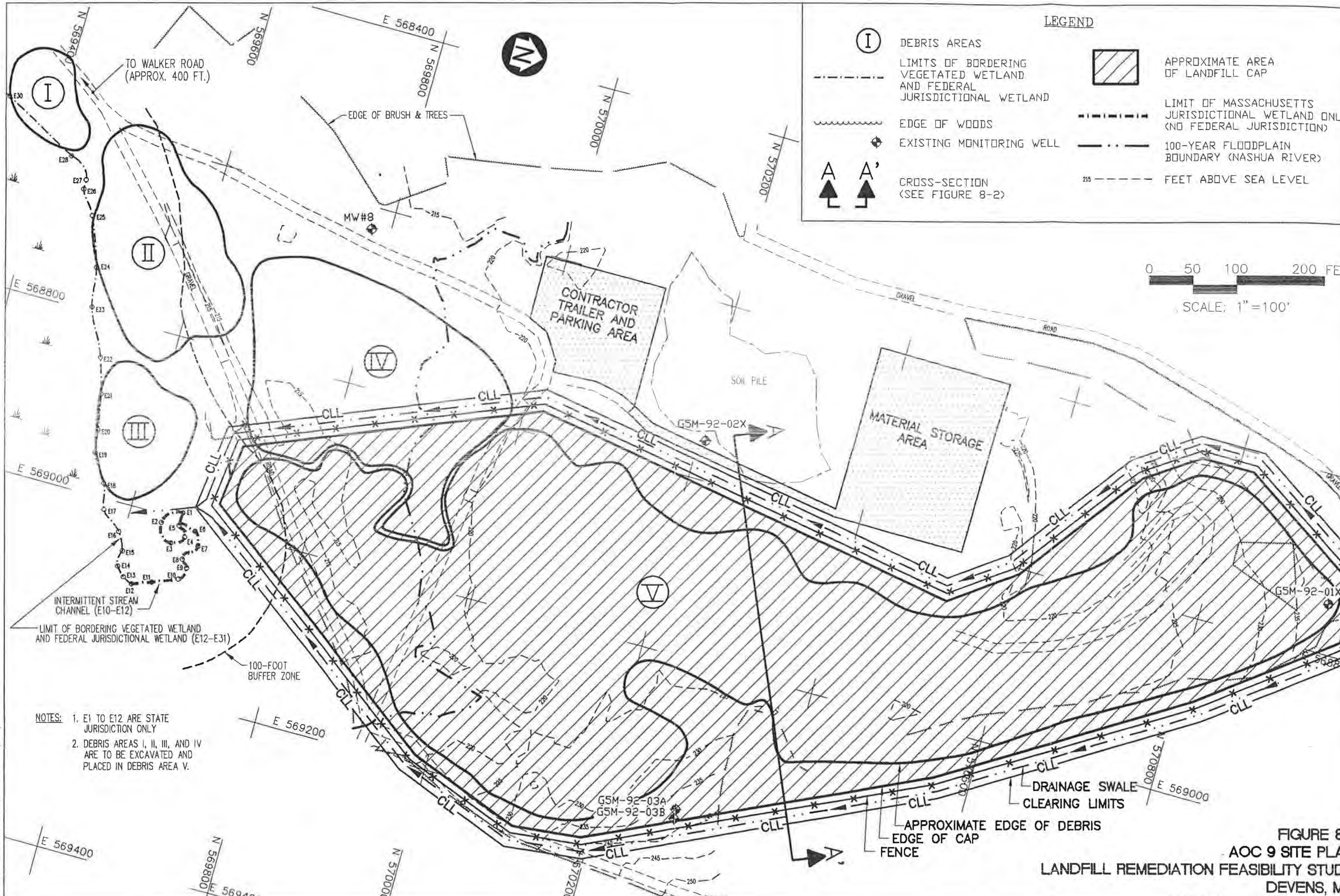
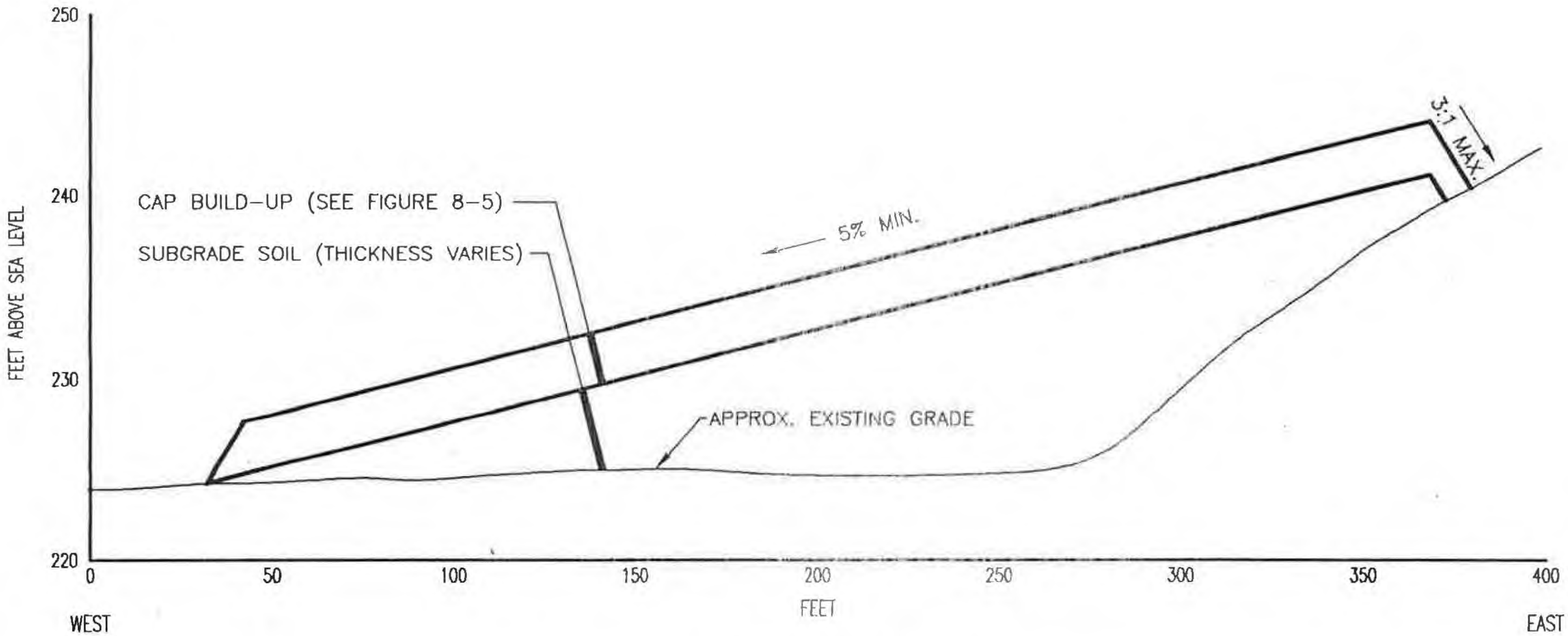


FIGURE 8-
AOC 9 SITE PLA
LANDFILL REMEDIATION FEASIBILITY STUD
DEVENS, M
ABB Environmental Services, In



Cross Section A–A'

NOTES:

1. SEE FIGURE 8–1 FOR CROSS SECTION ORIENTATION.

FIGURE 8-2
AOC 9 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F010.DWG 1/28/97

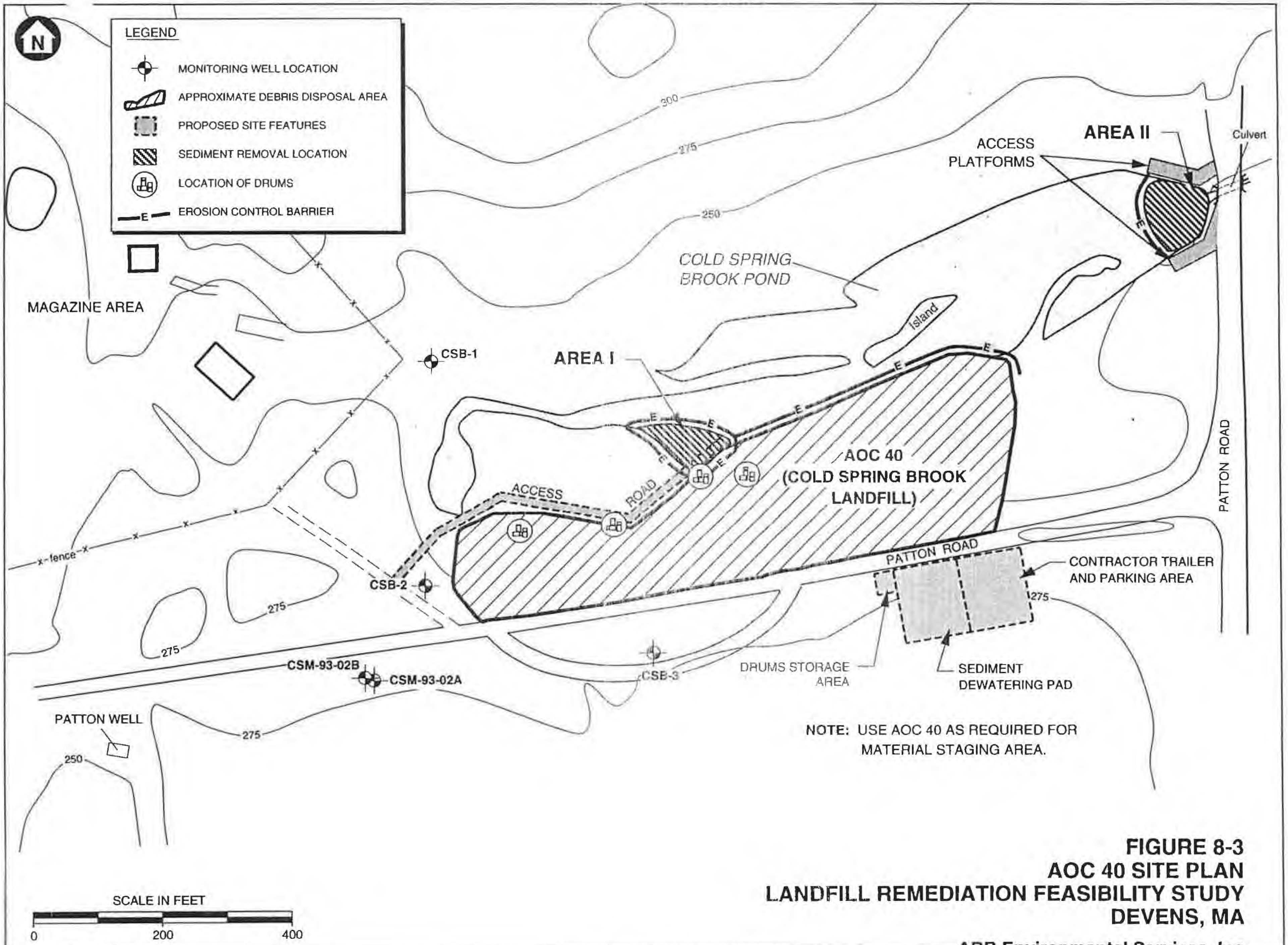
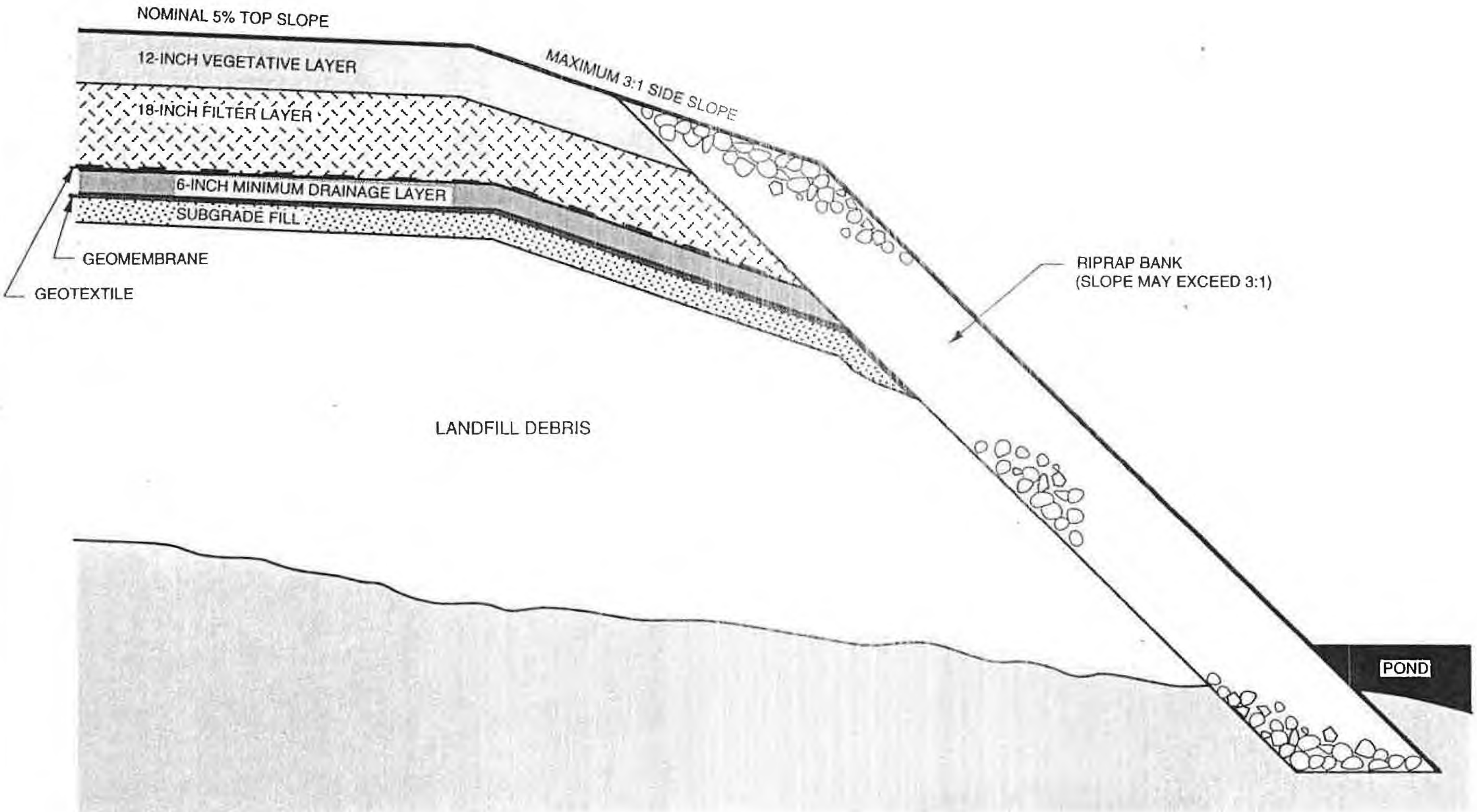


FIGURE 8-3
AOC 40 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

9507028D(e) 123456 8

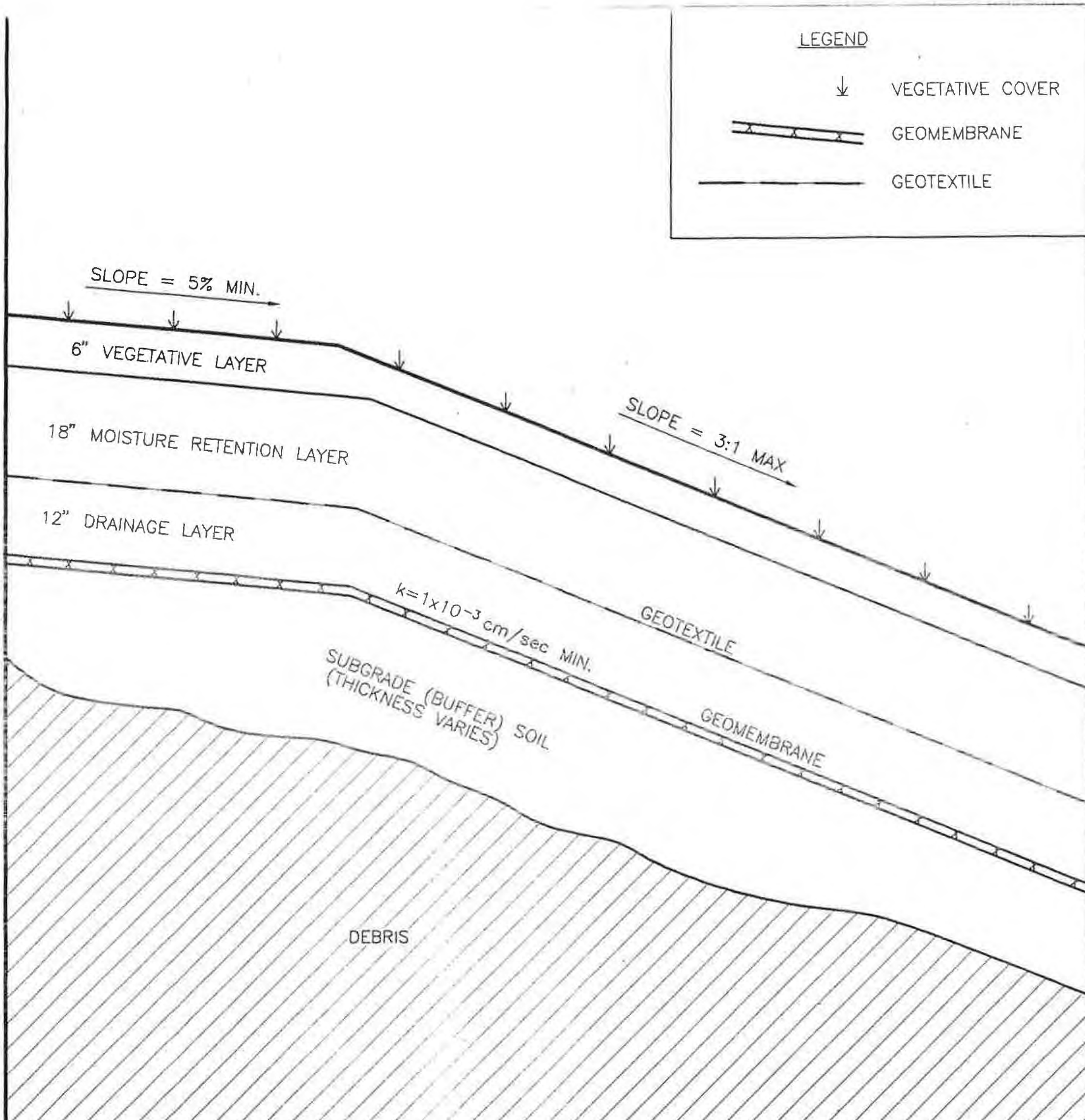


NOT TO SCALE

FIGURE 8-4
AOC 40 COVER SYSTEM FOR EXISTING LANDFILL
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

9402028D(a)

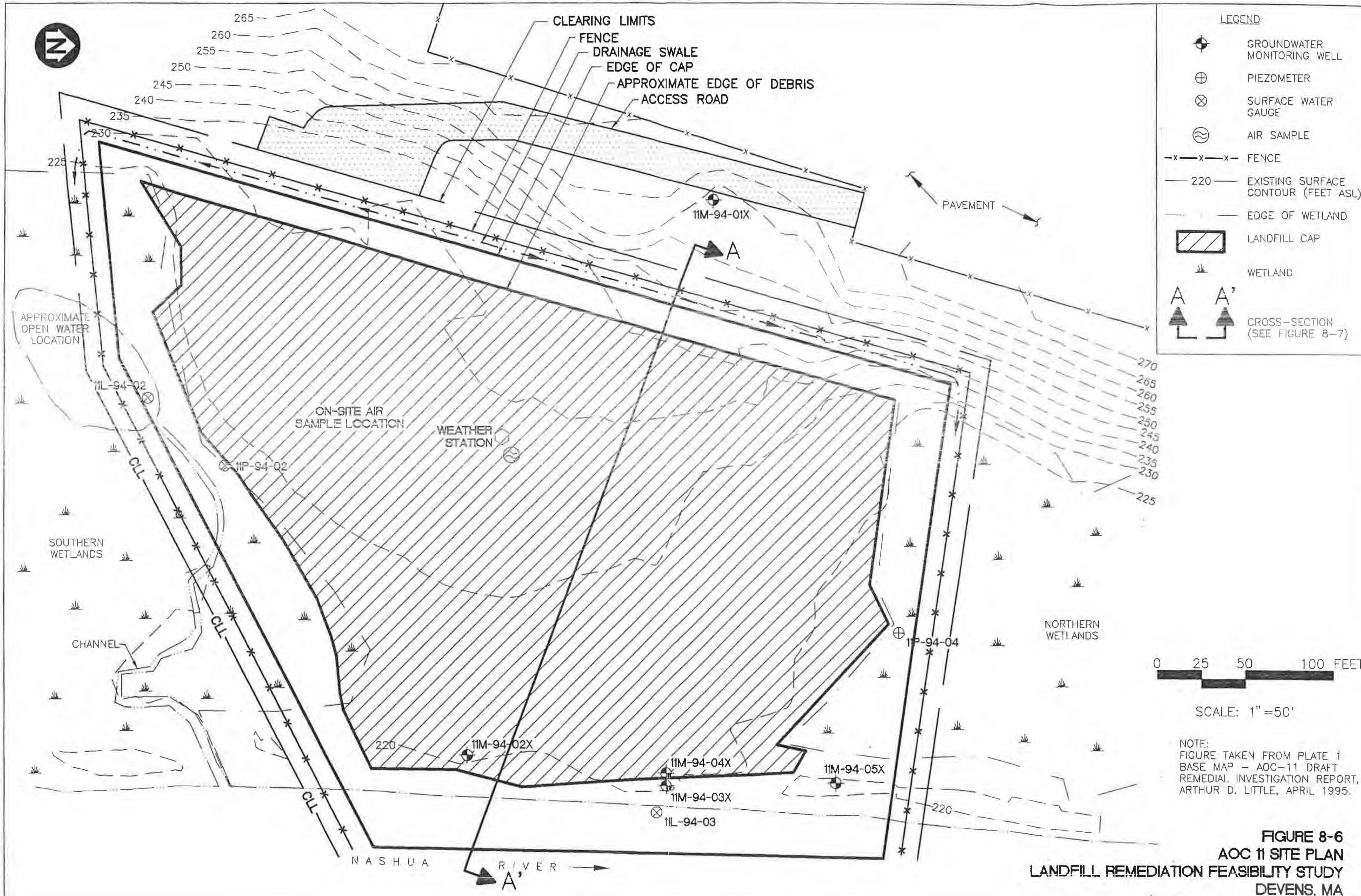


J:\8712-04\8712F012.DWG 1/28/97

NOT TO SCALE

FIGURE 8-5
CROSS SECTION THROUGH LANDFILL CAP
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

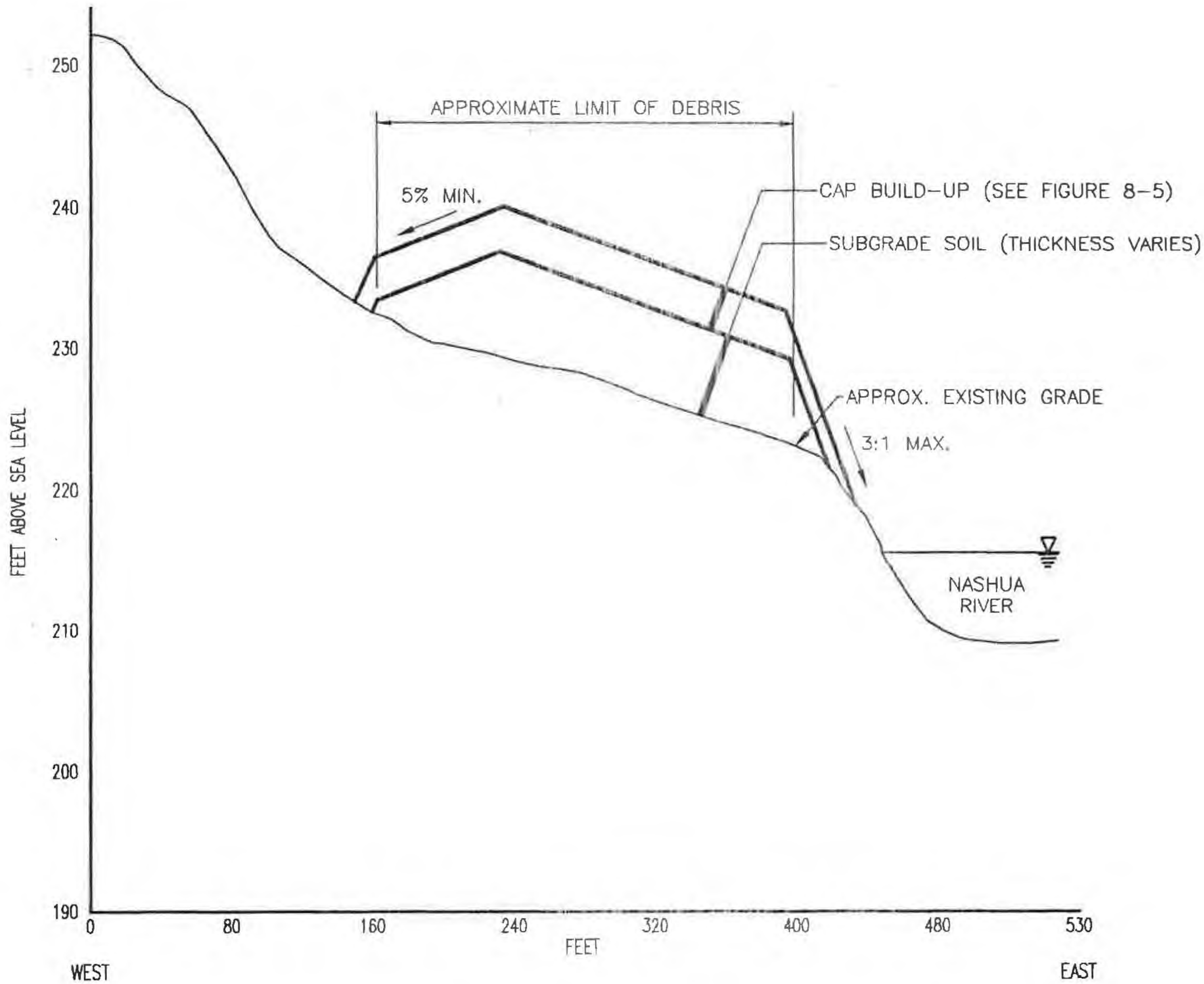


NOTE:
FIGURE TAKEN FROM PLATE 1 BASE MAP – AOC-11 DRAFT REMEDIAL INVESTIGATION REPORT, ARTHUR D. LITTLE, APRIL 1995.

FIGURE 8-6
AOC 11 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

8712-04\8712F001.DWG 1"=50' 1/28/97



Cross Section A-A'

NOTES:

1. CROSS SECTION TAKEN FROM FIGURE 3-2, DRAFT RI REPORT, ARTHUR D. LITTLE, APRIL 1995.
2. SEE FIGURE 8-6 FOR CROSS SECTION ORIENTATION.

FIGURE 8-7
AOC 11 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F006.DWG 1/28/97

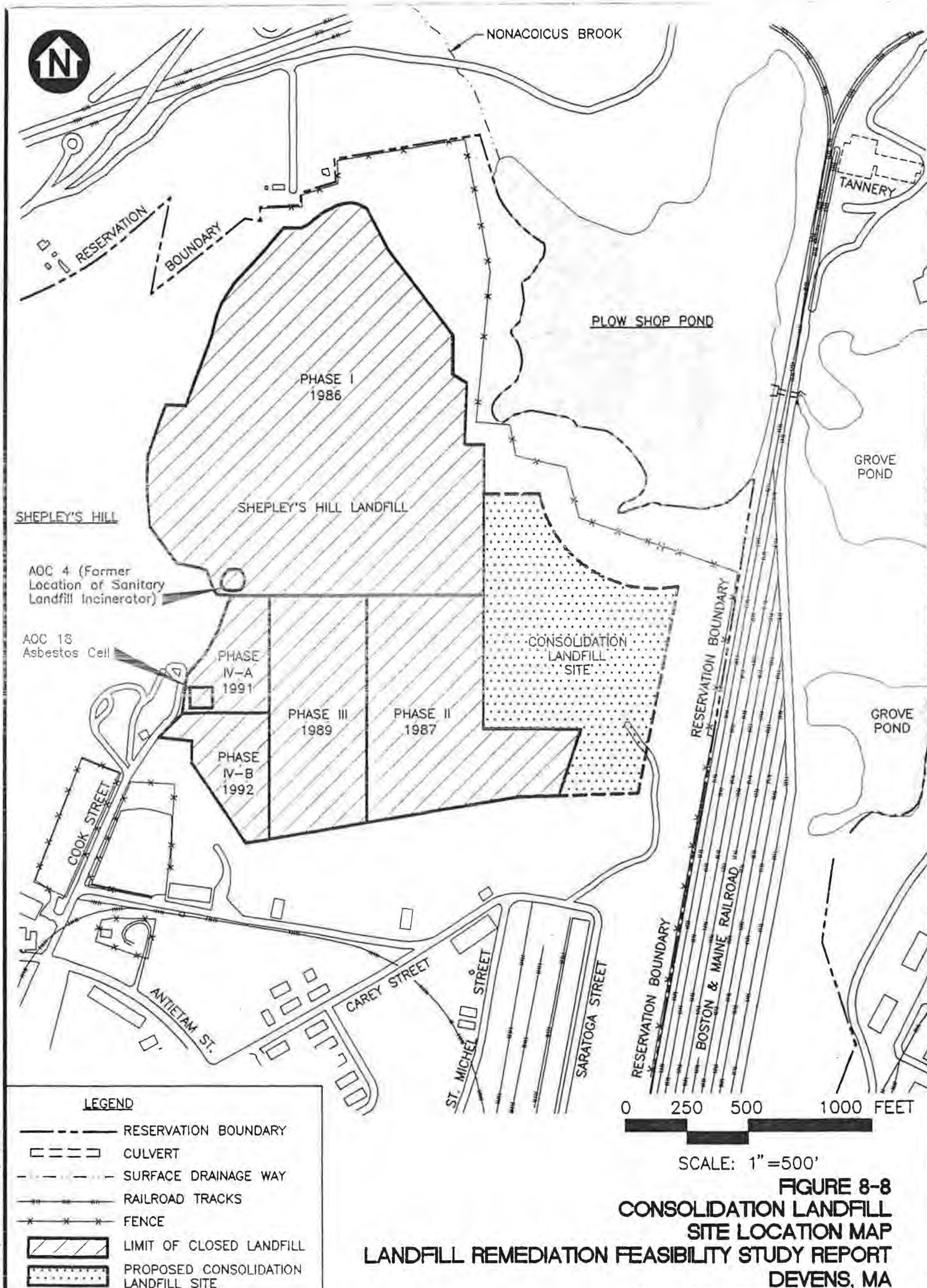
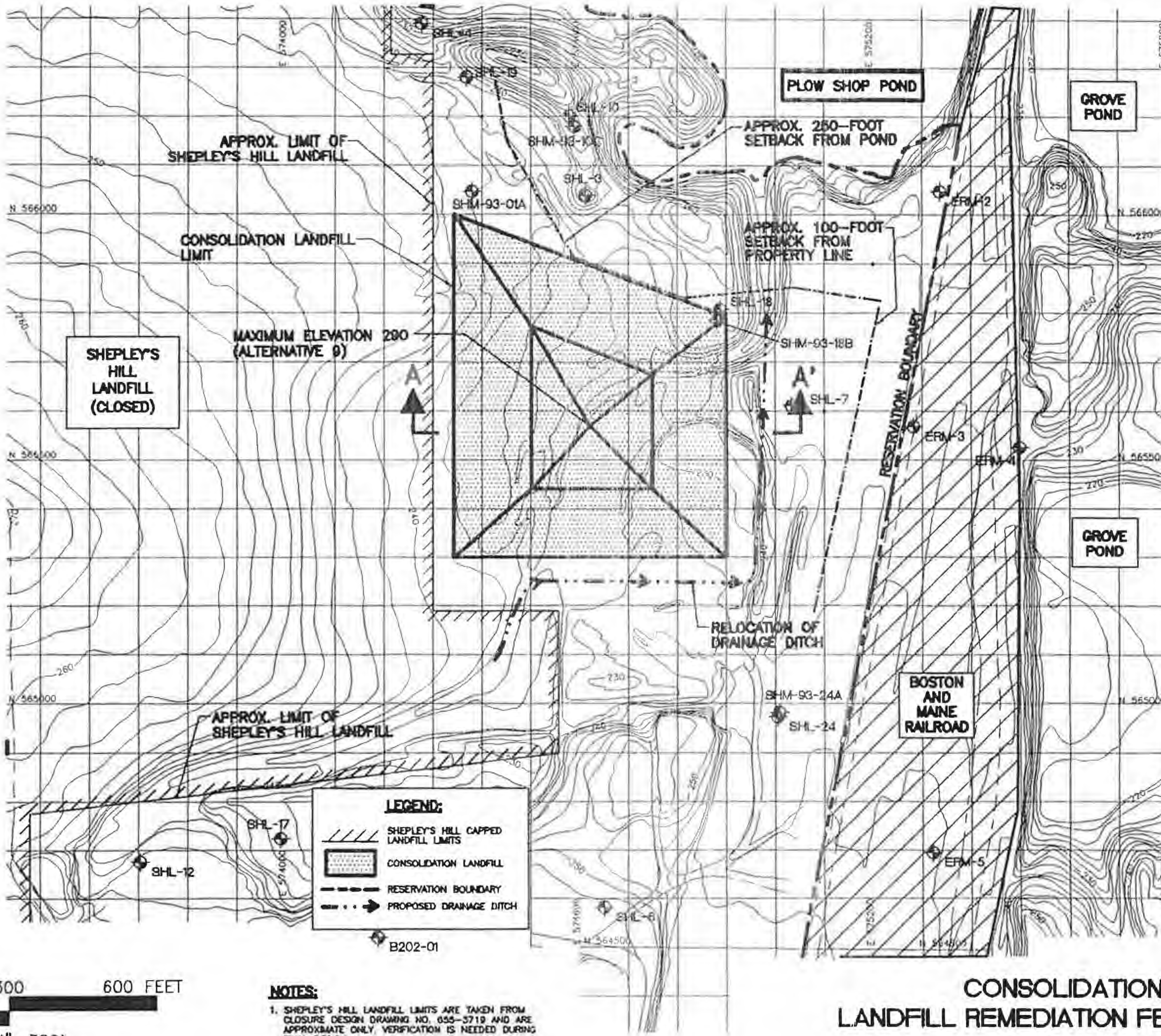


FIGURE 8-8
CONSOLIDATION LANDFILL SITE LOCATION MAP
LANDFILL REMEDIATION FEASIBILITY STUDY REPORT
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F037.DWG 1-28-97 (PLOT 1=300)



NOTES:

1. SHEPLEY'S HILL LANDFILL LIMITS ARE TAKEN FROM CLOSURE DESIGN DRAWING NO. 655-3719 AND ARE APPROXIMATE ONLY. VERIFICATION IS NEEDED DURING FINAL DESIGN.

FIGURE 8-9
CONSOLIDATION LANDFILL PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

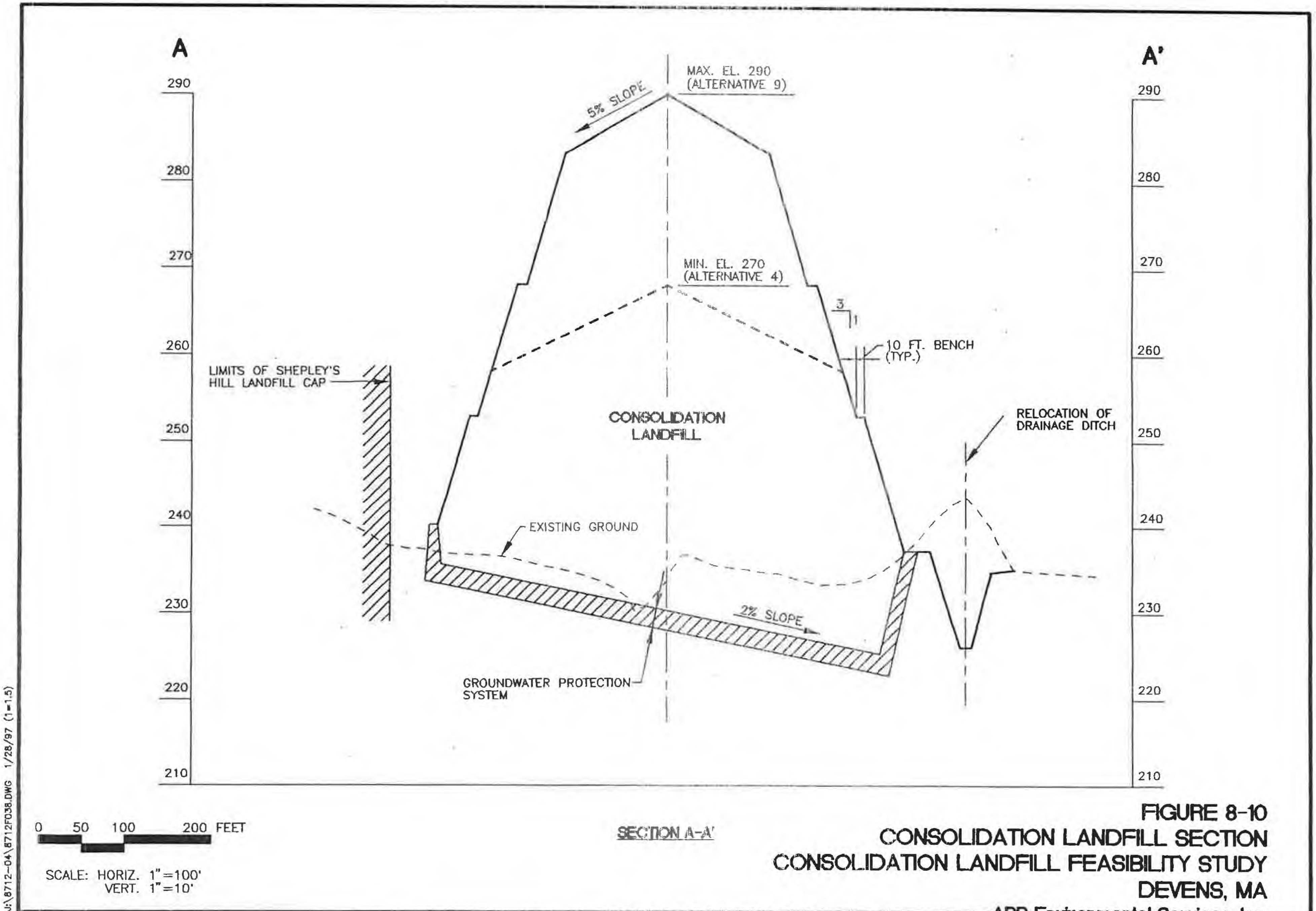
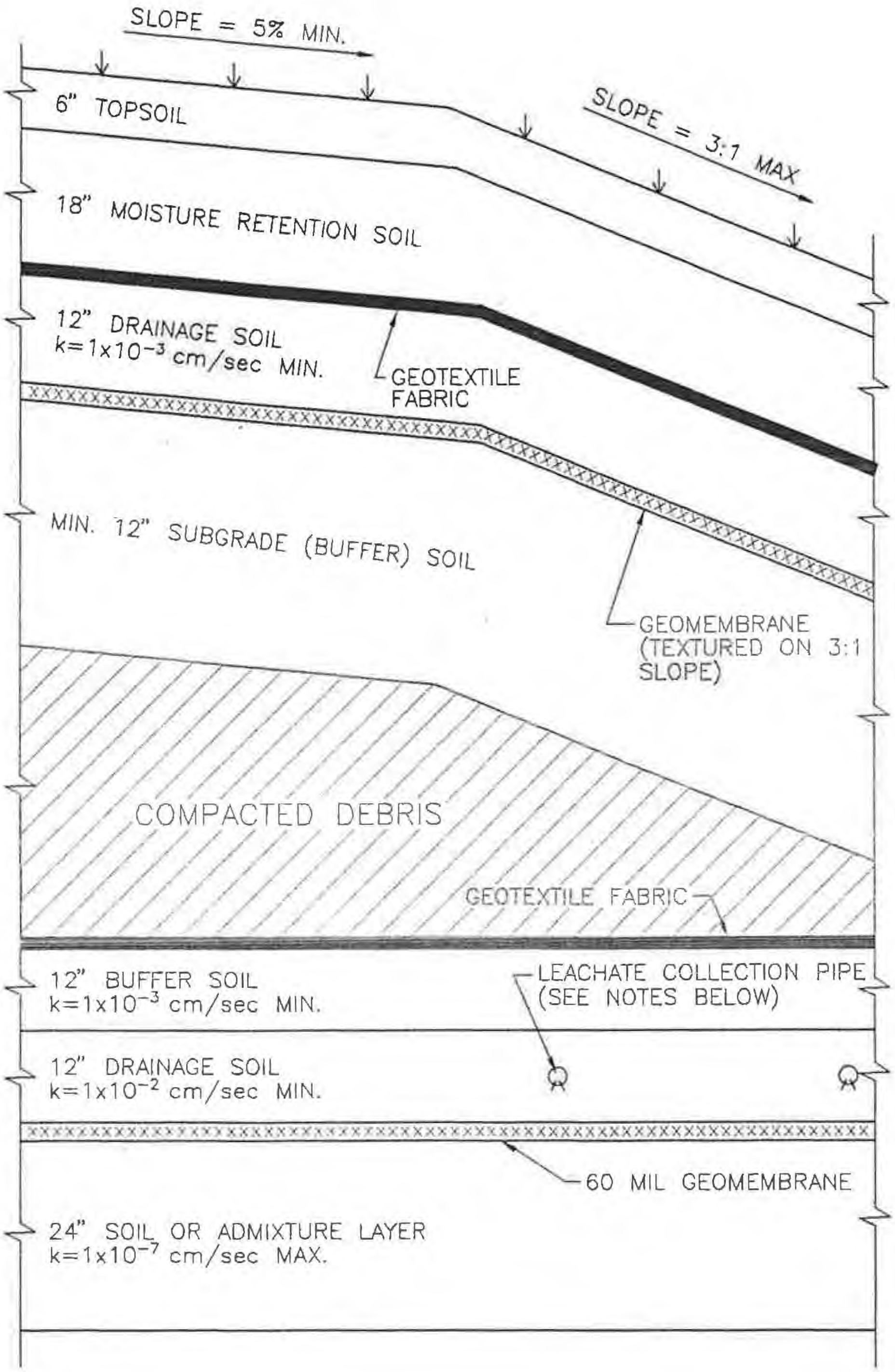


FIGURE 8-10
CONSOLIDATION LANDFILL SECTION
CONSOLIDATION LANDFILL FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.



NOTES:

1. LINER TO BE SLOPED @ 2% MIN.
2. LEACHATE COLLECTION PIPES (6-INCH DIA.) TO BE SLOPED @ 1% MIN..
3. ALTERNATELY, A GEOSYNTHETIC CLAY LINER MAY BE CONSIDERED FOR THE SOIL OR ADMIXTURE LAYER.

J:\8712-04\8712F036.DWG 1/28/97

NOT TO SCALE

FIGURE 8-11
CONSOLIDATION LANDFILL CAP AND LINER SECTIONS
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

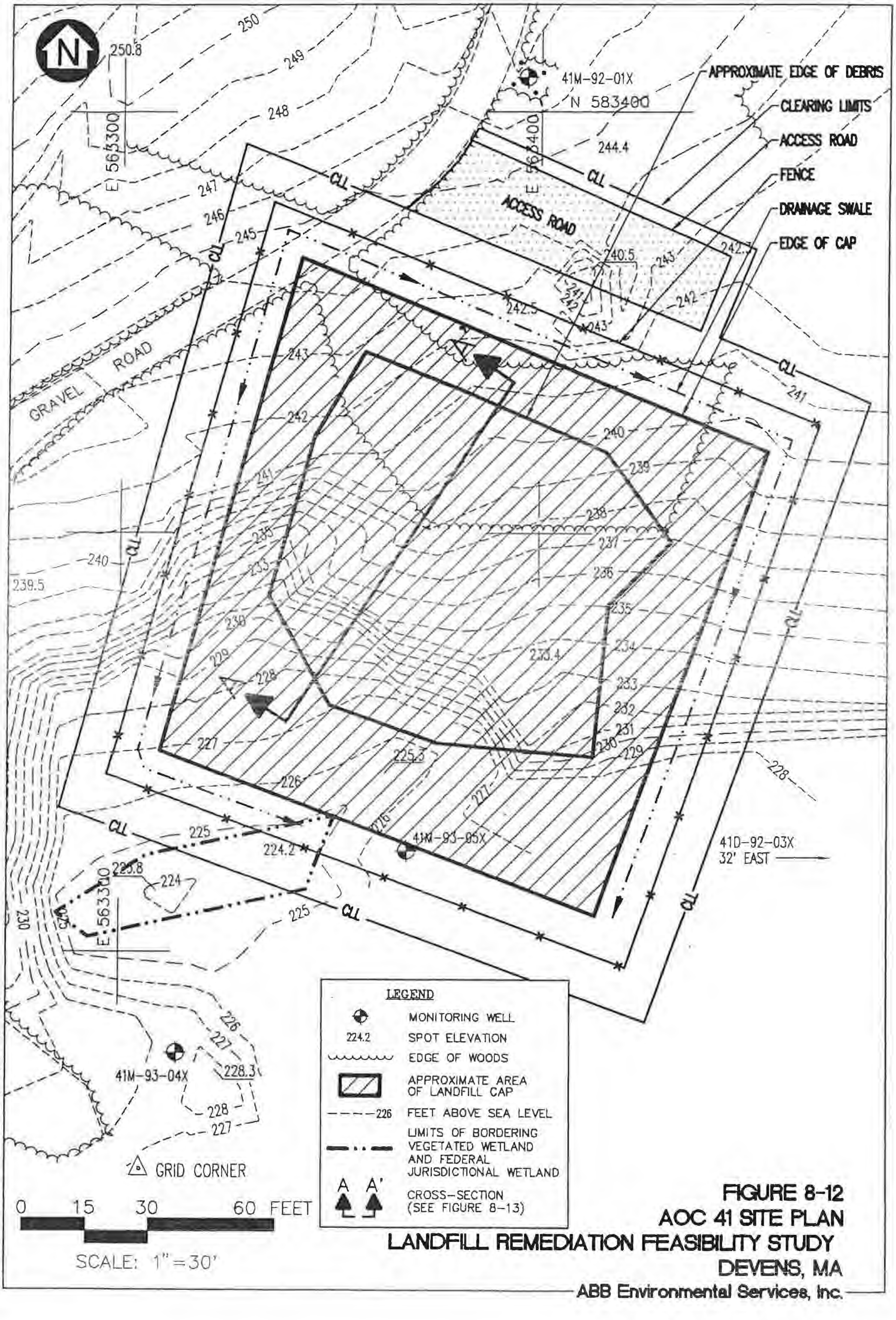
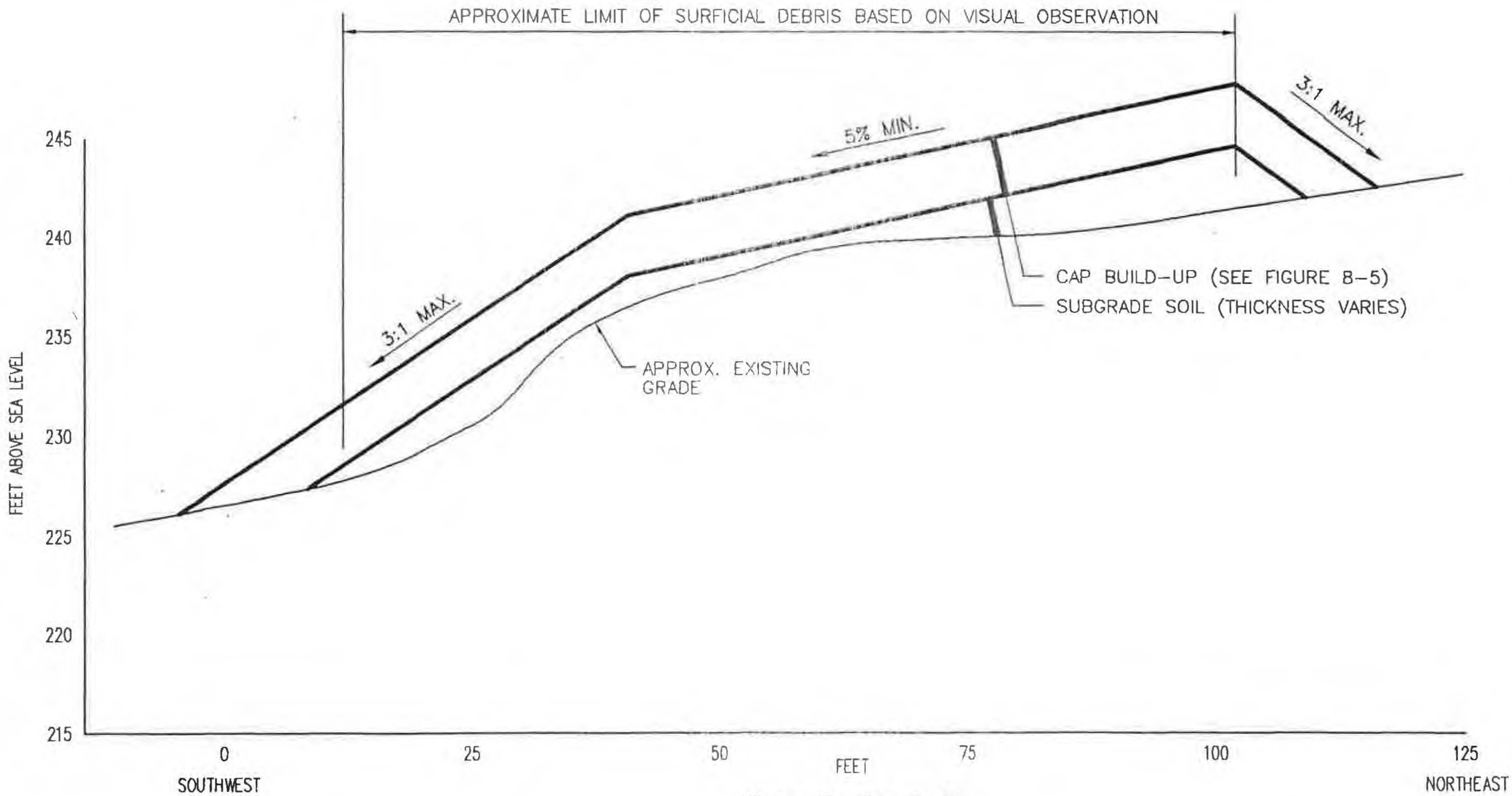


FIGURE 8-12
AOC 41 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.



Cross Section A-A'

J:\8712-04\8712F007.DWG 1/29/97

NOTE:

1. SEE FIGURE 8-12 FOR CROSS SECTION ORIENTATION.

FIGURE 8-13
AOC 41 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA
ABB Environmental Services, Inc.

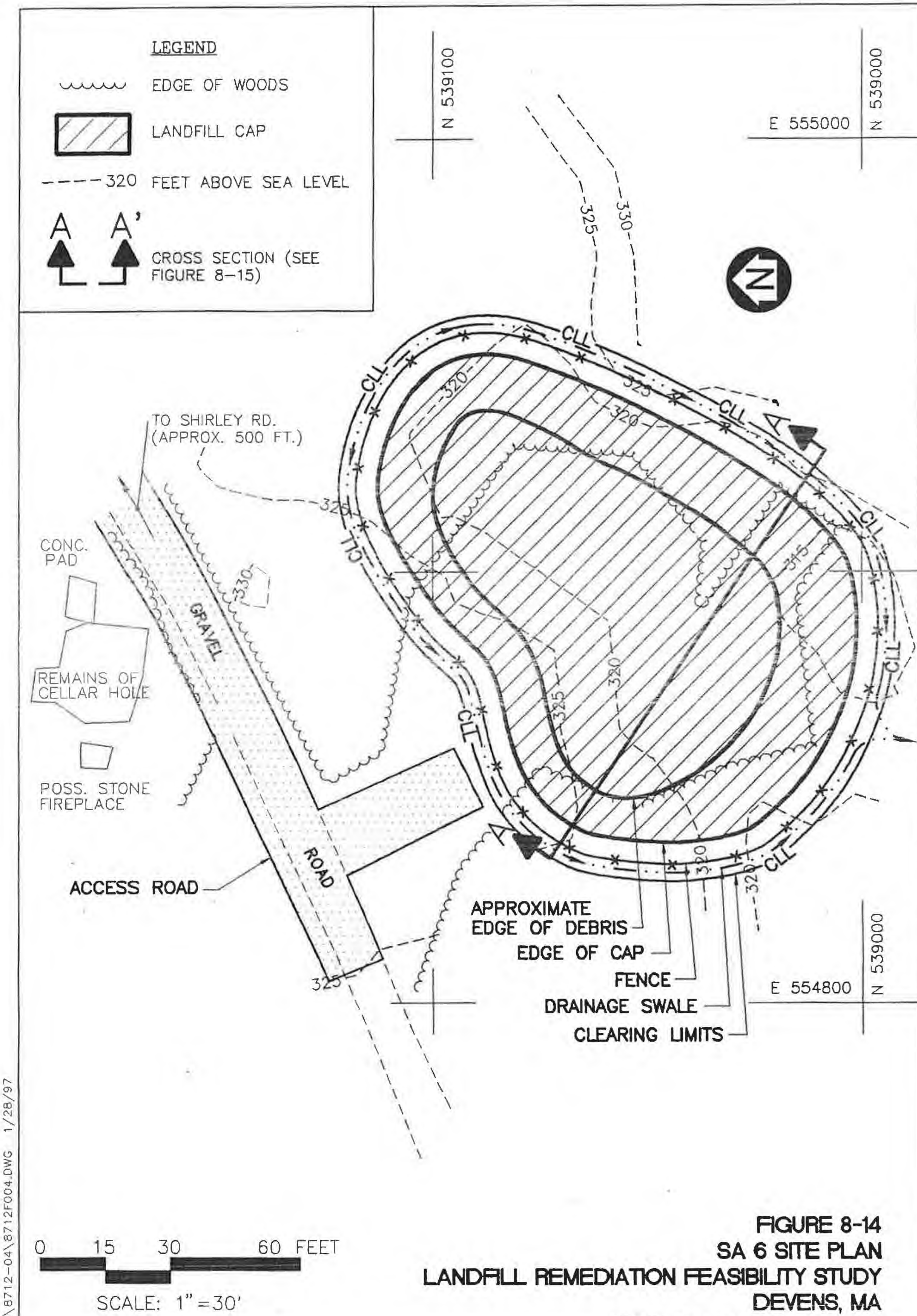
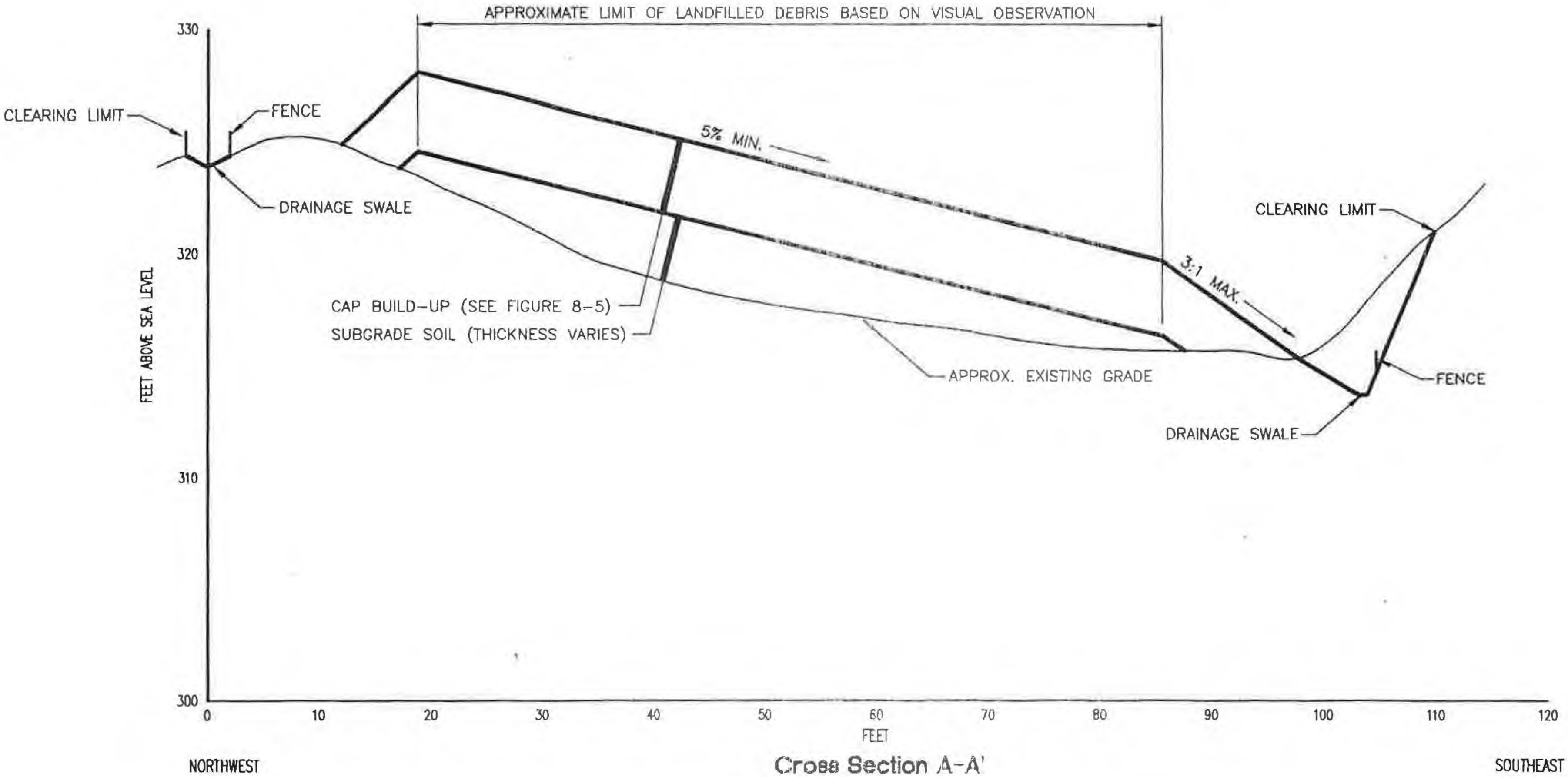


FIGURE 8-14
SA 6 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.



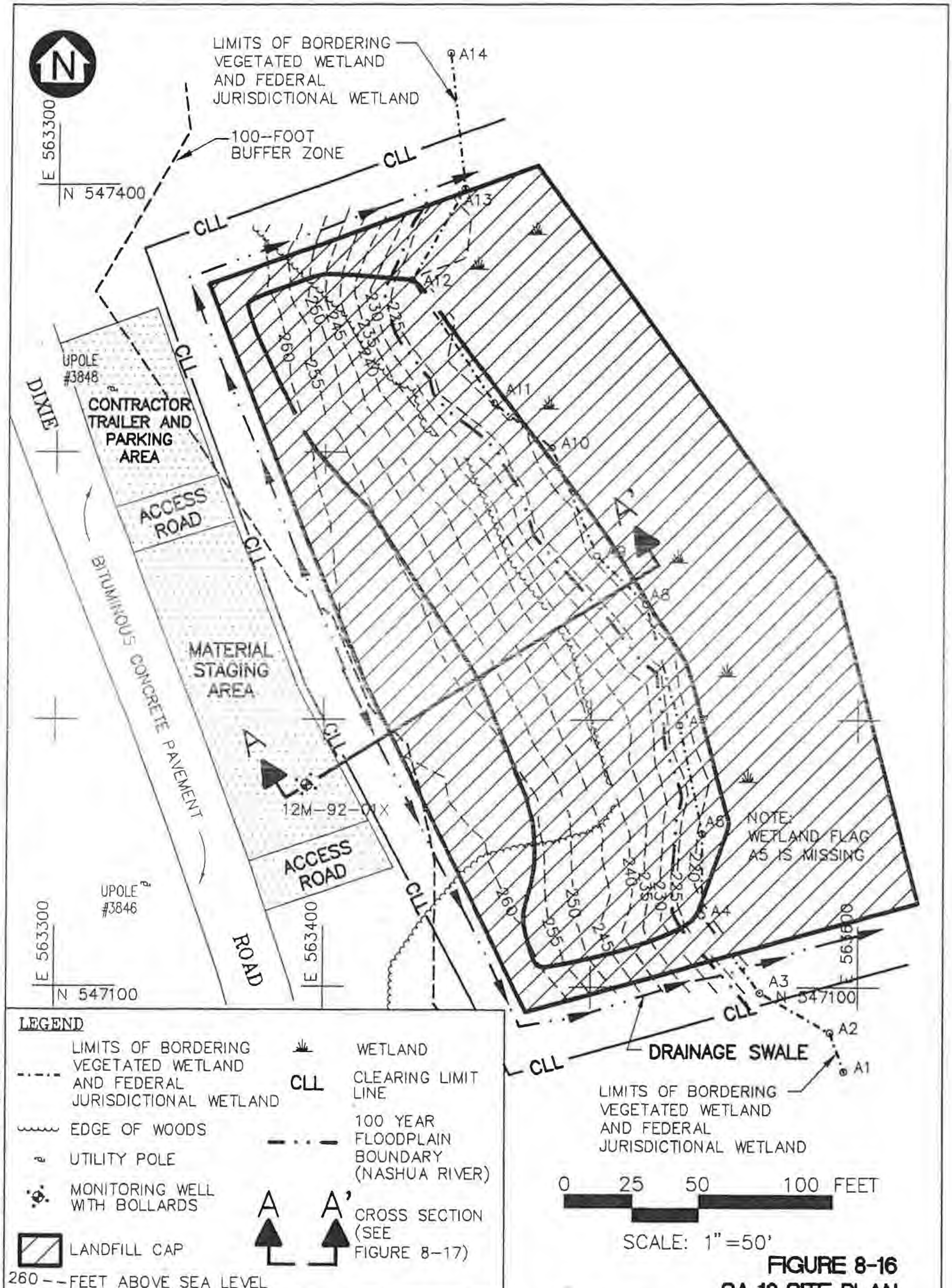
NOTE:

1. SEE FIGURE 8-14 FOR CROSS SECTION ORIENTATION.

FIGURE 8-15
SA 6 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F008.DWG 1/28/97

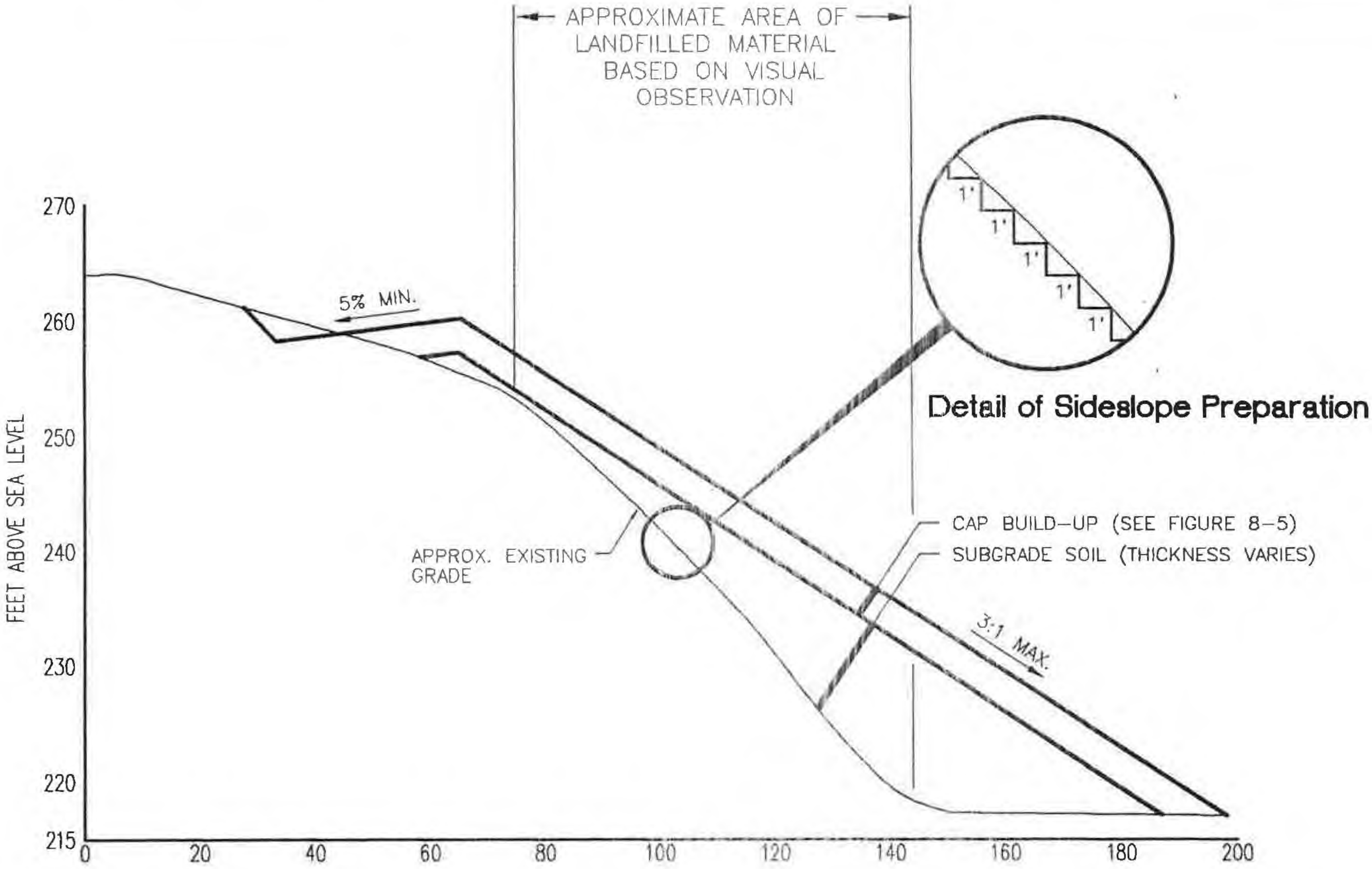


J:\8712-04\8712F032.DWG 1"=50' 1/28/97

FIGURE 8-16
SA 12 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F033.DWG 1"=30' 1/28/97



Cross Section A-A'

NOTES:

1. SEE FIGURE 8-16 FOR CROSS SECTION ORIENTATION.
2. EXCAVATE SIDESLOPES IN 1' STEPS TO AID SLOPE STABILITY.

0 15 30 60 FEET

SCALE: 1"=30' HORIZONTAL

SCALE: 1"=15' VERTICAL

FIGURE 8-17
SA 12 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F002.DWG 1/28/97

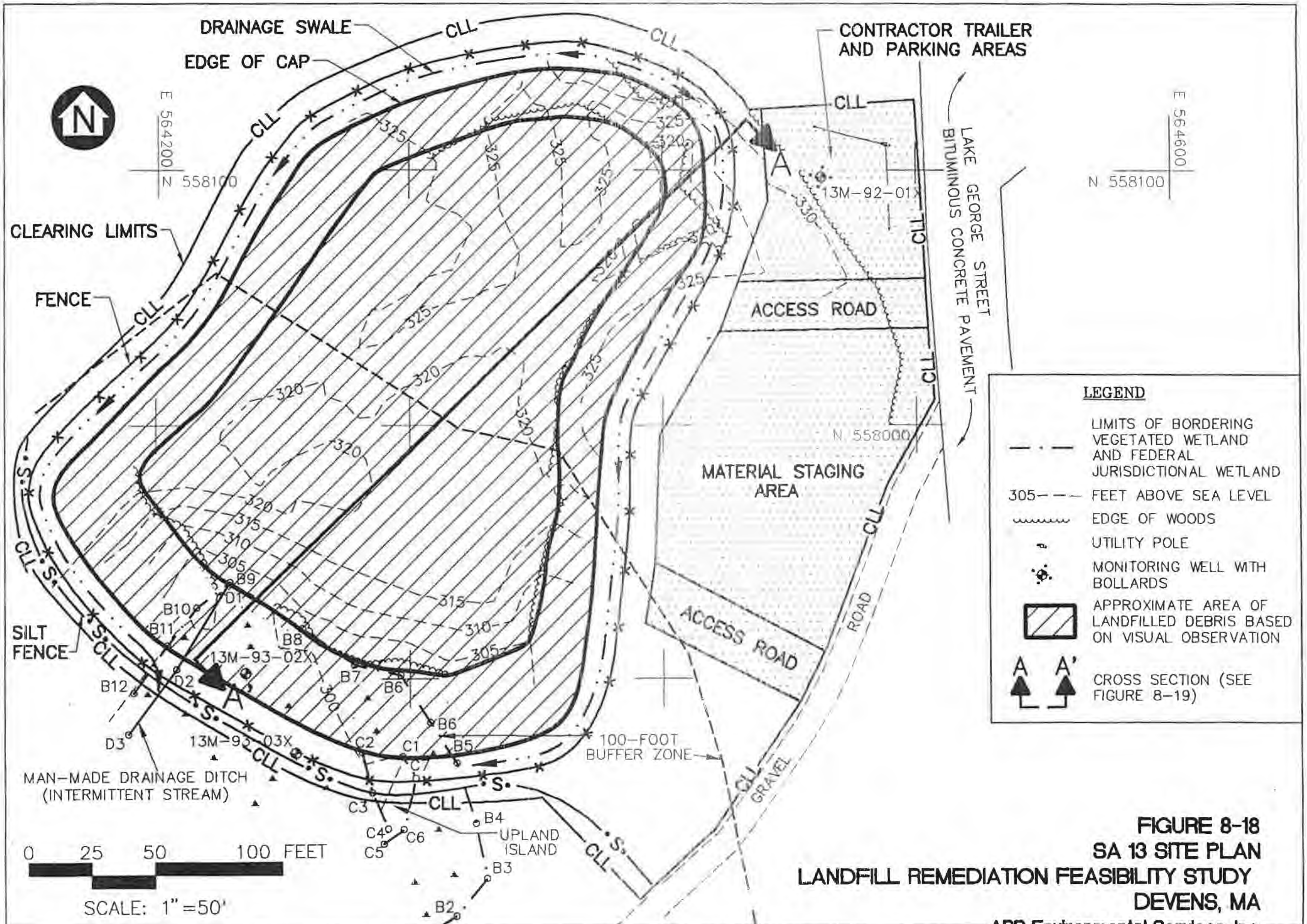
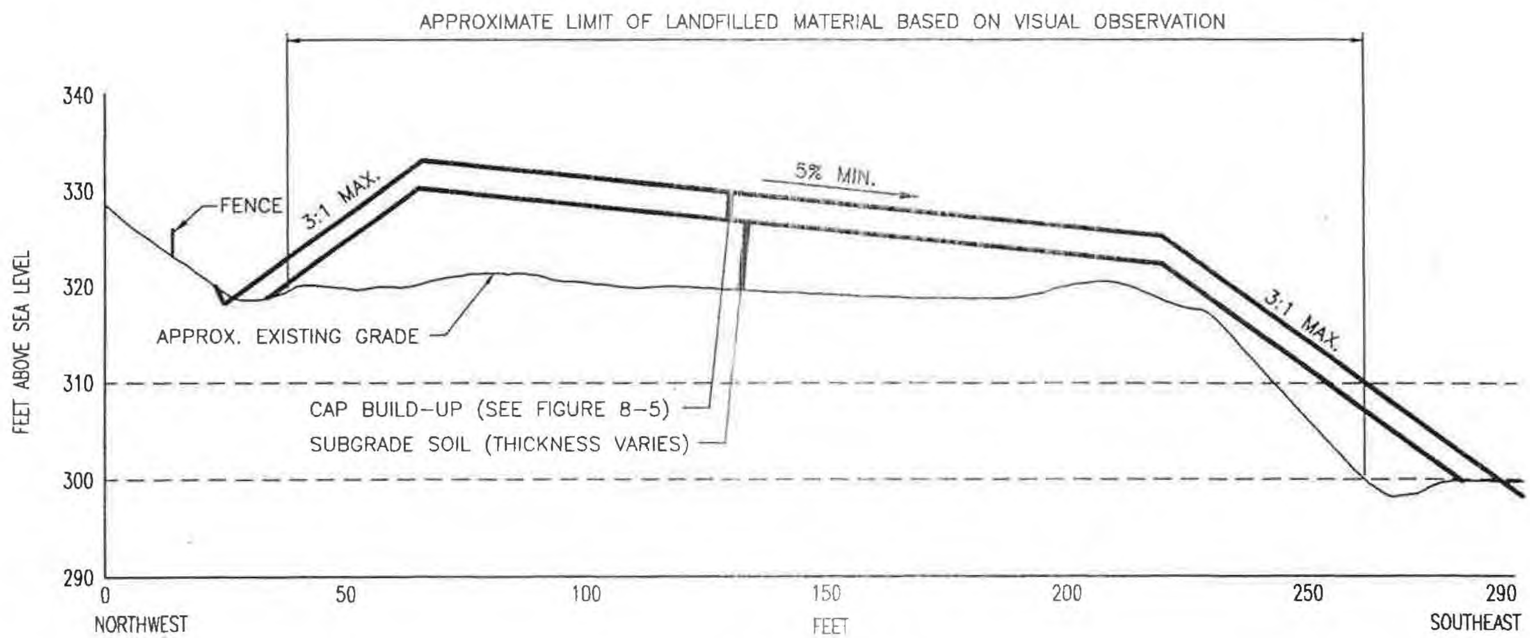


FIGURE 8-18
SA 13 SITE PLAN
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.



Cross Section A-A'

NOTE:

1. SEE FIGURE 8-18 FOR CROSS SECTION ORIENTATION.

FIGURE 8-19
SA 13 CROSS SECTION A-A'
LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ABB Environmental Services, Inc.

J:\8712-04\8712F009.DWG 1/28/97

TABLE ES-1
SUMMARY OF CONSIDERED LANDFILL REMEDIATION ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ALTERNATIVE	ALTERNATIVE COMPONENT				
	EXCAVATE/ CONSOLIDATE	CAP-IN-PLACE	EXCAVATE/ DISPOSE OFF-SITE	LIMITED REMOVAL (SURFACE DEBRIS)	NO FURTHER ACTION
PA-1[1]		AOCs 9, 11, 40, 41	SAs 6, 12, 13		
PA-2[2]	All seven landfills (near Shepley's Hill)				
PA-3	AOCs 9, 40, 41 SAs 6, 12, 13 (at North Post Landfill)	AOC 11			
PA-4	All seven landfills (at North Post Landfill)				
PA-5	AOCs 40, 41 SAs 6, 12, 13 (near Shepley's Hill	AOCs 9, 11			
PA-6	AOCs 9, 11, 41 SAs 6, 12, 13 (near Shepley's Hill)	AOC 40			

TABLE ES-1
SUMMARY OF CONSIDERED LANDFILL REMEDIATION ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ALTERNATIVE	ALTERNATIVE COMPONENT				
	EXCAVATE/ CONSOLIDATE	CAP-IN-PLACE	EXCAVATE/ DISPOSE OFF-SITE	LIMITED REMOVAL (SURFACE DEBRIS)	NO FURTHER ACTION
1[3]					All seven landfills
2		AOCs 9, 40		AOC 11 - dispose under AOC 9 Cap	AOC 41 SAs 6, 12, 13
3		AOCs 9, 11, 40			AOC 41 SAs 6, 12, 13
4	AOCs 9, 40			AOC 11 - dispose in consolidation landfill	AOC 41 SAs 6, 12, 13
5	AOCs 9, 40	AOC 41 SAs 6, 12, 13		AOC 11 - dispose in consolidation landfill	
6	AOCs, 9, 11, 40	AOC 41 SAs 6, 12, 13			
7		All seven disposed areas			
8	AOCs 9, 40, 41 SAs 6, 12, 13			AOC 11 - dispose in consolidation landfill	
9	All seven landfills				

Notes:

1 PA-1 = BCT Plan of Action (3/31/95), Option 1.
2 Alternative PA-2 is identical to Alternative 9.
3 Alternatives 1 through 9 were developed by the BCT on December 9, 1996.

TABLE ES-2
COMPARATIVE ANALYSIS OF ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

EVALUATION CRITERIA	DEGREE OF ADHERENCE TO EVALUATION CRITERIA								
	ALTERNATIVE NO.								
	1	2	3	4	5	6	7	8	9
Overall protection of human health and the environment	Low	Medium	Medium	Medium	High	High	High	Medium	High
Compliance with ARARs	Low	Medium	Medium	Medium	Medium	High	High	Medium	High
Long-term effectiveness and permanence	Low	Medium	Medium	Medium	High	High	High	Medium	High
Reduction of toxicity, mobility, and volume through treatment	None	Low	Low	Low	Low	Low	Low	Low	Low
Effectiveness: Short-term	None	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Implementability	Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Cost	None	$7.6M	$9.5M	$16.6M	$19.6M	$21.6M	$12.5M	$18.1M	$20.2M

W001973T2.080/58

TABLE 3-1
INTERPRETED RISK ASSESSMENT SUMMARY

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

AREA OF CONTAMINATION AND MEDIUM	RISK EVALUATION APPROACH	INTERPRETED HUMAN HEALTH RISK	INTERPRETED ECOLOGICAL RISK
SA 6	Not applicable	None anticipated	None anticipated
AOC 9			
Surface Soil	PRE	No	No
Subsurface Soil	PRE	No	Not evaluated
Groundwater	PRE	No [1, 2]	Not evaluated
Surface Water	PRE	No [3]	No [7]
Sediment	PRE	No [4]	No
AOC 11			
Surface Soil	Baseline RA	No	No
Surface Water	Baseline RA	No	No [8]
Sediment	Baseline RA	No	No [8]
SA 12			
Surface Soil	PRE	No [5] (Landfill area)	Yes (Landfill area)
Groundwater	PRE	No [5]	Not evaluated
Surface Water	PRE	No [3]	No [8]
Sediment	PRE	No [4]	No [8]
SA 13			
Surface Soil	PRE	No [5]	Yes
Groundwater	PRE	No [2]	Not evaluated
Surface Water	PRE	No [3]	Yes
Sediment	PRE	No [4]	Yes
AOC 40			
Surface Soil	Baseline RA	No	No
Groundwater	Baseline RA	No [6]	Not Evaluated
Surface Water	Baseline RA	No	No
Sediment	Baseline RA	No	Yes
AOC 41			
Surface Soil	PRE	No [5]	No
Surface Water	PRE	No [3]	No [7]
Sediment	PRE	No [4]	No [9]

Notes:

1 Data review shows groundwater contamination at upgradient and crossgradient wells, therefore potential risk is interpreted as non site related.

2 Comparison of unfiltered groundwater-sample data for inorganics to drinking water screening values suggests risk; however, based on filtered-sample data, high inorganic concentrations appear associated with entrained suspended solids.

3 Comparison of surface water data to drinking water screening values suggests potential risk; however, probability of significant overstatement exists because exposure to surface water is expected to be less than for drinking water scenario.

4 Comparison of sediment data to residential soil screening values suggests potential risk; however, probability of significant overstatement exists because exposure to sediment is expected to be less than for residential scenario.

5 Comparison of surface soil or groundwater data to residential screening values suggests potential risk; however, probability of significant overstatement exists because no plans exist for residential use of the site.

6 Comparison of groundwater data to a future residential use scenario suggests potential risk; however, probability of significant overstatement exists because there is no residential groundwater exposure under current land use conditions.

7 Comparison of unfiltered surface water sample data to AWQC suggests potential risks; however, suspended contaminants may not be bioavailable. Further, regulatory test species are considered not representative of AOC species.

8 Complete data review shows contamination in surface water and sediments is most likely attributed to Nashua River contamination and is not site related.

9 Interim Sediment Quality Criteria used for screening of DDT are overly conservative for Devens.

TABLE 4-1
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS
Federal	Floodplains	Floodplain Management Executive Order 11988 [40 CFR Part 6, Appendix A]	Applicable	Requires federal agencies to evaluate the potential adverse effects associated with direct and indirect development of a floodplain. Alternatives that involve modification/construction within a floodplain may not be selected unless a determination is made that no practicable alternative exists. If no practicable alternative exists, potential harm must be minimized and action taken to restore and preserve the natural and beneficial values of the floodplain.
	Wetlands	Protection of Wetlands Executive Order 11990 [40 CFR Part 6, Appendix A]	Applicable	Under this Order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands. If remediation is required within wetland areas, and no practical alternative exists, potential harm must be minimized and action taken to restore natural and beneficial values.
	Wetlands, Aquatic Ecosystem	CWA, Dredge or Fill Requirements Section 404 [40 CFR Part 230]	Relevant and Appropriate	Section 404 of the CWA regulates the discharge of dredged or fill materials to U.S. waters, including wetlands. Filling wetlands would be considered a discharge of fill materials. Procedures for complying with regulatory conditions are contained in 33 CFR Part 323. Guidelines for Specification of Disposal Sites for Dredged or Fill material at 40 CFR Part 230, promulgated under CWA Section 404(b)(1), maintain that no discharge of dredged or fill material will be permitted if there is a practical alternative that would have less effect on the aquatic ecosystem. If adverse impacts are unavoidable, action must be taken to restore, or create alternative wetlands.
	Archaeological and Historic Sites	National Historic Preservation Act [16 USC 470 et seq.]	Relevant and Appropriate	These laws establish the procedures for the inventory, registration, and preservation of historical and archeological resources. Such resources must be retrieved, preserved, and properly managed when terrain is altered as a result of a federal or federally licensed construction activity.
	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.	Relevant and Appropriate	Actions that affect species/habitat require consultation with DOI, FWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources.
	Endangered Species	Endangered Species Act [50 CFR 17.11-17.12]	Applicable	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act(16 USC 703 et seq.)	Relevant and Appropriate	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.

TABLE 4-1
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS
State	Floodplains, Wetlands, Surface Waters	Massachusetts Wetland Protection Regulations [310 CMR 10.00]	Applicable	These regulations include permitting requirements and performance standards on dredging, filling, altering, or polluting surface waters, floodplains, and wetlands. Work within 100 feet of a bank of a surface water or of a vegetated wetland is also regulated under these requirements. This state law is locally administered, often in conjunction with local wetland laws, by the Conservation Commission.
	Endangered Species	Massachusetts Endangered Species Regulations [321 CMR 8.00]	Applicable	Actions must be conducted in a manner that minimizes the impact to Massachusetts-listed rare, threatened, or endangered species, and species listed by the Massachusetts Natural Heritage Program.

Notes:

CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Regulations
CWA	=	Clean Water Act
DOI	=	Department of the Interior
FWS	=	Fish and Wildlife Service
MEPA	=	Massachusetts Environmental Policy Act
MGL	=	Massachusetts General Laws
NMFS	=	National Maine Fisheries Service
USC	=	United States Code

TABLE 4-2
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARs

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS
Federal	Surface water	CWA, Ambient Water Quality Criteria [40 CFR 131; Quality Criteria for Water 1986]	Relevant and Appropriate	Federal AWQC include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) acute and chronic toxicity values for the protection of aquatic life. AWQC for the protection of human health provide protective concentrations for exposure from ingesting contaminated water and contaminated aquatic organisms, and from ingesting contaminated aquatic organisms alone. Remedial actions involving contaminated surface water or discharge of contaminants to surface water must consider the uses of the water and the circumstances of the release or threatened release.
	Groundwater	Safe Drinking Water Act (SDWA), National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate	These regulations establish MCLs and MCLGs for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health goals.
State	Surface water	Massachusetts Surface Water Quality Standards [314 CMR 4.00]	Relevant and Appropriate	Massachusetts Surface Water Quality Standards designate the most sensitive uses for which surface waters of the Commonwealth are to be enhanced, maintained, and protected, and designate minimum water quality criteria for sustaining the designated uses. Surface waters at Fort Devens are classified as Class B. Surface waters assigned to this class are designated as habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation. These criteria supersede federal AWQC only when they are more stringent (more protective) than the AWQC.
	Groundwater	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Relevant and Appropriate	These standards designate and assign uses for which groundwaters of the commonwealth shall be maintained and protected, and set forth water quality criteria necessary to maintain the designated uses. Groundwater at Fort Devens is classified as Class I, fresh groundwater designated as a source of potable water supply.

continued

Table 4-2
Synopsis of Federal and State Chemical-Specific ARARs

Landfill Remediation Feasibility Study
Devens, MA

Regulatory Authority	Chemical Medium	Requirement	Status	Requirement Synopsis
State (continued)	Groundwater	Massachusetts Drinking Water Regulations [310 CMR 22.00]	Relevant and Appropriate	These regulations list Massachusetts MCLs which apply to drinking water distributed through a public water system.

Notes:

AWQC	=	Ambient Water Quality Criteria
CERCLA	=	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	=	Code of Federal Regulations
CMR	=	Code of Massachusetts Rules
CWA	=	Clean Water Act
MCL	=	Maximum Contaminant Level
MCLG	=	Maximum Contaminant Level Goal
MMCL	=	Massachusetts Maximum Contaminant Level
NPDWR	=	National Primary Drinking Water Regulations
SDWA	=	Safe Drinking Water Act
SMCL	=	Secondary Maximum Contaminant Level

TABLE 4-3
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENTS	STATUS	REQUIREMENT SYNOPSIS
Federal	Construction over/in navigable waters	Rivers and Harbors Act of 1899 [33 USC 401 et seq.]	Relevant and Appropriate	Section 10 of the Rivers and Harbors Act of 1899 requires an authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any "navigable water of the U.S."; the excavation from or deposition of material in such waters, or any obstruction of alteration in such waters.
	Control of surface water runoff; Direct discharge to surface water	CWA, NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate	The NPDES permit program specifies the permissible concentration or level of contaminants in the discharge from any point source to waters of the United States.
State	Solid Waste Landfill Construction, Operation, Closure, and Post-Closure Care	Massachusetts Solid Waste Management Regulations [310 CMR 19.000]	Relevant and Appropriate	These regulations outline the requirements for construction, operation, closure, and post closure at solid waste management facilities in the Commonwealth of Massachusetts.
	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate	For activities that require a MADEP Wetlands Order of Conditions to dredge or fill navigable waters or wetlands, a Chapter 91 Waterways License, a USACE permit or any major permit issued by USEPA (e.g., CWA NPDES permit), a Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00.
	Actions that affect ambient air quality	Massachusetts Air Pollution Control Regulations [310 CMR 7.00]	Applicable	Meeting the substantive requirements of a permit and appropriate treatment are required for actions that may result in emissions in excess of Massachusetts standards.

Notes:

CFR = Code of Federal Regulations
CMR = Code of Massachusetts Rules
CWA = Clean Water Act
MADEP = Massachusetts Department of Environmental Protection
MGL = Massachusetts General Laws
NPDES = National Pollutant Discharge Elimination System
USACE = U.S. Army Corps of Engineers
USC = United States Code

TABLE 6-1
POTENTIAL REMEDIAL TECHNOLOGIES
AND DEBRIS PROCESS OPTIONS

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	DEBRIS PROCESS OPTION
No Action	None	Not Applicable
Removal	Surface Debris Removal Excavation	Surface Debris Removal Excavation
Disposal	On Site	Landfilling
Containment	Capping	Landfill Closure

TABLE 6-2
DESCRIPTION OF DEBRIS PROCESS OPTIONS

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

GENERAL RESPONSE ACTION/TECHNOLOGY	DESCRIPTION OF DEBRIS PROCESS OPTIONS
No Action	
None	No action taken to remediate landfills.
Removal	
Surface Debris Removal	Surface Debris Removal. Remove only those wastes protruding through the land surface.
Excavation	Excavation. Remove waste source by excavating debris sites.
Disposal	
On Site	Landfilling. Disposal of debris at on-site Consolidation Landfill.
Containment	
Capping	Landfill Closure. Close landfill with low-permeability cover system.

TABLE 6-3
SCREENING OF TECHNOLOGIES AND DEBRIS PROCESS OPTIONS

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

GENERAL RESPONSE ACTION/ PROCESS OPTION	APPLICABILITY TO		SCREENING STATUS	COMMENTS
	SITE-LIMITING CHARACTERISTICS	WASTE-LIMITING CHARACTERISTICS		
<u>No Action</u>				
None	None Easily implementable.	Does not remove threats posed by waste at the landfills.	Retained.	Required for consideration by NCP.
<u>Removal</u>				
Surface Debris Removal	Compliance with wetlands regulations for some activities may be required.	None.	Retained.	Would be used selectively.
Excavation	Access to some portions of debris sites may be difficult due to steep terrain. Compliance with wetlands regulations would be required for some construction activities within debris disposal areas.	Effectively removes debris. Excavation of some debris may be difficult due to steep terrain or remote location.	Retained.	Would be used extensively.

continued

TABLE 6-3
SCREENING OF TECHNOLOGIES AND DEBRIS PROCESS OPTIONS

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

GENERAL RESPONSE ACTION/ PROCESS OPTION	APPLICABILITY TO		SCREENING STATUS	COMMENTS
	SITE-LIMITING CHARACTERISTICS	WASTE-LIMITING CHARACTERISTICS		
Disposal				
Landfilling	On-site space restrictions must be considered. Must comply with Massachusetts solid waste regulations.	To the extent possible, debris must be recompacted to pre-excavated volume.	Retained.	Only practical technology for debris disposal.
Containment				
Capping	Capping of some landfills would be difficult because of their locations on steep terrain or in low-lying areas near water bodies.	None.	Retained.	As defined by USEPA, capping is the Presumptive Remedy for solid waste landfills.

TABLE 7-1
SUMMARY OF DEVELOPED LANDFILL REMEDIATION ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ALTERNATIVE	ALTERNATIVE COMPONENT				
	EXCAVATE/ CONSOLIDATE	CAP-IN-PLACE	EXCAVATE/ DISPOSE OFF-SITE	LIMITED REMOVAL (SURFACE DEBRIS)	NO FURTHER ACTION
PA-1[1]		AOCs 9, 11, 40, 41	SAs 6, 12, 13		
PA-2[2]	All seven landfills (near Shepley's Hill)				
PA-3	AOCs 9, 40, 41 SAs 6, 12, 13 (at North Post Landfill)	AOC 11			
PA-4	All seven landfills (at North Post Landfill)				
PA-5	AOCs 40, 41 SAs 6, 12, 13 (near Shepley's Hill	AOCs 9, 11			
PA-6	AOCs 9, 11, 41 SAs 6, 12, 13 (near Shepley's Hill)	AOC 40			

continued

TABLE 7-1
SUMMARY OF DEVELOPED LANDFILL REMEDIATION ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ALTERNATIVE	ALTERNATIVE COMPONENT				
	EXCAVATE/ CONSOLIDATE	CAP-IN-PLACE	EXCAVATE/ DISPOSE OFF-SITE	LIMITED REMOVAL (SURFACE DEBRIS)	NO FURTHER ACTION
1[3]					All seven landfills
2		AOCs 9, 40		AOC 11 - dispose under AOC 9 Cap	AOC 41 SAs 6, 12, 13
3		AOCs 9, 11, 40			AOC 41 SAs 6, 12, 13
4	AOCs 9, 40			AOC 11 - dispose in consolidation landfill	AOC 41 SAs 6, 12, 13
5	AOCs 9, 40	AOC 41 SAs 6, 12, 13		AOC 11 - dispose in consolidation landfill	
6	AOCs, 9, 11, 40	AOC 41 SAs 6, 12, 13			
7		All seven disposed areas			
8	AOCs 9, 40, 41 SAs 6, 12, 13			AOC 11 - dispose in consolidation landfill	
9	All seven landfills				

Notes:

1 PA-1 = BCT Plan of Action (3/31/95), Option 1.
2 Alternative PA-2 is identical to Alternative 9, and is eliminated from further discussion in this report.
3 Alternatives 1 through 9 were developed by the BCT on December 9, 1996.

TABLE 7-2
PRELIMINARY SCREENING OF ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

Alternative	Effectiveness	Implementability	Cost	Status
PA-1 Excavate/Dispose Offsite: SAs 6, 12, 13 Cap-in-Place AOCs 9, 11, 40, 41	Ecological risks would be eliminated at SAs 12 and 13. Effectiveness of landfill caps would be measured by post-closure groundwater monitoring. Damage to proposed cap at AOC 11 caused by Nashua River flooding is a concern.	Excavation, consolidation, and cap-in-place actions can be accomplished using standard construction procedures and conventional equipment.	Capital: Moderate Operating: Moderate	Eliminated. Off-site disposal costs are too high compared to disposal options in other alternatives.
PA-2	Identical to Alternative 9	Eliminated from Further Discussion.		
PA-3 Consolidate at North Post Landfill: AOCs 9, 40, 41 SAs 6, 12, 13 Cap-In-Place: AOC 11	Ecological risks would be eliminated at AOC 40 and SAs 12, 13. Effectiveness of cap at AOC 11 would be measured by post-closure groundwater monitoring. Damage to proposed cap at AOC 11 caused by Nashua River flooding is a concern.	Excavation, consolidation, and cap-in-place actions can be accomplished using standard construction procedures and conventional equipment.	Capital: High Operating: Moderate	Eliminated. Shepley's Hill Landfill is preferable to North Post Landfill as site for consolidation landfill.

continued

TABLE 7-2
PRELIMINARY SCREENING OF ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

Alternative	Effectiveness	Implementability	Cost	Status
PA-4 Consolidate at North Post Landfill: AOCs 9, 11, 40, 41 SAs 6, 12, 13	Ecological risks would be eliminated at AOC 40 and SAs 12, 13.	Excavation and consolidation actions can be accomplished using standard construction procedures and conventional equipment. 30-year monitoring and maintenance program needed at only one landfill.	Capital: High Operating: Moderate	Eliminated. Shepley's Hill Landfill area is preferable to North Post Landfill as site for consolidation landfill.
PA-5 Consolidate near Shepley's Hill: AOCs 40, 41, and SAs 6, 12, 13 Cap-in-Place: AOCs 9, 11	Ecological risks would be eliminated at AOC 40 and SAs 12, 13. Effectiveness of caps at AOCs 9 and 11 would be measured by post-closure groundwater monitoring. Damage to cap at AOC 11 caused by Nashua River flooding is a concern.	Excavation, consolidation, and cap-in-place actions can be accomplished using standard construction procedures and conventional equipment.	Capital: High Operating: Moderate	Eliminated. This alternative contains different actions for AOCs 9 and 40, the landfills having the 2 largest waste volumes. Thus, economies of scale cannot be realized.
PA-6 Consolidate near Shepley's Hill: AOCs 9, 11, 41, and SAs 6, 12, 13 Cap-in-Place AOC 40	Ecological risks would be eliminated at SAs 12, 13. Effectiveness of cap at AOC 40 would be measured by groundwater monitoring.	Excavation, consolidation, and cap-in-place actions can be accomplished using standard construction procedures and conventional equipment.	Capital: High Operating: Moderate	Eliminated. This alternative contains different actions for AOCs 9 and 40, the landfills having the 2 largest waste volumes. Thus, economies of scale cannot be realized.

continued

TABLE 7-2
PRELIMINARY SCREENING OF ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

Alternative	Effectiveness	Implementability	Cost	Status
1. No Further Action: All seven landfills.	Not to be evaluated using Screening Criteria.			Retained.
2. No Further Action: AOC 41 and SAs 6, 12, 13 Limited Removal: AOC 11 Cap-in-place: AOCs 9,40	Because the PRE did not identify significant human health or ecological risk, a low-permeability cap would provide only low risk - reduction benefit at AOC 9. Cap and monitoring at AOC 40 would mitigate and allow assessment of potential future release of contaminants to groundwater. Physical hazards would be removed at AOC 11.	Capping at AOCs 9 and 40, and limited removal at AOC 11 can be accomplished using standard construction procedures and conventional equipment. No implementability concerns for No Further Action at AOC 41 and SAs 6, 12, and 13.	Capital: Low Operating: Low	Retained
3. No Further Action: AOC 41 and SAs 6, 12, 13 Cap-in-place: AOCs 9, 11, 40	Because significant human health or ecological risks were not identified at AOCs 9 and 11, a low-permeability cap would provide low risk-reduction benefit. Damage to cap at AOC 11 caused by Nashua River flooding is a concern.	Capping at AOCs 9, 11, and 40 can be accomplished using standard construction procedures and conventional equipment. No implementability concerns for No Further Action at AOC 41 and SAs 6, 12, and 13.	Capital: Moderate Operating: Moderate	Retained.

continued

TABLE 7-2
PRELIMINARY SCREENING OF ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

Alternative	Effectiveness	Implementability	Cost	Status
4. No Further Action: AOC 41 and SAs 6, 12, 13 Limited Removal: AOC 11 Consolidate: AOCs 9, 40	Ecological risk would be mitigated at AOC 40. Physical hazards would be removed at AOC 11.	Excavation and consolidation of wastes at AOCs 9 and 40, and limited waste removal at AOC 11 can be accomplished using standard construction procedures and conventional equipment. UXO clearance activities would be implemented during waste excavations at AOCs 9 and 40. No implementability concerns for No Further Action at AOC 41 and SAs 6, 12, and 13.	Capital: Moderate Operating: Low	Retained.
5. Limited Removal: AOC 11 Cap-in-Place: AOC 41 and SAs 6, 12, 13 Consolidate: AOCs 9, 40	Ecological risk would be mitigated at AOC 40. Because significant human health and ecological risks were not identified at AOC 41 and SAs 6, 12, and 13, a low-permeability cap would provide only low risk-reduction benefit. Physical hazards would be removed at AOC 11.	Excavation, consolidation, cap-in-place, and limited removal actions can be accomplished using standard construction procedures and conventional equipment.	Capital: Moderate Operating: Moderate	Retained.

continued

TABLE 7-2
PRELIMINARY SCREENING OF ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

Alternative	Effectiveness	Implementability	Cost	Status
6. Cap-in-Place: AOC 41 and SAs 6, 12, 13 Consolidate: AOCs 9, 11, 40	Environmental risks would be mitigated at AOC 40. Because significant human health and ecological risks were not identified at AOC 41 and SAs 6, 12, and 13, a low-permeability cap would provide only low risk-reduction benefit. Erosion of a cap at SA 12 is a concern because of the site's steep terrain.	Excavation, consolidation, and cap-in-place actions can be accomplished using standard construction procedures and conventional equipment.	Capital: High Operating: Moderate	Retained.
7. Cap-In-Place: AOCs 9, 11, 40, 41, and SAs 6, 12, 13	Environmental risks at the seven landfills would be mitigated. Because significant human health and ecological risks were not identified at the landfills, low permeability cap would provide only low risk-reduction benefit. Damage to AOC 11 cap from flooding and to the steep SA 12 cap from erosion is a concern.	Cap-in-place actions can be accomplished using standard construction procedures and conventional equipment. 30-year monitoring and maintenance program would be required at seven capped landfills.	Capital: High Operating: High	Retained.

continued

TABLE 7-2
PRELIMINARY SCREENING OF ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

Alternative	Effectiveness	Implementability	Cost	Status
8. Limited Removal: AOC 11 Consolidate: AOCs 9, 40, 41, and SAs 6, 12, 13	Ecological risks would be removed at AOC 40 and at SAs 12, 13. Physical hazards would be removed from AOC 11.	Excavation, consolidation, and limited removal actions can be accomplished using standard construction procedures and conventional equipment.	Capital: High Operating: Moderate	Retained.
9. Consolidate: AOCs 9, 11, 40, and 41, and SAs 6, 12, 13	Ecological risks would be mitigated at AOC 40 and SAs 12, 13.	Excavation and consolidation actions can be accomplished using standard construction procedures and conventional equipment. 30-year monitoring and maintenance program needed at only one landfill.	Capital: High Operating: Moderate	Retained.

TABLE 7-3
SCREENING SUMMARY OF REMEDIAL ACTION ALTERNATIVES

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

Remedial Action Alternative		Retained	Eliminated
PA-1:	Cap-in-Place AOCs 9, 11, 40, 41 Excavate/Dispose Offsite SAs 6, 12, 13		X
PA-2:	Excavate/Consolidate AOCs 9, 11, 40, 41, and SAs 6, 12, 13 near Shepley's Hill	See Alternative 9	
PA-3:	Excavate/Consolidate AOCs 9, 40, 41, and SAs 6, 12, 13 at North Post Landfill Cap-in-Place AOC 11		X
PA-4:	Excavate/Consolidate AOCs 9, 11, 40, 41, and SAs 6, 12, 13 at North Post Landfill		X
PA-5:	Excavate/Consolidate AOCs 40, 41, and SAs 6, 12, 13 near Shepley's Hill Cap-in-Place AOCs 9, 11		X
PA-6:	Excavate/Consolidate AOCs 9, 11, 41 and SAs 6, 12, 13 near Shepley's Hill Cap-in-Place AOC 40		X
1:	No Further Action at AOCs 9, 11, 40, 41, and SAs 6, 12, 13	X	
2:	No Further Action at AOC 41 and SAs 6, 12, 13 Limited Removal at AOC 11 Cap-in-Place AOCs 9, 40	X	
3.	No Further Action at AOC 41 and SAs 6, 12, 13 Cap-in-Place AOCs 9, 11, 40	X	
4.	No Further Action at AOC 41 and SAs 6, 12, 13 Limited Removal at AOC 11 Excavate/Consolidate AOCs 9, 40	X	
5.	Limited Removal at AOC 11 Cap-in-Place AOC 41 and SAs 6, 12, 13 Excavate/Consolidate AOCs 9, 40	X	
6.	Cap-in-Place AOC 41 and SAs 6, 12, 13 Excavate/Consolidate AOCs 9, 11, 40	X	
7.	Cap-in-Place AOCs 9, 11, 40, 41 and SAs 6, 12, 13	X	
8.	Limited Removed at AOC 11 Excavate/Consolidate AOCs 9, 40, 41, and SAs 6, 12, 13	X	
9.	Excavate Consolidate AOCs 9, 11, 40, 41 and SAs 6, 12, 13	X	

TABLE 8-1
ALTERNATIVE EVALUATION CRITERIA

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

THRESHOLD CRITERIA (must be met by each alternative)

- OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT - Assesses how well an alternative, as a whole, achieves and maintains protection of human health and the environment.

- COMPLIANCE WITH ARARS - Assesses how the alternative complies with location-, chemical-, and action-specific ARARs, and whether a waiver is required or justified.

PRIMARY CRITERIA (basis of alternative evaluation)

- LONG-TERM EFFECTIVENESS AND PERMANENCE - Evaluates the effectiveness of the alternative in protecting human health and the environment after response objectives have been met. Includes consideration of the magnitude of residual risks and the adequacy and reliability of controls.

- REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT - Evaluates the effectiveness of treatment processes used to reduce toxicity, mobility, and volume of hazardous substances. This criterion considers the degree to which treatment is irreversible, and the type and quantity of residuals remaining after treatment.

- SHORT-TERM EFFECTIVENESS - Examines the effectiveness of the alternative in protecting human health and the environment during the construction and implementation of a remedy until response objectives have been met. Considers the protection of the community, workers, and the environment during implementation of remedial actions.

- IMPLEMENTABILITY - Assesses the technical and administrative feasibility of an alternative and availability of required goods and services. Technical feasibility considers the ability to construct and operate a technology and its reliability, the ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of a remedy. Administrative feasibility considers the ability to obtain approvals from other parties or agencies and extent of required coordination with other parties or agencies.

- COST - Evaluates the capital and operation and maintenance cost of each alternative.

BALANCING CRITERIA

- STATE ACCEPTANCE - This criterion considers the state's preferences among or concerns about alternatives.

- COMMUNITY ACCEPTANCE - This criterion considers the communities preferences among or concerns about alternatives.

TABLE 8-2
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE 2

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate AOC 9 AOC 11 AOC 40	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The U.S. Fish and Wildlife Service, acting as a review agency for the USEPA, will be kept informed of proposed remedial actions.
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11 - 17.12]	Applicable AOC 9 AOC 11 AOC 40	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	The protection of endangered species and their habitat will be considered during excavation activities and cover installation.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act (16 USC 703 et seq.)	Relevant and Appropriate AOC 11	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	The protection of endangered species and their habitat will be considered during excavation activities and cover installation.

TABLE 8-3
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE 2

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface water	Clean Water Act, Ambient Water Quality Criteria [40 CFR 131; Quality Criteria for Water 1986]	Relevant and Appropriate AOC 11 AOC 40	Federal Ambient Water Quality Criteria (AWQC) include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) acute and chronic toxicity values for the protection of aquatic life. AWQC for the protection of human health provide protective concentrations for exposure from ingesting contaminated water and contaminated aquatic organisms, and from ingesting contaminated aquatic organisms alone. Remedial actions involving contaminated surface water or discharge of contaminants to surface water must consider the uses of the water and the circumstances of the release or threatened release.	Remedial actions will be performed in a manner to prevent AWQC exceedances in surface water. Actives at AOC 11 will be performed to prevent AWQC exceedances in the Nashua River. Removal of sediment at AOC 40 will be performed in a manner to prevent AWQC exceedances in Cold Spring Brook Pond. Supernatant from dredged spoil will be monitored to prevent AWQC exceedances in Cold Spring Brook Pond.
	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate AOC 40	The National Primary Drinking Water Regulations establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	At AOC 40 the MCL for bis(2-ethylhexyl)phthalate will be met under average scenario, and the MCL for arsenic will be met under average and maximum scenario. MCLs are not exceeded at Patton Well.

TABLE 8-4
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE 2

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Construction over/in navigable waters	Rivers and Harbors Act of 1899 [33 USC 401 et seq.]	Relevant and Appropriate AOC 40	Section 10 of the Rivers and Harbors Act of 1899 requires an authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any "navigable water of the U.S."; the excavation from or deposition of material in such waters, or any obstruction of alteration in such waters.	Excavating, filling, and disposal activities will be conducted to meet the substantive criteria and standards of these regulations.
	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate AOC 9 AOC 11 AOC 40	The National Pollutant Discharge Elimination System (NPDES) permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. On-site discharges will meet the substantive requirements of these regulations.
State	Solid Waste Landfill Construction, Operation, Closure, and Post-Closure Care	Massachusetts Solid Waste Management Regulations [310 CMR 19.000]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13	These regulations outline the requirements for construction, operation, closure, and post-closure at solid waste management facilities in the Commonwealth of Massachusetts.	The requirements of 310 CMR 19.021 will not be satisfied for SA 12 and SA 13. Final closure and post-closure plans will be prepared and submitted to satisfy the requirements of 310 CMR 19.021 for AOCs 9, 11, and 40. The proposed landfill cover at AOC 9 will meet the requirements of 310 CMR 19.112. The proposed cover at AOC 40 will conform with the intent of 310 CMR 19.112, although it may be considered an Alternative Cover System Design by MADEP (310 CMR 19.113). Long-term monitoring and maintenance plans which meet the requirements of 310 CMR 19.118, 19.132, and 19.142 will be developed for AOCs 9 and 40. A Record Notice of Landfill Operation will be filed for AOCs 9, 11, and 40 in accordance with 310 CMR 19.141.

TABLE 8 - 5
COST SUMMARY TABLE
ALTERNATIVE 2: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
LIMITED REMOVAL AT AOC 11;
CAP IN PLACE AOCs 9 & 40

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ITEM		TOTAL COST
DIRECT COSTS		
NO FURTHER ACTION		
SA 6	$	0
SA 12		0
SA 13		0
AOC 41		0
LIMITED REMOVAL AT AOC 11		44,000
CAP IN PLACE		
AOC 9		3,301,000
AOC 40		1,758,000
TOTAL DIRECT COSTS	$	5,103,000
INDIRECT COSTS		
HEALTH AND SAFETY	$	255,000
LEGAL, ADMIN, PERMITTING		255,000
ENGINEERING		510,000
SERVICES DURING CONSTRUCTION		510,000
TOTAL INDIRECT COSTS	$	1,530,000
TOTAL CAPITAL (DIRECT + INDIRECT) COSTS	**$**	**6,633,000**
OPERATION AND MAINTENANCE COSTS		
TOTAL ANNUAL O&M COSTS FOR AOC 11 - 2 YRS	$	4,000
TOTAL ANNUAL O&M COSTS FOR CAP-IN-PLACE AREAS - 30 YRS		72,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS		13,000
TOTAL PRESENT WORTH OF O&M COSTS	**$**	**953,000**
TOTAL COSTS ALTERNATIVE 2	**$**	**7,586,000**

TABLE 8-6
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARs FOR ALTERNATIVE 3

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate AOC 9 AOC 11 AOC 40	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The U.S. Fish and Wildlife Service, acting as a review agency for the USEPA, will be kept informed of proposed remedial actions.
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Applicable AOC 9 AOC 11 AOC 40	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	The protection of endangered species and their habitat will be considered during excavation activities and cover installation.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate AOC 11	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial actions will be performed to protect migratory birds, their nests, and eggs.

TABLE 8-7
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE 3

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface water	Clean Water Act, Ambient Water Quality Criteria [40 CFR 131; Quality Criteria for Water 1986]	Relevant and Appropriate AOC 11 AOC 40	Federal Ambient Water Quality Criteria (AWQC) include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) acute and chronic toxicity values for the protection of aquatic life. AWQC for the protection of human health provide protective concentrations for exposure from ingesting contaminated water and contaminated aquatic organisms, and from ingesting contaminated aquatic organisms alone. Remedial actions involving contaminated surface water or discharge of contaminants to surface water must consider the uses of the water and the circumstances of the release or threatened release.	Remedial actions will be performed in a manner to prevent AWQC exceedances in surface water. Actives at AOC 11 will be performed to prevent AWQC exceedances in the Nashua River. Removal of sediment at AOC 40 will be performed in a manner to prevent AWQC exceedances in Cold Spring Brook Pond. Supernatant from dredged spoil will be monitored to prevent AWQC exceedances in Cold Spring Brook Pond.
	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate AOC 40	The National Primary Drinking Water Regulations establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	At AOC 40 the MCL for bis(2-ethylhexyl)phthalate will be met under average scenario, and the MCL for arsenic will be met under average and maximum scenario. MCLs are not exceeded at Patton Well.

TAB ·8
SYNOPSIS OF FEDERAL AND STATE ACTIO..-SPECIFIC ARARS FOR ALTERNATIVE 3

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Construction over/in navigable waters	Rivers and Harbors Act of 1899 [33 USC 401 et seq.]	Relevant and Appropriate AOC 40	Section 10 of the Rivers and Harbors Act of 1899 requires an authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any "navigable water of the U.S."; the excavation from or deposition of material in such waters, or any obstruction of alteration in such waters.	Excavating, filling, and disposal activities will be conducted to meet the substantive criteria and standards of these regulations.
	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate AOC 9 AOC 11 AOC 40	The National Pollutant Discharge Elimination System (NPDES) permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. On-site discharges will meet the substantive requirements of these regulations.
State	Solid Waste Landfill Construction, Operation, Closure, and Post-Closure Care	Massachusetts Solid Waste Management Regulations [310 CMR 19.000]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13	These regulations outline the requirements for construction, operation, closure, and post-closure at solid waste management facilities in the Commonwealth of Massachusetts.	Final closure and post-closure plans will be prepared and submitted to satisfy the requirements of 310 CMR 19.021 for AOCs 9, 11, and 40. The requirements of 310 CMR 19.021 will not be satisfied for SA 12 and SA 13. The proposed landfill cover at AOC 9 will meet the requirements of 310 CMR 19.112. The proposed landfill cover at AOC 11 will meet. The requirements of 310 CMR 19.112. The proposed landfill cover at AOC 40 will conform with the intent of 310 CMR 19.112 although it may be considered an Alternative Cover System Design by MADEP (310 CMR 19.113). Long-term monitoring and maintenance plans which meet the requirements of 310 CMR 19.118, 19.132, 19.133, and 19.142 will be developed for AOCs 9, 11, and 40. A Record Notice of Landfill Operation will be filed for AOCs 9, 11, and 40 in accordance with 310 CMR 19.141.

TABLE 8 - 9
COST SUMMARY TABLE
ALTERNATIVE 3: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
CAP IN PLACE AOCs 9, 11, & 40

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ITEM		TOTAL COST
DIRECT COSTS		
NO FURTHER ACTION		
SA 6	$	0
SA 12		0
SA 13		0
AOC 41		0
CAP IN PLACE		3,301,000
AOC 9		1,269,000
AOC 11		1,758,000
AOC 40		
TOTAL DIRECT COSTS	$	6,328,000
INDIRECT COSTS		
HEALTH AND SAFETY	$	316,000
LEGAL, ADMIN, PERMITTING		316,000
ENGINEERING		633,000
SERVICES DURING CONSTRUCTION		633,000
TOTAL INDIRECT COSTS	$	1,898,000
TOTAL CAPITAL (DIRECT + INDIRECT) COSTS	$	8,226,000
OPERATION AND MAINTENANCE COSTS		
TOTAL ANNUAL O&M COSTS FOR AOC 9, 11, 40 - 30 YRS	$	99,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS		13,000
TOTAL PRESENT WORTH OF O&M COSTS	$	1,281,000
TOTAL COSTS ALTERNATIVE 3	$	9,507,000

TABLE 8-10
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE 4

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et. seq.]	Relevant and Appropriate AOC 9 AOC 11 AOC 40	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The U.S. Fish and Wildlife Service, acting as a review agency for the USEPA, will be kept informed of proposed remedial actions.
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Applicable AOC 9 AOC 11 AOC 40 Consolidation Facility	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	The protection of endangered species and their habitat will be considered during excavation activities and cover installation.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate AOC 11	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial actions will be performed to protect migratory birds, their nests, and eggs.

TABLE 8-11
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE 4

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface water	Clean Water Act, Ambient Water Quality Criteria [40 CFR 131; Quality Criteria for Water 1986]	Relevant and Appropriate AOC 11 AOC 40	Federal Ambient Water Quality Criteria (AWQC) include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) acute and chronic toxicity values for the protection of aquatic life. AWQC for the protection of human health provide protective concentrations for exposure from ingesting contaminated water and contaminated aquatic organisms, and from ingesting contaminated aquatic organisms alone. Remedial actions involving contaminated surface water or discharge of contaminants to surface water must consider the uses of the water and the circumstances of the release or threatened release.	Remedial actions will be performed in a manner to prevent AWQC exceedances in surface water. Actives at AOC 11 will be performed to prevent AWQC exceedances in the Nashua River. Removal of sediment at AOC 40 will be performed in a manner to prevent AWQC exceedances in Cold Spring Brook Pond. Supernatant from dredged spoil will be monitored to prevent AWQC exceedances in Cold Spring Brook Pond.
	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate AOC 40	The National Primary Drinking Water Regulations establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	At AOC 40 the MCL for bis(2-ethylhexyl)phthalate will be met under average scenario, and the MCL for arsenic will be met under average and maximum scenario. MCLs are not exceeded at Patton Well.
State	Surface water	Massachusetts Surface Water Quality Standards [314 CMR 4.00]	Relevant and Appropriate AOC 11 AOC 40	Massachusetts Surface Water Quality Standards designate the most sensitive uses for which surface waters of the Commonwealth are to be enhanced, maintained, and protected, and designate minimum water quality criteria for sustaining the designated uses. Surface waters at Fort Devens are classified as Class B. Surface waters assigned to this class are designated as habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation. These criteria supersede federal AWQC only when they are more stringent (more protective) than the AWQC.	At AOC 11 activities will be performed in a manner to prevent exceedances of surface water quality in the Nashua River. At AOC 40 sediment removal will be performed in a manner to prevent exceedances of Surface Water Quality Standards in Cold Spring Brook Pond. Supernatant from dredged spoil dewatering will be monitored to prevent exceedances in the pond. To the extent necessary, Surface Water Quality Standards will be used to develop discharge limitations.

TABLE 3-12
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE 4

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Construction over/in navigable waters	Rivers and Harbors Act of 1899 [33 USC 401 et seq.]	Relevant and Appropriate AOC 40	Section 10 of the Rivers and Harbors Act of 1899 requires an authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any "navigable water of the U.S."; the excavation from or deposition of material in such waters, or any obstruction of alteration in such waters.	Excavating, filling, and disposal activities will be conducted to meet the substantive criteria and standards of these regulations.
	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate AOC 9 AOC 11 AOC 40 Consolidation Facility	The National Pollutant Discharge Elimination System (NPDES) permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. On-site discharges will meet the substantive requirements of these regulations.
State	Solid Waste Landfill Construction, Operation, Closure, and Post-Closure Care	Massachusetts Solid Waste Management Regulations [310 CMR 19.000]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 Consolidation Facility	These regulations outline the requirements for construction, operation, closure, and post closure at solid waste management facilities in the Commonwealth of Massachusetts.	Final closure and post-closure plans will be prepared and submitted to satisfy the requirements of 310 CMR 19.021 for AOCs 9, 11, and 40. The requirements of 310 CMR 19.021 will not be satisfied for SA 12 and SA 13. The consolidation landfill will be constructed, operated, and closed in conformance with the regulations at 310 CMR 19.000. A Record Notice of Landfill Operation will be filed for AOC 11 in accordance with 310 CMR 19.141.
	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate AOC 40	For activities that require a MADEP Wetlands Order of Conditions to dredge or fill navigable waters or wetlands, a Chapter 91 Waterways License, a USACE permit or any major permit issued by USEPA (e.g., Clean Water Act NPDES permit), a Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00.	Excavation, filling, and disposal activities will meet the substantive criteria and standards of these regulations. Remedial activities will be designed to attain and maintain Massachusetts Water Quality Standards in affected waters.

TABLE 8 - 13
COST SUMMARY TABLE
ALTERNATIVE 4: NO FURTHER ACTION AT SAs 6, 12, 13, AOC 41;
LIMITED REMOVAL AT AOC 11;
EXCAVATE AND CONSOLIDATE AOCs 9 & 40

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ITEM		TOTAL COST
DIRECT COSTS		
NO FURTHER ACTION		
SA 6	$	0
SA 12		0
SA 13		0
AOC 41		0
LIMITED REMOVAL AT AOC 11		44,000
EXCAVATE AND CONSOLIDATE		
AOC 9		3,835,000
AOC 40		3,370,000
CONSOLIDATION LANDFILL CONSTRUCTION		5,240,000
TOTAL DIRECT COSTS	$	12,489,000
INDIRECT COSTS		
HEALTH AND SAFETY	$	624,000
LEGAL, ADMIN, PERMITTING		624,000
ENGINEERING		1,249,000
SERVICES DURING CONSTRUCTION		1,249,000
TOTAL INDIRECT COSTS	$	3,746,000
TOTAL CAPITAL (DIRECT + INDIRECT) COSTS	**$**	**16,235,000**
OPERATION AND MAINTENANCE COSTS		
TOTAL ANNUAL O&M COSTS FOR AOC 11 - 2 YRS	$	4,000
TOTAL ANNUAL O&M COSTS CONSOLIDATION LANDFILL - 30 YRS		23,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS		29,000
TOTAL PRESENT WORTH OF O&M COSTS	$	411,000
TOTAL COSTS ALTERNATIVE 4	**$**	**16,646,000**

TABLE 8-14
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE 5

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The U.S. Fish and Wildlife Service, acting as a review agency for the USEPA, will be kept informed of proposed remedial actions.
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Applicable SA 6 AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41 Consolidation Facility	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	The protection of endangered species and their habitat will be considered during excavation activities and cover installation.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate AOC 11	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial actions will be performed to protect migratory birds, their nests, and eggs.

TABLE 8-15
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE 5

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface water	Clean Water Act, Ambient Water Quality Criteria [40 CFR 131; Quality Criteria for Water 1986]	Relevant and Appropriate AOC 11 AOC 40	Federal Ambient Water Quality Criteria (AWQC) include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) acute and chronic toxicity values for the protection of aquatic life. AWQC for the protection of human health provide protective concentrations for exposure from ingesting contaminated water and contaminated aquatic organisms, and from ingesting contaminated aquatic organisms alone. Remedial actions involving contaminated surface water or discharge of contaminants to surface water must consider the uses of the water and the circumstances of the release or threatened release.	Remedial actions will be performed in a manner to prevent AWQC exceedances in surface water. Actives at AOC 11 will be performed to prevent AWQC exceedances in the Nashua River. Removal of sediment at AOC 40 will be performed in a manner to prevent AWQC exceedances in Cold Spring Brook Pond. Supernatant from dredged spoil will be monitored to prevent AWQC exceedances in Cold Spring Brook Pond.
	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate AOC 40	The National Primary Drinking Water Regulations establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	At AOC 40 the MCL for bis(2-ethylhexyl)phthalate will be met under average scenario, and the MCL for arsenic will be met under average and maximum scenario. MCLs are not exceeded at Patton Well.

TABL_ _-16
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE 5

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Construction over/in navigable waters	Rivers and Harbors Act of 1899 [33 USC 401 et seq.]	Relevant and Appropriate AOC 40	Section 10 of the Rivers and Harbors Act of 1899 requires an authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any "navigable water of the U.S."; the excavation from or deposition of material in such waters, or any obstruction of alteration in such waters.	Excavating, filling, and disposal activities will be conducted to meet the substantive criteria and standards of these regulations.
	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41 Consolidation Facility	The National Pollutant Discharge Elimination System (NPDES) permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. On-site discharges will meet the substantive requirements of these regulations.
State	Solid Waste Landfill Construction, Operation, Closure, and Post-Closure Care	Massachusetts Solid Waste Management Regulations [310 CMR 19.000]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 Consolidation Facility	These regulations outline the requirements for construction, operation, closure, and post closure at solid waste management facilities in the Commonwealth of Massachusetts.	Final closure and post-closure plans will be prepared and submitted to satisfy the requirements of 310 CMR 19.021 for all disposal areas; however, only debris removal is proposed for AOC 11. The proposed landfill cover systems at SA 6, SA 12, SA 13, and AOC 41 will meet the requirements of 310 CMR 19.112. The consolidation landfill will be constructed, operated, and closed in conformance with the regulations at 310 CMR 19.000. A Record Notice of Landfill Operation will be filed for SA 6, AOC 11, SA 12, SA 13, and AOC 41 in accordance with 310 CMR 19.141.
	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate AOC 40	For activities that require a MADEP Wetlands Order of Conditions to dredge or fill navigable waters or wetlands, a Chapter 91 Waterways License, a USACE permit or any major permit issued by USEPA (e.g., Clean Water Act NPDES permit), a Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00.	Excavation, filling, and disposal activities will meet the substantive criteria and standards of these regulations. Remedial activities will be designed to attain and maintain Massachusetts Water Quality Standards in affected waters.

TABLE 8 - 17
COST SUMMARY TABLE
ALTERNATIVE 5: LIMITED REMOVAL AT AOC 11;
CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9 & 40

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ITEM		TOTAL COST
DIRECT COSTS		
LIMITED REMOVAL AT AOC 11	$	44,000
CAP IN PLACE		
SA 6		159,000
SA 12		507,000
SA 13		395,000
AOC 41		175,000
EXCAVATE AND CONSOLIDATE		
AOC 9		3,835,000
AOC 40		3,370,000
CONSOLIDATION LANDFILL CONSTRUCTION		5,240,000
TOTAL DIRECT COSTS	$	13,725,000
INDIRECT COSTS		
HEALTH AND SAFETY	$	686,000
LEGAL, ADMIN, PERMITTING		686,000
ENGINEERING		1,373,000
SERVICES DURING CONSTRUCTION		1,373,000
TOTAL INDIRECT COSTS	$	4,118,000
TOTAL CAPITAL (DIRECT + INDIRECT) COSTS	$	17,843,000
OPERATION AND MAINTENANCE COSTS		
TOTAL ANNUAL O&M COSTS FOR AOC 11 - 2 YRS	$	4,000
TOTAL ANNUAL O&M COSTS FOR CAP IN PLACE AREAS - 30 YRS		109,000
TOTAL ANNUAL O&M COSTS CONSOLIDATION LANDFILL - 30 YRS		23,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS		29,000
TOTAL PRESENT WORTH OF O&M COSTS	$	1,764,000
TOTAL COSTS ALTERNATIVE 5	$	19,607,000

TABLE 8-18
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE 6

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The U.S. Fish and Wildlife Service, acting as a review agency for the USEPA, will be kept informed of proposed remedial actions.
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Applicable SA 6 AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41 Consolidation Facility	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	The protection of endangered species and their habitat will be considered during excavation activities and cover installation.
	Atlantic Flyway , Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate AOC 11	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial actions will be performed to protect migratory birds, their nests, and eggs.

TABLE 8-19
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE 6

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface water	Clean Water Act, Ambient Water Quality Criteria [40 CFR 131; Quality Criteria for Water 1986]	Relevant and Appropriate AOC 11 AOC 40	Federal Ambient Water Quality Criteria (AWQC) include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) acute and chronic toxicity values for the protection of aquatic life. AWQC for the protection of human health provide protective concentrations for exposure from ingesting contaminated water and contaminated aquatic organisms, and from ingesting contaminated aquatic organisms alone. Remedial actions involving contaminated surface water or discharge of contaminants to surface water must consider the uses of the water and the circumstances of the release or threatened release.	Remedial actions will be performed in a manner to prevent AWQC exceedances in surface water. Actives at AOC 11 will be performed to prevent AWQC exceedances in the Nashua River. Removal of sediment at AOC 40 will be performed in a manner to prevent AWQC exceedances in Cold Spring Brook Pond. Supernatant from dredged spoil will be monitored to prevent AWQC exceedances in Cold Spring Brook Pond.
	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate AOC 40	The National Primary Drinking Water Regulations establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	At AOC 40 the MCL for bis(2-ethylhexyl)phthalate will be met under average scenario, and the MCL for arsenic will be met under average and maximum scenario. MCLs are not exceeded at Patton Well.

TABL_ d-20
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE 6

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Construction over/in navigable waters	Rivers and Harbors Act of 1899 [33 USC 401 et seq.]	Relevant and Appropriate AOC 40	Section 10 of the Rivers and Harbors Act of 1899 requires an authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any "navigable water of the U.S."; the excavation from or deposition of material in such waters, or any obstruction of alteration in such waters.	Excavating, filling, and disposal activities will be conducted to meet the substantive criteria and standards of these regulations.
	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41 Consolidation Facility	The National Pollutant Discharge Elimination System (NPDES) permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. On-site discharges will meet the substantive requirements of these regulations.
State	Solid Waste Landfill Construction, Operation, Closure, and Post-Closure Care	Massachusetts Solid Waste Management Regulations [310 CMR 19.000]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 Consolidation Facility	These regulations outline the requirements for construction, operation, closure, and post closure at solid waste management facilities in the Commonwealth of Massachusetts.	Final closure and post-closure plans will be prepared and submitted to satisfy the requirements of 310 CMR 19.021 for all disposal areas. The proposed landfill cover systems at SA 6, SA 12, SA 13, and AOC 41 will meet the requirements of 310 CMR 19.112. The consolidation landfill will be constructed, operated, and closed in conformance with the regulations at 310 CMR 19.000. A Record Notice of Landfill Operation will be filed for SA 6, SA 12, SA 13, SA 13, and AOC 41 in accordance with 310 CMR 19.141.
	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate AOC 40	For activities that require a MADEP Wetlands Order of Conditions to dredge or fill navigable waters or wetlands, a Chapter 91 Waterways License, a USACE permit or any major permit issued by USEPA (e.g., Clean Water Act NPDES permit), a Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00.	Excavation, filling, and disposal activities will meet the substantive criteria and standards of these regulations. Remedial activities will be designed to attain and maintain Massachusetts Water Quality Standards in affected waters.

TABLE 8 - 21
COST SUMMARY TABLE
ALTERNATIVE 6: CAP-IN-PLACE SAs 6, 12, 13, AOC 41;
EXCAVATE AND CONSOLIDATE AOCs 9, 11, & 40

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ITEM		TOTAL COST
DIRECT COSTS		
CAP IN PLACE		
SA 6	$	159,000
SA 12		507,000
SA 13		395,000
AOC 41		175,000
EXCAVATE AND CONSOLIDATE		
AOC 9		3,835,000
AOC 11		1,571,000
AOC 40		3,370,000
CONSOLIDATION LANDFILL CONSTRUCTION		5,240,000
TOTAL DIRECT COSTS	$	15,252,000
INDIRECT COSTS		
HEALTH AND SAFETY	$	763,000
LEGAL, ADMIN, PERMITTING		763,000
ENGINEERING		1,525,000
SERVICES DURING CONSTRUCTION		1,525,000
TOTAL INDIRECT COSTS	$	4,576,000
TOTAL CAPITAL (DIRECT + INDIRECT) COSTS	$	19,828,000
OPERATION AND MAINTENANCE COSTS		
TOTAL ANNUAL O&M COSTS FOR CAP IN PLACE AREAS - 30 YRS	$	109,000
TOTAL ANNUAL O&M COSTS CONSOLIDATION LANDFILL - 30 YRS		23,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS		29,000
TOTAL PRESENT WORTH OF O&M COSTS	$	1,757,000
TOTAL COSTS ALTERNATIVE 6	$	21,585,000

continued

TABLE 8-22
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE 7

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The U.S. Fish and Wildlife Service, acting as a review agency for the USEPA, will be kept informed of proposed remedial actions.
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Applicable SA 6 AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	The protection of endangered species and their habitat will be considered during excavation activities and cover installation.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate AOC 11	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial actions will be performed to protect migratory birds, their nests, and eggs.

Table 8-23
Synopsis of Federal and State Chemical-Specific ARARs for Alternative 7

Landfill Remediation Feasibility Study
Devens, MA

Regulatory Authority	Chemical Medium	Requirement	Status	Requirement Synopsis	Action To Be Taken To Attain Requirement
Federal	Surface water	Clean Water Act, Ambient Water Quality Criteria [40 CFR 131; Quality Criteria for Water 1986]	Relevant and Appropriate AOC 11 AOC 40	Federal Ambient Water Quality Criteria (AWQC) include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) acute and chronic toxicity values for the protection of aquatic life. AWQC for the protection of human health provide protective concentrations for exposure from ingesting contaminated water and contaminated aquatic organisms, and from ingesting contaminated aquatic organisms alone. Remedial actions involving contaminated surface water or discharge of contaminants to surface water must consider the uses of the water and the circumstances of the release or threatened release.	Remedial actions will be performed in a manner to prevent AWQC exceedances in surface water. Actives at AOC 11 will be performed to prevent AWQC exceedances in the Nashua River. Removal of sediment at AOC 40 will be performed in a manner to prevent AWQC exceedances in Cold Spring Brook Pond. Supernatant from dredged spoil will be monitored to prevent AWQC exceedances in Cold Spring Brook Pond.
	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate AOC 40	The National Primary Drinking Water Regulations establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	At AOC 40 the MCL for bis(2-ethylhexyl)phthalate will be met under average scenario, and the MCL for arsenic will be met under average and maximum scenario. MCLs are not exceeded at Patton Well.

TABLE 8-24
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE 7

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Construction over/in navigable waters.	Rivers and Harbors Act of 1899 [33 USC 401 et seq.]	Relevant and Appropriate AOC 40	Section 10 of the Rivers and Harbors Act of 1899 requires an authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any "navigable water of the U.S."; the excavation from or deposition of material in such waters, or any obstruction of alteration in such waters.	Excavating, filling, and disposal activities will be conducted to meet the substantive criteria and standards of these regulations.
	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate AOC 9 AOC 11 AOC 40	The National Pollutant Discharge Elimination System (NPDES) permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. On-site discharges will meet the substantive requirements of these regulations.
State	Solid Waste Landfill Construction, Operation, Closure, and Post-Closure Care	Massachusetts Solid Waste Management Regulations [310 CMR 19.000]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13	These regulations outline the requirements for construction, operation, closure, and post closure at solid waste management facilities in the Commonwealth of Massachusetts.	Final closure and post-closure plans will be prepared and submitted to satisfy the requirements of 310 CMR 19.021 for all disposal areas. The proposed landfill cover systems at SA 6, AOC 9, AOC 11, SA 12, SA 13, and AOC 41 will meet the requirements of 310 CMR 19.112. The proposed landfill cover at AOC 40 will conform with the intent of 310 CMR 19.112, although it may be considered an Alternative Cover System Design by MADEP (310 CMR 19.113). A Record Notice of Landfill Operation will be filed for all disposal areas in accordance with 310 CMR 19.141.
	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate AOC 40	For activities that require a MADEP Wetlands Order of Conditions to dredge or fill navigable waters or wetlands, a Chapter 91 Waterways License, a USACE permit or any major permit issued by USEPA (e.g., Clean Water Act NPDES permit), a Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00.	Excavation, filling, and disposal activities will meet the substantive criteria and standards of these regulations. Remedial activities will be designed to attain and maintain Massachusetts Water Quality Standards in affected waters.

TABLE 8 - 25
COST SUMMARY TABLE
ALTERNATIVE 7: CAP IN PLACE
ALL SEVEN DISPOSAL AREAS

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ITEM			TOTAL COST
DIRECT COSTS			
	SA 6	$	159,000
	AOC 9		3,301,000
	AOC 11		1,269,000
	SA 12		507,000
	SA 13		395,000
	AOC 40		1,758,000
	AOC 41		175,000
	TOTAL DIRECT COSTS	$	7,564,000
INDIRECT COSTS			
	HEALTH AND SAFETY	$	378,000
	LEGAL, ADMIN, PERMITTING		378,000
	ENGINEERING		756,000
	SERVICES DURING CONSTRUCTION		756,000
	TOTAL INDIRECT COSTS	$	2,268,000
	TOTAL CAPITAL (DIRECT + INDIRECT) COSTS	$	9,832,000
OPERATION AND MAINTENANCE COSTS			
	TOTAL ANNUAL O&M COSTS - 30 YRS	$	208,000
	TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS		13,000
	TOTAL PRESENT WORTH OF O&M COSTS	$	2,634,000
	TOTAL COSTS ALTERNATIVE 7	$	12,466,000

TABLE 8-26
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE 8

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The U.S. Fish and Wildlife Service, acting as a review agency for the USEPA, will be kept informed of proposed remedial actions.
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Applicable SA 6 AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41 Consolidation Facility	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	The protection of endangered species and their habitat will be considered during excavation activities and cover installation.
Federal	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate AOC 11	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial actions will be performed to protect migratory birds, their nests, and eggs.

TABLE 8-27
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE 8

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface water	Clean Water Act, Ambient Water Quality Criteria [40 CFR 131; Quality Criteria for Water 1986]	Relevant and Appropriate AOC 11 AOC 40	Federal Ambient Water Quality Criteria (AWQC) include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) acute and chronic toxicity values for the protection of aquatic life. AWQC for the protection of human health provide protective concentrations for exposure from ingesting contaminated water and contaminated aquatic organisms, and from ingesting contaminated aquatic organisms alone. Remedial actions involving contaminated surface water or discharge of contaminants to surface water must consider the uses of the water and the circumstances of the release or threatened release.	Remedial actions will be performed in a manner to prevent AWQC exceedances in surface water. Actives at AOC 11 will be performed to prevent AWQC exceedances in the Nashua River. Removal of sediment at AOC 40 will be performed in a manner to prevent AWQC exceedances in Cold Spring Brook Pond. Supernatant from dredged spoil will be monitored to prevent AWQC exceedances in Cold Spring Brook Pond.
	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate AOC 40	The National Primary Drinking Water Regulations establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	At AOC 40 the MCL for bis(2-ethylhexyl)phthalate will be met under average scenarios, and the MCL for arsenic will be met under average and maximum scenarios. MCLs are not exceeded at Patton Well.

TABLE 8-28
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE 8

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Construction over/in navigable waters.	Rivers and Harbors Act of 1899 [33 USC 401 et seq.]	Relevant and Appropriate AOC 40	Section 10 of the Rivers and Harbors Act of 1899 requires an authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any "navigable water of the U.S."; the excavation from or deposition of material in such waters, or any obstruction of alteration in such waters.	Excavating, filling, and disposal activities will be conducted to meet the substantive criteria and standards of these regulations.
	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate AOC 9 AOC 11 AOC 40 Consolidation Facility	The National Pollutant Discharge Elimination System (NPDES) permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. On-site discharges will meet the substantive requirements of these regulations.
State	Solid Waste Landfill Construction, Operation, Closure, and Post-Closure Care	Massachusetts Solid Waste Management Regulations [310 CMR 19.000]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 Consolidation Facility	These regulations outline the requirements for construction, operation, closure, and post closure at solid waste management facilities in the Commonwealth of Massachusetts.	Final closure and post-closure plans will be prepared and submitted to satisfy the requirements of 310 CMR 19.021 for all disposal areas; however, only debris removal is proposed for AOC 11. The consolidation landfill for SA 6, AOC 9, SA 12, SA 13, AOC 40, and AOC 41 will be constructed, operated, and closed in conformance with the regulations at 310 CMR 19.000.
	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate AOC 40	For activities that require a MADEP Wetlands Order of Conditions to dredge or fill navigable waters or wetlands, a Chapter 91 Waterways License, a USACE permit or any major permit issued by USEPA (e.g., Clean Water Act NPDES permit), a Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00.	Excavation, filling, and disposal activities will meet the substantive criteria and standards of these regulations. Remedial activities will be designed to attain and maintain Massachusetts Water Quality Standards in affected waters.

TABLE 8 - 29
COST SUMMARY TABLE
ALTERNATIVE 8: LIMITED REMOVAL AT AOC 11;
EXCAVATE AND CONSOLIDATE AOCs 9, 40, & 41, SA 6, 12, & 13

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

ITEM		TOTAL COST
DIRECT COSTS		
LIMITED REMOVAL AT AOC 11		
EXCAVATE AND CONSOLIDATE	$	44,000
SA6		64,000
AOC 9		3,835,000
SA 12		490,000
SA 13		502,000
AOC 40		3,370,000
AOC 41		93,000
CONSOLIDATION LANDFILL CONSTRUCTION		5,240,000
TOTAL DIRECT COSTS	$	13,638,000
INDIRECT COSTS		
HEALTH AND SAFETY	$	682,000
LEGAL, ADMIN, PERMITTING		682,000
ENGINEERING		1,364,000
SERVICES DURING CONSTRUCTION		1,364,000
TOTAL INDIRECT COSTS	$	4,092,000
TOTAL CAPITAL (DIRECT + INDIRECT) COSTS	$	17,730,000
OPERATION AND MAINTENANCE COSTS		
TOTAL ANNUAL O&M COSTS FOR AOC 11 - 2 YRS	$	4,000
TOTAL ANNUAL O&M COSTS CONSOLIDATION LANDFILL - 30 YRS		23,000
TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS		29,000
TOTAL PRESENT WORTH OF O&M COSTS	$	411,000
TOTAL COSTS ALTERNATIVE 8	$	18,141,000

TABLE 8-30
SYNOPSIS OF FEDERAL AND STATE LOCATION-SPECIFIC ARARS FOR ALTERNATIVE 9

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	LOCATION CHARACTERISTIC	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface Waters, Endangered Species, Migratory Species	Fish and Wildlife Coordination Act [16 USC 661 et seq.]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	To the extent necessary, actions will be taken to develop measures to prevent, mitigate, or compensate for project related impacts to habitat and wildlife. The U.S. Fish and Wildlife Service, acting as a review agency for the USEPA, will be kept informed of proposed remedial actions.
	Endangered Species	Endangered Species Act [50 CFR Parts 17.11-17.12]	Applicable SA 6 AOC 9 AOC 11 SA 12 SA 13 AOC 40 AOC 41 Consolidation Facility	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	The protection of endangered species and their habitat will be considered during excavation activities and cover installation.
	Atlantic Flyway, Wetlands, Surface Waters	Migratory Bird Treaty Act [16 USC 703 et seq.]	Relevant and Appropriate AOC 11	The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. A depredation permit is required to take, possess, or transport migratory birds or disturb their nests, eggs, or young.	Remedial actions will be performed to protect migratory birds, their nests, and eggs.

TABLE 8-31
SYNOPSIS OF FEDERAL AND STATE CHEMICAL-SPECIFIC ARARS FOR ALTERNATIVE 9

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	CHEMICAL MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Surface water	Clean Water Act, Ambient Water Quality Criteria [40 CFR 131; Quality Criteria for Water 1986]	Relevant and Appropriate AOC 11 AOC 40	Federal Ambient Water Quality Criteria (AWQC) include (1) health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds and (2) acute and chronic toxicity values for the protection of aquatic life. AWQC for the protection of human health provide protective concentrations for exposure from ingesting contaminated water and contaminated aquatic organisms, and from ingesting contaminated aquatic organisms alone. Remedial actions involving contaminated surface water or discharge of contaminants to surface water must consider the uses of the water and the circumstances of the release or threatened release.	Remedial actions will be performed in a manner to prevent AWQC exceedances in surface water. Actives at AOC 11 will be performed to prevent AWQC exceedances in the Nashua River. Removal of sediment at AOC 40 will be performed in a manner to prevent AWQC exceedances in Cold Spring Brook Pond. Supernatant from dredged spoil will be monitored to prevent AWQC exceedances in Cold Spring Brook Pond.
	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, MCLs and MCLGs [40 CFR Parts 141.60 - 141.63 and 141.50 - 141.52]	Relevant and Appropriate AOC 40	The National Primary Drinking Water establish Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health based goals set equal to or lower than MCLs.	At AOC 40 the MCL for bis(2-ethylhexyl)phthalate will be met under average scenario, and the MCL for arsenic will be met under average and maximum scenario. MCLs are not exceeded at Patton Well.

TABLE 8-32
SYNOPSIS OF FEDERAL AND STATE ACTION-SPECIFIC ARARS FOR ALTERNATIVE 9

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

REGULATORY AUTHORITY	ACTION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal	Construction over/in navigable waters	Rivers and Harbors Act of 1899 [33 USC 401 et seq.]	Relevant and Appropriate AOC 40	Section 10 of the Rivers and Harbors Act of 1899 requires an authorization from the Secretary of the Army, acting through the U.S. Army Corps of Engineers (USACE), for the construction of any structure in or over any "navigable water of the U.S."; the excavation from or deposition of material in such waters, or any obstruction of alteration in such waters.	Excavating, filling, and disposal activities will be conducted to meet the substantive criteria and standards of these regulations.
	Control of surface water runoff, Direct discharge to surface water	Clean Water Act NPDES Permit Program [40 CFR 122,125]	Relevant and Appropriate AOC 9 AOC 11 AOC 40 Consolidation Facility	The National Pollutant Discharge Elimination System (NPDES) permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including surface runoff, to waters of the United States.	Construction activities will be controlled to meet USEPA discharge requirements. On-site discharges will meet the substantive requirements of these regulations.
State	Solid Waste Landfill Construction, Operation, Closure, and Post-Closure Care	Massachusetts Solid Waste Management Regulations [310 CMR 19.000]	Relevant and Appropriate AOC 9 AOC 11 SA 12 SA 13 Consolidation Facility	These regulations outline the requirements for construction, operation, closure, and post closure at solid waste management facilities in the Commonwealth of Massachusetts.	Final closure and post-closure plans will be prepared and submitted to satisfy the requirements of 310 CMR 19.021 for all disposal areas. The consolidation landfill for small disposal areas will be constructed, operated and closed in conformance with the regulators at 310 CMR 19.000.
	Activities that potentially affect surface water quality	Massachusetts Water Quality Certification and Certification for Dredging [314 CMR 9.00]	Relevant and Appropriate AOC 40	For activities that require a MADEP Wetlands Order of Conditions to dredge or fill navigable waters or wetlands, a Chapter 91 Waterways License, a USACE permit or any major permit issued by USEPA (e.g., Clean Water Act NPDES permit), a Massachusetts Division of Water Pollution Control Water Quality Certification is required pursuant to 314 CMR 9.00.	Excavation, filling, and disposal activities will meet the substantive criteria and standards of these regulations. Remedial activities will be designed to attain and maintain Massachusetts Water Quality Standards in affected waters.

TABLE 8 - 33
COST SUMMARY TABLE
ALTERNATIVE 9: EXCAVATE AND CONSOLIDATE ALL DEBRIS AREAS

LANDFILL REMEDIATION FEASIBILITY STUDY
DEVENS, MA

	ITEM		TOTAL COST
DIRECT COSTS			
	SA6	$	64,000
	AOC 9		3,835,000
	AOC 11		1,571,000
	SA 12		490,000
	SA 13		502,000
	AOC 40		3,370,000
	AOC 41		93,000
	CONSOLIDATION LANDFILL CONSTRUCTION		5,240,000
	TOTAL DIRECT COSTS	$	15,165,000
INDIRECT COSTS			
	HEALTH AND SAFETY	$	758,000
	LEGAL, ADMIN, PERMITTING		758,000
	ENGINEERING		1,517,000
	SERVICES DURING CONSTRUCTION		1,517,000
	TOTAL INDIRECT COSTS	$	4,550,000
	TOTAL CAPITAL (DIRECT + INDIRECT) COSTS	$	19,715,000
OPERATION AND MAINTENANCE COSTS			
	TOTAL ANNUAL O&M COSTS CONSOLIDATION LANDFILL - 30 YRS	$	23,000
	TOTAL ADDITIONAL ANNUAL O&M COSTS FOR AOC 40 - 5 YRS		29,000
	TOTAL PRESENT WORTH OF O&M COSTS	$	480,000
	TOTAL COSTS ALTERNATIVE 9	$	20,195,000