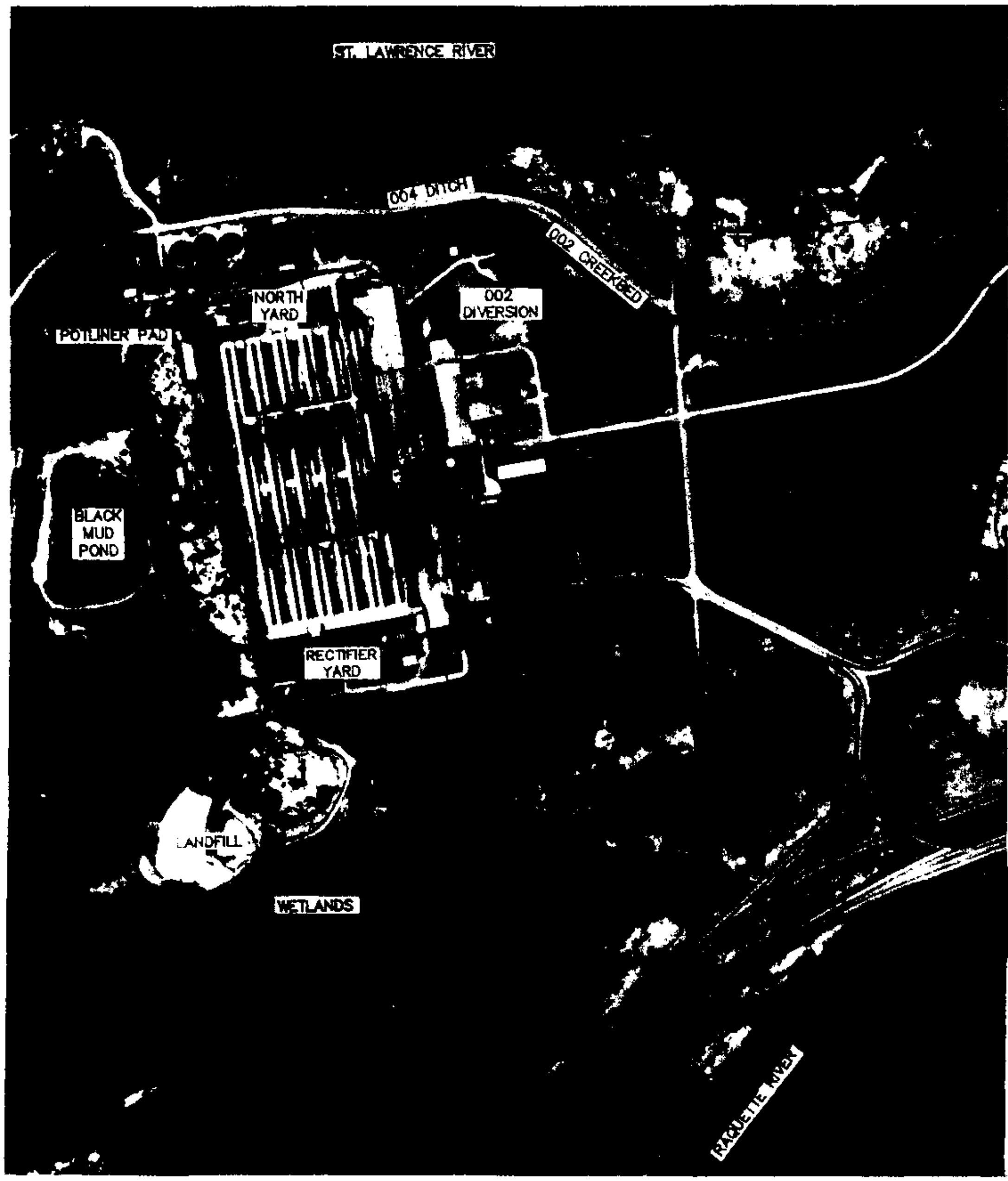
FINAL REPORT

VOLUME I

REVISED FINAL FEASIBILITY STUDY ST. LAWRENCE REDUCTION PLANT



Prepared for:

Reynolds Metals Co.
St. Lawrence Reduction Plant
P.O. Box 500
Massena, NY 13662
August 19, 1991

Woodward-Clyde

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August 19, 1991
89C2515C-2

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REVISED FINAL FEASIBILITY STUDY
REYNOLDS METALS COMPANY

Dear Darrell:

On behalf of the Reynolds Metals Company, Woodward-Clyde Consultants (WCC) is pleased to submit the enclosed Revised Final Feasibility Study Report for the St. Lawrence Reduction Plant in Massena, New York. This report is the second revision of the draft FS submitted on February 15, 1991. The report revisions, which have been made to account for your comments dated April 8, 1991, July 10, 1991, and July 25, 1991, are summarized on the following pages. As a result of the analyses herein and with the input from the Department, we believe that a defensible and comprehensive remediation plan can be developed for the site.

Please do not hesitate to call WCC or Dale DeLisle with any questions or comments on this report.

Very truly yours,

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RESPONSE TO COMMENTS
AND
GUIDE TO REVISIONS IN THE FS REPORT

The following summarizes the revisions made to the Draft Feasibility Study Report, dated February 15, 1991. The revisions have been made in response to comments received from the New York State Department of Environmental Conservation (NYSDEC), dated April 8, 1991 *July 10, 1991 and July 25, 1991. Revisions based on the latter two sets of NYSDEC comments are highlighted by italics in this "Response to Comments."*

GENERAL COMMENTS

1) Additional details have been provided on the costs for capital expenditures and post-closure operational and maintenance (O&M). The basis for these costs are described in Appendix A. The cost tables provided for each set of alternatives summarize costs for the main components of capital and O&M costs. In conformance with TAGM 4030, the level of detail provided for each alternative is adequate to discern significant differences between alternatives and to make a defensible selection of the preferred remediation. Additional details of capital and O&M costs will be developed in the Remedial Action Plan and/or Remedial Design. Because of the significance of the North Yard remediation, a greater level of detail has been provided in Appendix G for those alternatives.

2) A presentation and discussion of ARARs has been added to Part I of the report, including a tabulation of the ARARs that are most significant in determining the basis for action. Additional discussion regarding the ability of each alternative to meet specific ARARs has been added to appropriate sections in the detailed analysis. In summary, although there are minor exceptions to this, the remedial alternatives considered in this FS are designed to meet ARARs for each area of concern, recognizing this as a "threshold criteria" which all alternatives must meet.

3) The TAGM 4030 scores for each alternative have been revised to only give credit for reduction in mobility when the reduction is due to treatment of waste materials. The scores have also been revised to provide credit for treatment of source materials only, not groundwater, surface water, or leachate.

4) Additional discussion has been added to the text in Part II to describe some control measures that could be implemented to reduce short-term impacts. In all cases, the cost estimates have been developed with the inclusion of standard routine practices to control short-term impacts.

5) The design, construction, operation, and closure of an on-site secure landfill has been added as an additional consideration for disposal of contaminated soils, sediments, and treatment residuals. A complete discussion of the conceptual design of the landfill is presented in Appendix E, with a summary in Part II. Rather than adding specific alternatives to each area of concern, the landfill cell is considered as a potential site-wide solution for addressing wastes from several areas.

6) We question the preliminary soil cleanup goals provided by the NYSDEC because of the misapplication of equilibrium partitioning concepts to soil contaminants that are not in equilibrium with percolating rainwater. *Soil cleanup levels proposed by the NYSDEC are presented in Section 4 for the purposes of this FS,but do not indicate that they are achievable in all locations.* The ARARs and TBCs that are summarized in this report are used as a baseline with which to evaluate remedial alternatives.

7) *ARARs listed in this report are considered threshold criteria for evaluation of alternatives. As such, all alternatives were designed to meet ARARs at the completion of the remediation.* Surface water and groundwater collection and treatment has been added to Alternative 4C at the Black Mud Pond. For Alternatives 2A, 3A and 3B at the landfill, surface water and groundwater collection have not been added since these alternatives remove the wastes, resulting in "clean closure" of the landfill site. Under these scenarios, there would be no residual contaminants to come in contact with surface water, and the

removal of the fill would expose the glaciolacustrine clay to the surface, making groundwater collection infeasible.

A new figure has been added to Part IX to summarize plant-wide surface water collection/remediation for all alternatives. In all cases where interception trenches (or perimeter drains) have been included in alternatives, they are keyed into low permeability units, since the native soils in the area are of low permeability (glacial till and/or glaciolacustrine clay). Vertical barriers have not been included in any alternatives, as they would impede the collection of groundwater from any interception trenches and minimize the effective drawdown of the local groundwater collection system.

SECTION-SPECIFIC COMMENTS

PART I - BACKGROUND

2.2 Contamination Characteristics:

The information requested in this comment is discussed in this section of the report with appropriate references to supporting documentation, such as the RI Report. As stated in the RI Reports, the Draft FS, and elsewhere, WCC agrees with the statements made by the NYSDEC regarding the landfill being a source of contaminants to the wetlands.

The landfill cover is recognized as interim; the close-in-place alternative for the Landfill (1B) would have a RCRA-standard cap installed on top of the existing cover.

3.1 Remedial Action Objectives:

Minimization of plant operational disruptions has been deleted as a specific RAO. However, because of the significance of this concern, it has been retained in the FS in discussions of implementability and by including the costs for plant disruptions and modifications in the alternatives' cost, where appropriate (e.g. alternatives 2A, 2B, 3A, and 3B in the North Yard, as described in Appendix G).

5.0 Interim Remedial Measures:

Completed IRMs are described in Section 5.0, as in the Draft FS. These areas are also addressed as to the adequacy of the remedial measures in Part VIII, which is a new addition to account for all "Miscellaneous Areas." This section also addresses the remedial measures needed at the other areas mentioned in the comment.

Table I-4 Primary Remedial Criteria:

The table*(s)* has been corrected, updated and renumbered to account for the expanded discussion of ARARs and TBCs. *The proposed NYSDEC cleanup levels for soil are included for baseline comparisons and were used throughout the FS in calculating volumes.*

PART II - TECHNOLOGIES

6.2.1 Capping and Cover Systems:

In all places where an asphalt cap was proposed, the cap would be composed of a multiple-layer composite system, including the following main components:

Graded subbase
Drainage layer of aggregate
Petro-mat (or equivalent) asphalt impregnated geotextile
Asphalt base course
Asphalt top coat

This asphalt-composite cap is proposed only in or near operational areas of the plant where the durability of asphalt is preferred over a soil composite cap. An alternate concrete composite cap may be substituted for the asphalt, but a specific design has not been developed.

6.4.3 Off-site Disposal at Secure Landfill

TAGM 3018 is hereby acknowledged as a TBC document.

6.5.2 Soil and Sediment Treatment

Solvent Extraction:

Solvent extraction was removed from consideration after the Preliminary FS. While this technology may have applicability to some of the contaminants at the Reynolds facility, the presence of dioxins precludes even bench scale treatability studies, according to RCC (the technology's leading vendor).

Incineration:

WCC agrees with the NYSDEC that the alternatives that include off-site incineration are prohibitively expensive, considering the volumes of wastes to be disposed.

On-site incineration would require permitting by the USEPA under the Toxic Substances Control Act regulations.

Alternative 7 for the Black Mud Pond has been added to address on-site incineration of black mud.

Resource Recovery:

The FS has been modified to reflect the comments regarding the regulatory status of resource recovery of black mud. In addition, WCC has preliminarily investigated the possibility of black mud disposal/reuse in a RCRA-permitted cement kiln, as summarized in Appendix H. *Costs for such activities would be commensurate with disposal for the waste materials.*

Figure II-1:

The figure (and accompanying text) has been modified to agree with the regulatory requirements.

Figure II-4:

The figure has been replaced by additional details in Appendix E.

Part III BLACK MUD

As described in detail in the Final RI the containment wall has been shown to be effective in meeting its original design intent, i.e. to mitigate flow of leachate from the pond to the northwest through the winnowed till zone in that area.

The Black Mud Pond is currently located in a recharge zone, i.e. at the top of a hill. The potential for downward movement of groundwater in this area will be severely reduced by eliminating recharge. This will be accomplished by capping the Pond area.
Deep recovery wells in this area would not "reverse the hydraulic gradient," but would create a greater downward potential.

Contaminated sediment in the swales, the buried waste materials in the southwest corner of the Black Mud Pond, and residual soils below the mud are now specifically addressed.

7.1.2 Short Term Impacts:

This topic is clarified in the revised text.

7.1.3 Long Term Effectiveness and Permanence:

When the system reaches equilibrium, the groundwater collection system is expected to collect a few gallons per minute, at the most, from the entire area. This "inconsequential" volume is due to the low permeability of the glacial till in the area.

7.2.1 (Alternatives 2A and 2B):

[Comment retracted by the NYSDEC]

PART IV

10.1.3 Long-Term Effectiveness:

Leachate volumes are quantified in the revised text.

10.2.2 Short-Term Impacts:

The statement has been deleted.

PART V - WETLANDS

The technical feasibility of removing or capping the sediment in the Wetlands is a concern, due to the difficulties of performing construction activities in areas of soft ground. This is addressed in the revised FS text. In addition, WCC recognizes that creating a new wetlands in a nearby area (so that there is no net loss) may be more feasible than restoring the existing wetlands after remediation. The alternatives have been revised accordingly.

Landfill disposal of soils and sediments from this area would be performed if the secure landfill (Appendix E) is constructed and if the Former Potliner Storage Area is not selected as a "management area" for disposal of low level contaminated soils.

PART VI - POTLINER PAD AREA

Landfill disposal of soils and sediments from this area would be performed if the secure landfill (Appendix E) is constructed and if the Former Potliner Storage Area is not selected as a "management area" for disposal of low level contaminated soils.

Potliner Pad rehabilitation is described in Part VI.

PART VII - NORTH YARD

19.2 Infrared Thermal Destruction:

Confirmation data are included.

For Alternative 1 only, any parts of the remediation involving excavation of contaminated soils from the North Yard would occur after closure of the entire plant. This does not include removal of soils necessary to grade the area as preparation for capping.

Appendix C has been expanded to include substantially more information on environmental emissions, controls, case studies, etc.

A detailed plan for keeping the plant operating while remediating has been developed and is presented in Appendix G. This plan calls for staging the remediation over approximately three construction seasons and modifying plant facilities and operations in the process. *Additional scheduling details are included in the appendix.* The costs for these modifications are included in Alternatives 2A, 2B, 3A, and 3B.

20.1.1 Paving

Alternative 1 for the North Yard has been revised to emphasize that paving is a temporary measure that would meet environmental goals until the plant closes, at which time the North Yard would undergo final remediation consisting of excavation and *treatment* of contaminated soils *and disposal of residuals*. In accordance with the NYSDEC recommendation, and since Reynolds does not have any current plans to close the plant, WCC assumed that the plant closure and final remediation would take place 30 years from now.

Groundwater collection in the North Yard is most efficiently performed by the existing French drains (essentially "collection trenches") for shallow groundwater, and if necessary, by strategically located recovery wells for deeper groundwater. *The effectiveness of shallow groundwater collection and treatment is discussed in a newly-added Section 19.6.*

20.1.3 Long Term Effectiveness and Permanence:

The asphalt cap would have to be maintained in order to assure its integrity over the long term. Alternatively, a composite concrete cap may be feasible and may reduce maintenance requirements.

20.2.1 Alternative Definition:

Disposal of the treated soil in a hazardous waste landfill was assumed as a conservative measure, since *it is unknown if* the regulatory approvals to use these residuals as common backfill *will* be *achievable*.

20.2.6 Compliance with ARARs:

The incinerator may be in noncompliance with air standards during inevitable temporary excursions from normal operating conditions. *Additional discussion of this possibility has been included in the report text.*

20.3.5 Implementability:

Excavation under the rail tracks is possible, but will require substantial coordination with plant activities, as described in Appendix G.

21.4 Implementability:

This is addressed in responses to earlier comments on the North Yard, and in detail in Appendix G.

VIII - RECTIFIER YARD

23.0 Alternative Description:

The remediation alternative of this area has been expanded to include other options for the contaminated sediments and soils, depending on the concentrations present.

PART IX - SUMMARY AND CONCLUSIONS

The issues raised by the NYSDEC regarding economy of scale are quite relevant and are now addressed in this section.

The "editorial comment," while a statement of fact, has been deleted from this revised FS.

Appendix D:

All alternatives have been reviewed and rescored on the TAGM tables in accordance with all previous comments, as appropriate.

ADDITIONAL "SECOND ROUND REVIEW" COMMENTS

2.2 Contamination Characterization, North Yard

Reynolds submitted a Work Plan to the NYSDEC on July 31, 1991 and received conditional approval on August 2, 1991 to decommission and replace the damaged wells.

Figure II-1

The geomembrane is indicated as 40 mil HDPE and the filter layer is clarified, with additional typical specifications on Table II-1.

FINAL REPORT

VOLUME I

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August 19, 1991

Prepared by:

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Plymouth Meeting, PA 19462

Project No. 89C2515C-2

EXECUTIVE SUMMARY

This report presents the Final Feasibility Study (FS) Report for the Reynolds Metals Company in Massena, New York. This submittal addresses the following on-site areas of concern:

Black Mud Pond
Landfill and Former Potliner Storage Area
Wetlands
Potliner Pad
North Yard
Miscellaneous Areas (Rectifier Yard/Drainages,
North of Haverstock Road, Soil Stockpile)

The Final FS follows the Preliminary FS completed in July, 1990. The Preliminary FS was concerned with technology screenings and development of remedial alternatives. The remedial alternatives developed and retained in the Preliminary FS were brought forward to the Final FS for detailed evaluation.

The procedures used for the detailed evaluation of remedial alternatives follow those requested by the New York State Department of Environmental Conservation (NYSDEC) in their Technical and Administrative Guidance Memorandum (TAGM) No. 4030 of September 13, 1989 (revised 1990). In addition, standard environmental and engineering practices appropriate for an FS were applied. Detailed evaluations were made according to the following seven criteria:

- Short-Term Impacts and Effectiveness
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Implementability
- Compliance with ARARs
- Overall Protection of Human Health and the Environment

- Cost

As a result of this evaluation, Woodward-Clyde Consultants (WCC) has recommended alternatives for each area of concern. These recommendations are summarized as follows:

- For the Black Mud Pond, WCC recommends alternative 2A, which includes the installation of a permanent cap over the dewatered material in the existing pond with surface water and groundwater monitoring. The estimated cost for this alternative is $5,200,000.

- For the Landfill Area, WCC recommends alternative 1B, which includes the installation of a perimeter drain for leachate/groundwater collection and treatment, and a permanent cap. This alternative is estimated to cost $7,800,000.

- For the Wetlands, alternative 2A is recommended. This includes removing contaminated sediments and water from the Wetlands. The sediments should be placed in the Former Potliner Storage Area for permanent management, and a new wetlands area be built nearby. The cost of this alternative is estimated at $3,700,000.

- For the Potliner Pad Area, alternative 2B is recommended. This alternative includes in-place capping of sediments and soils and collection and treatment of surface water and groundwater. This alternative's cost is estimated at $2,000,000.

- For the North Yard, WCC recommends alternative 1, which includes in-place capping of contaminated soils and collection and treatment of surface water and shallow groundwater, with surface water and groundwater monitoring. The estimated cost of this alternative is $11,000,000.

- For the Miscellaneous Areas, WCC recommends removing contaminated soils/sediments. Contaminated soils/sediments with less than 50 ppm of PCBs would be placed in the Former Potliner Storage Area for permanent management, and soils/sediments with greater than 50 ppm of PCBs would be disposed in a on-site secure landfill. The estimated capital costs for these areas total $1,100,000.

It is important to note that the specific components of the recommended alternatives are subject to revision when reviewed in the context of a plant-wide remediation strategy. Such a strategy is also included in this report. In summary, the estimated total present worth cost for plant-wide remediation (excluding IRMs already completed) is $31,000,000.

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VOLUME II

LIST OF APPENDICES

PART I: BACKGROUND INFORMATION

1.0 INTRODUCTION

Woodward-Clyde Consultants (WCC) has completed a Remedial Investigation (RI) for the Reynolds Metals Company (RMC) at its St. Lawrence Reduction Plant in Massena, New York. The RI was performed as part of the New York State Superfund program under the terms of a Consent Order negotiated between RMC and the New York State Department of Environmental Conservation (NYSDEC).

This document, which represents a Final Feasibility Study (FS) Report, is based on sampling results obtained during the RI. Based on the FS Report, an appropriate remedy for the site can be selected. The FS has been conducted under guidelines presented in NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) No. 4030, of September 13, 1989 (revised 1990). This Final FS follows a Preliminary Feasibility Study Report (July 2, 1990) and incorporates data from appropriate treatability studies. The Preliminary FS identified remedial technologies and developed potential alternatives (Table I-1), which are subject to a final screening process in this document.

The FS Report for the site has been subdivided into ten parts. Part I, which provides background and introductory information, has been subdivided into four sections following this introduction, including:

- Section 2: Summary of the Remedial Investigation
- Section 3: Summary of the Preliminary FS
- Section 4: Remediation Parameters and Remedial Criteria
- Section 5: Summary of Remedial Work Performed

Part II presents an identification of remedial technologies common to all parts of the plant. Parts III through VIII provide area-specific discussions of remedial alternatives. Part III (Black Mud Pond), Part IV (Landfill and Former Potliner Storage Area), Part V (Wetlands), Part VI (Potliner Pad Area), and Part VII (North Yard) are each comprised of three sections that include a descriptive analysis of alternatives, a comparative analysis of alternatives, and conclusions and recommendations concerning each area. Part VIII (Miscellaneous Areas) presents proposed remedial measures for three areas: the Rectifier Yard, the Area North of Haverstock Road, and the Soil Stockpile adjacent to the Black Mud Pond.

The FS process is intended to be dynamic, in that the technologies available for environmental remediation are evolving in terms of commercial availability, development status, and costs. This FS is based on technologies available and applicable at the time of this writing and do not preclude the use of new technologies available at later stages of the project (i.e., prior to commencing remediation).

2.0 SUMMARY OF THE REMEDIAL INVESTIGATION

WCC has completed an extensive RI at the site. The main objective of the RI was to provide a comprehensive assessment of the site's environmental conditions.

The results of the investigations are presented in the Phase I RI Report (Revision 2, March 31, 1989) and the Final RI Report (July 2, 1990). Because the RI Reports are intended as companion volumes to this FS Report, Sections 2.1 and 2.2 below provide only a brief overview of more significant information obtained during the RI.

2.1 SITE SETTING

The St. Lawrence Reduction Plant is located on the shores of the St. Lawrence River near the Town of Massena, St. Lawrence County, New York. It is the second largest employer in the area. The St. Lawrence Reduction Plant, occupying about 112 acres, was constructed in 1958 to produce aluminum from alumina (aluminum oxide). The site is bounded on the north by the St. Lawrence River, on the east by Conrail (formerly New York Central Railroad), on the south by the Raquette River, and on the west by Haverstock Road (South Grasse River Road). Reynolds' property occupies approximately 1600 acres.

The following list includes additional, relevant information concerning the site setting:

- The closest groundwater users in the vicinity are approximately 3 miles from the plant; the closest surface water user is the General Motors Facility, with an intake approximately 1 mile downstream on the St. Lawrence River.

- A large tract of regulated Wetlands (identified as No. RR-6 by the NYSDEC) is located on the Reynolds property. The Wetlands is 172 acres in size and is a Class 2 wetland.

- The subsurface conditions beneath the Reynolds site are characterized by fill (generally reworked glacial till) underlain by glacial till and/or lacustrine deposits. The fill is comprised of variable clay, silt, sand, and gravel. Its thickness varies from not present to approximately 25 feet on the berm of the Landfill and in selected North Yard utility trenches.

- The lacustrine deposits exhibit low permeabilities (on the order of 1×10^{-6} cm/sec) and overlie the glacial till in the low-lying areas of the Landfill and Wetlands. They are mainly comprised of a uniform gray clay ranging in thickness from 20 to 40 feet over the glacial till.

- The glacial till (average permeability 1×10^{-6} cm/sec) is prevalent throughout the site. The till is gray, dense with a high clay content, and has a brown weathering profile.

- An orange-brown sand ("winnowed till") is present north and northwest of the Black Mud Pond. The winnowed till has a higher coefficient of permeability (on the order of 1×10^{-3} cm/sec) than that of the underlying glacial till.

- Groundwater within the unconsolidated glacial deposits is generally unconfined. The water table is generally a reflection of the surface topography at depths ranging from approximately 4 to 15 feet.

- A ridge of glacial till underlying the Black Mud Pond forms a ground water divide from which groundwater flows toward the Raquette River to the south and toward the St. Lawrence River to the north. The groundwater flow direction at the Landfill is southward, toward the adjacent Wetlands. Groundwater in the North Yard flows directly, or indirectly via utility trenches, northward toward the St. Lawrence River.

2.2 CONTAMINATION CHARACTERIZATION

To facilitate discussion of the potential remedial activities at the Reynolds site, contaminated areas have been categorized into areas of concern (Figure I-1). The paragraphs below present a brief summary for each area of concern with an identification of contaminants, an identification of source areas, and a discussion of contaminant transport mechanisms. Table I-2 summarizes contaminated media for each area of concern. In accordance with the RI and previous reports, the site characterization is described in terms of the "site indicator parameters," which include:

PCBs
PAHs
Cyanides (total)
Fluorides
Phenols (total)
Selected metals

North Yard: The North Yard is the location of the Heat Transfer Medium (HTM) system. The HTM system is used to maintain the temperature and fluidity of the coal tar pitch for anode and cathode manufacturing. PCB fluids were formerly used in the HTM system, but it has been retrofilled with non-PCB oils in the early 1980's.

Leakage or spillage from the HTM system was the source of the PCB, PCDF, and PCDD contamination. PCBs, PCDFs, and PCDDs are distributed in North Yard surficial soils in a pattern that reflects the HTM system layout; however, 2,3,7,8-TCDD has only been detected twice at low concentrations and its distribution is believed to be limited to a small area. PCBs are also present in sediments within North Yard catch basins, which collect surface water and water from subsurface French drains.

North Yard groundwater contamination is characterized by local areas of elevated concentrations, relative to background, of aluminum, arsenic, cyanide, and fluoride. Specific sources for this local contamination are not known. PCBs have not been detected in North

Yard groundwater. North Yard wells are located in the vicinity of a number of plant process areas including the Pitch Pump House, Cryolite Recovery Plant, and the Carbon Paste Plant.

Groundwater flow is a potential migration pathway for some North Yard contaminants. The utility trenches act as preferential pathways for groundwater flow. Due to the till's low permeability, groundwater in the underlying glacial till is not a significant migration pathway.

The presence of PCB-contaminated sediment in the North Yard catch basins and French drains indicates that stormwater run-off and infiltration is a migration pathway. Spreading of contaminated soils is also attributable to wind and foot or vehicle traffic.

Solid Waste Landfill and Former Potliner Storage Area (Landfill Area): The Landfill, which currently is not in use, became operational in 1957 with the construction of the Reduction Plant. The Landfill Area consists of approximately 11 acres of land immediately south of the plant. The Landfill received solid waste generated at the facility (garbage, office wastes, shipping materials, etc.), construction debris, bags and filters used in plant dust control, and previously, sanitary sewage sludge from Reynolds' sewage treatment plant. The Former Potliner Storage Area is located in the eastern portion of the Landfill Area. The Landfill is underlain by glacial till and glaciolacustrine clay.

All site indicator parameters are present in elevated concentrations in Landfill and Former Potliner Storage Area waste, leachate and groundwater. Elevated concentrations of some PAH compounds are present in Landfill wastes.

Most of the contamination in the Landfill Area is characteristic of potliner-related materials. The source of these contaminants is the former occasional disposal of potliner materials in the Landfill and of residual potliner materials in the Former Potliner Storage Area. The Landfill's berm is also a source of groundwater contamination and should be considered part of the Landfill Area.

The source of PCB contamination in the Landfill may be PCB-contaminated sewage sludge. The contaminated sludge, before 1988, was disposed of in the Landfill. The source of PCB contamination in the Former Potliner Storage Area is unknown.

Shallow groundwater flow is a migration pathway for contaminants from the Landfill and Former Potliner Storage Area. Shallow groundwater originating in the source area discharges directly to the adjacent wetlands. The Landfill underdrain intercepts some, but not all, of the contaminated groundwater.

Vertical groundwater flow is not a migration pathway for contaminants, because of the low permeability of the clay, which is 20 to 30 feet thick, that underlies the Landfill. The hydraulic gradient in the glacial till at depth is generally directed upward.

Surface water is not a major migration pathway because it is collected as run-off and flows to the Landfill tank. However, a small leachate seep, present in the northwest corner of the Landfill, occasionally overflows the berm and drains to the small stream west of the Landfill, which discharges to the Wetlands.

Air is not a significant transport pathway in the Landfill because a daily cover was placed during the operational phase of the Landfill, and an interim cover has been placed since the Landfill ceased operations in 1990.

Wetlands: The RR-6 Wetlands are located south and west of the Landfill Area and encompass 172 acres. Approximately 10 acres to the south of the Landfill (including some of the drainages) have been impacted by surface water and sediment contamination. The impacts on these 10 acres are discussed below.

In the impacted wetlands area, surface water samples contain PCBs, aluminum, cyanide, fluoride, sulfate, and sodium at concentrations above background. Other site indicator parameters are present at levels comparable to, or slightly above, background. These contaminants are also present at elevated levels in Wetlands surficial sediments.

The data indicate that the Landfill Area is the major source of contamination to the Wetlands. The drainageway leading from the Rectifier Yard and the drainage west of the Landfill may be additional sources of PCB contamination.

Since the Wetlands is a groundwater discharge area, contaminants are not leaving the Wetlands via groundwater. Contaminants can potentially migrate from the Wetlands by two intermittent streams that flow to the Raquette River; however, data from the sediment and water in the Raquette River do not indicate detectable levels of contaminants from these drainageways.

Potliner Pad Area: The Potliner Pad Area, which was used to temporarily store spent potliner material prior to crushing, is a curbed, reinforced concrete pad (65 by 100 feet). It is located to the north of the Crusher Building. Potliner is no longer stored on the pad.

The contamination detected in the groundwater near the Potliner Pad is indicative of potliner-related materials and is characterized by elevated levels of cyanide, fluoride, sodium, sulfate, and aluminum. Surface water and sediment area-specific indicator contaminants include those mentioned above and PCBs.

The Potliner Pad Area (including the area around the Crusher Building) was the source of the nearby groundwater contamination. The area of the Potliner Pad and around the Crusher Building is also a source of contamination (fluoride and cyanide) in surface water and sediment. Some run-off from the Potliner Pad Area has apparently entered the "west ditch" (the drainage west of the on-site industrial wastewater treatment system). Surface water and sediment sample results indicate elevated levels of fluoride, cyanide, and PCBs, with the highest levels of cyanide and PCBs in the most downstream sediment and water sample location.

Black Mud Pond: The Black Mud Pond was constructed in 1973 on the west side of the plant. The purpose of the Black Mud Pond was to hold by-product solids of the Emission Control System and the Cryolite Recovery Plant. The waste stream consisted of a slurry containing solids and chemicals in solution. After settling, the decanted liquor was returned to the Cryolite Treatment Plant. The pond has a surface area of approximately 6 acres. The pond is no longer used as part of the process.

The constituents of the black mud and liquor include cyanide, fluoride, PCBs, magnesium, sodium, sulfate, aluminum, and PAHs. With the exception of PAHs, these contaminants have been detected in the groundwater and nearby surface water.

The Black Mud Pond is the source of groundwater contamination in the area. Shallow groundwater is a migration pathway for Black Mud Pond contaminants. Contaminants have not migrated far from the pond because of the presence of the groundwater containment wall, a reverse gradient across the containment wall of the glacial till, and the permeabilities averaging about 1×10^{-6} cm/sec in the saturated zone near the Black Mud Pond.

Shallow groundwater may discharge to drainageways to the south and east of the Black Mud Pond. Therefore, shallow groundwater migrating from the Pond Area may be responsible for contamination detected in surface water and in sediment samples taken from the drainageway to the south.

Deep groundwater is a limited migration pathway for contamination. Deep groundwater contamination associated with the Black Mud Pond has not migrated far from the pond due to the low permeability of the till.

Air sampling performed as part of the RI confirmed the results of the atmospheric modeling study performed in the Preliminary Risk Assessment. Airborne transport of contaminants from the pond may occur but the levels are well below acceptable levels for human inhalation exposure.

Miscellaneous Areas: In addition to the five areas of concern described above, the following areas have been identified: the 002, 003, and 004 outfalls; the Rectifier Yard; the Area North of Haverstock Road, and the soil stockpile to the west of the Black Mud Pond. These areas of PCB contamination are relatively small and localized. Section 5.0 describes the remedial work already performed in these areas, and in Part VIII the adequacy of the work performed is presented along with additional remedial measures proposed for some of these areas.

2.3 VOLUME ESTIMATES

Approximate volumes of PCB contaminated soil and sediment were calculated for each of the five areas of concern (Table I-3). PCB contaminant levels were used exclusively to estimate the volumes; areas involving other contaminants are addressed within the text of this report for the specific area of concern. In areas of limited sampling data, WCC has made reasonable assumptions regarding the contamination limits. These assumptions are based on available analytical data, topography, geology, predicted contaminant migration, and other factors. Table I-3 presents a range of volume estimates associated with several remedial criteria concentrations.

3.0
SUMMARY OF THE PRELIMINARY FEASIBILITY STUDY

The Preliminary FS (July 2, 1990) was the first of three steps to follow the remedial investigations at the plant. The other two steps are the treatability studies and this Final FS. The Preliminary FS identified remedial technologies and screened potential alternatives that could meet the remedial action objectives for the site. This section reviews and summarizes the remedial action objectives and the preliminary screening of alternatives.

3.1 REMEDIAL ACTION OBJECTIVES

The remedial action objectives listed below are generalized goals for the Reynolds FS for protecting human health and the environment:

1. Consider a means to permanently treat, reduce, or immobilize contaminants in soil, sediment, and waste.

2. Prevent the migration of contaminants in groundwater and surface water on or beyond the Reynolds Plant boundaries.

3. Minimize the mobility of contaminants in soils, sediments, and wastes to the extent necessary to prevent groundwater, surface water, and air contamination.

4. Provide a wetlands habitat, either by restoration or by creating a new wetland, equivalent in areal extent to the original Wetlands RR-6 ecosystem.

In addition to the environmental objectives listed above, another important concern is to accomplish these objectives with a minimal disruption of plant operations. This concern, most significant in the North Yard, is reflected in this FS by the balance sought in the evaluation of environmental, engineering, and economic considerations.

3.2 PRELIMINARY SCREENING OF ALTERNATIVES

The Preliminary FS identifies general response actions that could be applied to the media known to be contaminated above the site-specific remedial criteria. Then, for each combination of response action and medium, specific process technologies (e.g., treatment methods) were identified, thereby defining a list of possible remedial processes. This list was then narrowed by screening out those technologies that cannot be implemented or are not applicable to the site. The technologies identified were screened on the basis of effectiveness and implementability.

Remedial alternatives for each area of concern were then assembled by combining response actions appropriate to address the media of concern in the area.

The assembled alternatives were then screened, again using criteria of effectiveness and implementability, by following the scoring system in Tables 4-1 and 4-2 of the TAGM. This screening eliminated those alternatives for which detailed analysis is inappropriate. The result of this screening is a total of thirty-six alternatives retained for detailed analysis in the Final FS. These alternatives are briefly described in Table I-1 for each area.

4.0
SITE ARAR AND TBC IDENTIFICATION

Remediation of Areas of Concern at the Reynolds Metals Plant will conform with the NYSDEC requirements of being protective of human health and the environment. The FS must evaluate the extent to which each remedial alternative will be in accordance with any and all "applicable or relevant and appropriate requirements" (ARARs) identified. A requirement may be "applicable" or "relevant and appropriate" but not both. The USEPA defines "applicable" requirements as, "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 circumstances at a CERCLA site." "Relevant and appropriate" requirements are "those... standards, requirements, criteria or limitations promulgated under Federal or State law that, while not applicable... address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site." There are three types of ARARs: chemical-, action-, and location-specific. Table I-4 summarizes the list of sources of ARARs identified for the site.

The ability of a remedial alternative to meet ARARs is considered a threshold criteria in the evaluation of the alternative. As such, the remedial alternatives described in this FS have been designed to meet the ARARs (and TBCs) discussed below. However, in some areas, these criteria may be difficult to meet.

4.1 CHEMICAL-SPECIFIC ARARs

Chemical-specific ARARs are usually health- or risk-based values that establish the acceptable concentration of a chemical that may be found in or discharged to the ambient environment. Generally, if a chemical has more than one ARAR, the more stringent value should be conformed with. The ARAR-based chemical-specific remedial criteria for the site are presented in Table I-5. The values shown are regulatory limits for surface water, groundwater and air for the site-specific indicator parameters. (Other media are addressed as TBCs in the following section.)

In order to meet ARARs, the remediation must provide for these criteria to be complied with at the following general locations:

- Surface water cleanup criteria within intermittent drainageways will be met within the drainageway, downstream of each area of concern and prior to its confluence with either the St. Lawrence or Raquette Rivers.

- Groundwater cleanup criteria will be applied at the boundaries of each waste management unit (area of concern), typically defined by the existing monitoring well network.

- Air quality criteria will be maintained at the Reynolds' site boundaries.

4.2 TO-BE-CONSIDERED (TBC) REQUIREMENTS

To-be-considered (TBC) material are non-promulgated advisories or guidance issued by Federal or State governments that are not legally binding and do not have the status of potential ARARs. In situations where there are no identifiable ARARs, cleanup criteria have been selected with consideration of TBCs.

Enforceable regulatory criteria do not exist for PCBs (or other parameters) in soils and sediments. Remedial goals based on TBCs are summarized in Table I-6. The goals listed on Table I-6 have been provided by the NYSDEC for use in the FS as a baseline for comparison of remedial alternatives. As such, they provide a common measure of the environmental effectiveness of the alternatives; however, their use in this manner does not imply their achievability in actual practice.

Criteria have been established for two categories of soil and two categories of sediment. For soils, the criteria depends on the susceptibility of the soils to be eroded and/or transported in surface run-off (the prime contaminant transport mechanisms at the Reynolds plant). For sediment, criteria are based on whether or not the sediment supports an aquatic habitat (e.g., in the wetlands).

4.3 ACTION-SPECIFIC ARARs

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. Most of the action-specific ARARs identified on Table I-4 are related to the remedies requiring excavation, removal, or on-site treatment of hazardous waste. For example, RCRA regulations managing the construction of an on-site hazardous waste landfill would be relevant and appropriate. Waste transportation to a commercial facility for treatment or disposal would have to meet Hazardous Waste Manifest System requirements.

4.4 LOCATION-SPECIFIC ARARs

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities because they are in specific locations. The location-specific ARARs listed in Table I-4 are related to the existence of a State regulated wetlands on-site and the plant's orientation on a coastal boundary with Canada. New York State Division of Fish and Wildlife requirements governing activities near freshwater wetlands and those protecting endangered species are examples. Finally, requirements dealing with New York State Coastal Management policies may be considered ARARs.

5.0
SUMMARY OF REMEDIAL WORK PERFORMED

Various remedial projects and discharge abatements have been performed by RMC since the initiation of the RI, as described in this section of the report. The projects have been undertaken by RMC with the approval of the NYSDEC to eliminate potential run-off areas and exposure areas of contamination. Details of the scope of the work, as well as data collected, are included in reports previously submitted to NYSDEC. Those reports document the specific projects and are summarized in the following subsection. Additional discussions, primarily regarding the adequacy of these actions and the need for additional action, are presented in Part VIII of this FS.

5.1 OUTFALL 002 DIVERSION

Outfall 002 previously consisted of surface water flow along a drainage ditch located in the vicinity of the sewage treatment plant. The water flowed eastward along the south side of the railroad tracks before crossing underneath the tracks, then discharging to an embayment in the St. Lawrence River. In November of 1989, this flow was diverted to a piped system, which collects all cooling waters that formerly discharged to Outfall 002, and most of the surface water run-off from the east side of the plant. This water flows to a retention basin located northeast of the East Cast House. Effluent then discharges into the pre-existing pipe which carries the Outfall 003 discharge to the St. Lawrence River. The Interim Remedial Measure (IRM) performed to remove contaminated sediments from the former drainage ditch, Outfall 002, is discussed in Section 5.7.1.

5.2 OUTFALL 003

In July 1988, RMC installed a granular activated carbon (GAC) treatment system on the effluent of Outfall 003. The purpose of the GAC system is to remove PCBs from water discharged through this outfall. The GAC system has been operating continuously since its installation.

5.3 OUTFALL 004

Outfall 004 is a ditch that previously collected drainage from the three diked areas in the North Yard. Drainage from these areas previously flowed along a flat area north of the dikes before entering the ditch alongside Haverstock (South Grasse River) Road. It then flowed eastward to a culvert crossing under the Haverstock Road and discharged through a ditch into the St. Lawrence River. Two remedial measures have been taken relative to this outfall: 1) The use of the outfall as an outlet from the three diked areas has been discontinued. Run-off and other waters collected in these diked areas is currently intercepted by a drainageway which runs parallel to the 004 ditch, and is collected in a sump and pumped to the sanitary sewer system for carbon treatment and subsequent discharge to Outfall 003. Construction was initiated in 1990 (and completed in 1991) to divert this flow to a permanent, dedicated North Yard GAC system for treatment. 2) An IRM was performed to remove contaminated sediments from the former drainage ditch, as discussed in Section 5.6.2. In addition, the section of the ditch from Haverstock Road to the St. Lawrence River has been relocated to the east of its original location to further isolate any residual contamination.

5.4 NORTH YARD

Storm drainage and shallow groundwater flow from the French drains from the North Yard is being rerouted to the North Yard GAC treatment system. After treatment, this system currently discharges into the existing wastewater treatment plant to be used as make-up water for the fume control system. The effectiveness of this treatment is currently being evaluated as part of the plant's SPDES permitting program. Alternatively, discharges to Outfall 001 may be needed.

The effectiveness of groundwater collection by the French drains in demonstrated by historical data on soil and groundwater contamination in the North Yard. Despite the relatively high levels of soil contamination in the fill zone, only the shallow groundwater has demonstrated to be PCB contaminated. Interception of this shallow water by the French drains, combined with the low permeability of the native till soils in the area, have effectively mitigated the potential for downward migration of PCBs to deeper groundwater.

5.5 OTHER REMEDIAL WORK

RMC undertook decontamination of structural surfaces in the Pitch Pump House in 1989. Also, in 1989 and early 1990, the floor of the oil storage shed was replaced.

5.6 INTERIM REMEDIAL MEASURES

5.6.1 Outfall 002 Drainage Ditch

After the Outfall 002 drainage was diverted (as described in Section 5.1), Reynolds implemented an IRM for the former Outfall 002 drainage ditch sediments. Sediments in, and adjacent to, the former drainage ditch which had PCB concentrations greater than 10 ppm were excavated, staged to allow for drying, and hauled to Chemical Waste Management in Model City, New York, for disposal in a secure landfill. Final verification samples ranged in PCB concentration from <0.08 ppm to 9.4 ppm. Concrete structures and pipes were cleaned and sampled, then either left in place or stockpiled for eventual disposal. The soil left in place was covered with a minimum of one-foot of clean fill. In a portion of the ditch, a geotextile was laid over the clean fill to prevent sediment erosion, and six-inches of riprap was placed on top to minimize erosion. Other adjacent areas were seeded and sloped at less than 3 to 1 (H to V) towards the ditch. Discussions of the adequacy of this IRM and recommendations for future work are presented in Part VIII.

5.6.2 Outfall 004 Drainage Ditch

In addition to the remedial work described in Section 5.4 for Outfall 004, the IRM conducted for the drainage ditch involved excavation of sediments along the length of the ditch. The underlying soils were then covered with clay, crushed stone and the ditch paved. Areas where sand or other fill materials were encountered, were excavated and backfilled with clay and crushed stone prior to paving. All excavated sediments were hauled to Chemical Waste Management in Model City, New York for disposal in a secure landfill. Analytical characterization samples prior to remediation revealed PCB concentrations which ranged from

< 1.0 to 1000 ppm. Verification sampling after remediation revealed PCB concentrations which ranged from <0.56 to 1.9 ppm.

5.6.3 West Ditch

The downgradient portion of the West Ditch (leading from the Potliner Pad Area, Figure I-1), was remediated by removing contaminated sediments, and placing a corrugated metal pipe in the channel. Post-excavation verification sampling concentrations for PCBs ranged from less than 0.18 ppm to 0.52 ppm. The final as-built excavated depth of the channel is 24-inches below the former eroded water channel invert.

5.6.4 North Yard

IRMs in the North Yard include covering contaminated soils and limiting access to contaminated areas. Upon notification by WCC of the results of PCB sampling in the soils in the North Yard in June of 1988, RMC covered high concentration areas with polyethylene sheeting. Subsequently, additional layers of polyethylene were installed, and selected areas of the North Yard were paved with asphalt. Fencing was also installed and signs were posted to help control access to contaminated areas.

TABLE I-1

RETAINED ALTERNATIVES FOR DETAILED EVALUATION IN FINAL FEASIBILITY STUDY

Area of Concern	Alternative Number	Alternative Description
Black Mud Pond	1A	Resource Recovery of Black Mud; capping of nearby soils and sediments; institutional controls and monitoring for groundwater and surface water.
	1B	Same as 1A with collection and treatment of groundwater.
	2A	Dewater pond and install cap over entire area, including soils and sediments; institutional controls and monitoring for surface water and groundwater.
	2B	Same as 2A, with collection and treatment of groundwater.
	4C	Excavate, dewater and off-site incinerate black mud and soils; collection and treatment for groundwater and surface water.
	5A	Excavate, dewater, and off-site landfill black mud and soils; institutional controls for groundwater and surface water.
	5B	Same as 5A with collection and treatment of groundwater and surface water.
	6A	Excavate, dewater and on-site landfill black mud and soils; institutional controls for groundwater and surface water.
	6B	Same as 6A with collection and treatment of groundwater and surface water.
	7	Same as 4C, but on-site incinerate.
Wetlands	1A	Cap wetlands; collection and treatment of groundwater; run-on/run-off controls for surface water. Create new Wetlands.

TABLE I-1 (continued)

Area of Concern	Alternative Number	Alternative Description
Wetlands (cont'd.)	2A	Excavate and treat/dispose of wetlands sediments; replace with clean fill; run-on/run-off controls for surface water. Create new Wetlands.
	4A	Excavate and off-site incinerate wetland sediments; institutional controls for groundwater and surface water. Create new Wetlands.
North Yard	1A	Cap soils; monitor ground water; run-on/run-off controls for surface water.
	1B	Cap soils; collection and treatment of groundwater; run-on and run-off controls for surface water.
	1C	Cap soils; collection and treatment of both ground water and surface water.
	1D	Cap soils; collection and treatment of surface water; monitor groundwater.
	2A	Excavate, treat and dispose of soil, institutional controls and monitoring for groundwater; run-on and run-off controls for surface water.
	2B	Excavate, treat and dispose of soil; groundwater collection and treatment, run-on and run-off controls for surface water.
	2C	Excavate, treat and dispose of soil; collection and treatment of surface water; monitor groundwater.
Landfill	1B	Cap landfill and former potliner storage area; collect and treat groundwater/ leachate; run-on/run-off controls for surface water.
	2A	Excavate, sort and off-site incinerate landfill wastes and soils; collection and treatment of groundwater/ leachate; run-on/run-off controls for surface water.

TABLE I-1 (continued)

Area of Concern	Alternative Number	Alternative Description
Landfill (cont'd.)	3A	Excavate, sort and off-site landfill wastes and soils; collection and treatment of groundwater/leachate; run-on/run-off controls for surface water.
	3B	Excavate, sort and on-site landfill wastes and soils; collection and treatment of groundwater/leachate; run-on/run-off controls for surface water.
Potliner Pad	1A	Institutional controls for all media.
	1B	Cap sediments in nearby ditch; collection and treatment of groundwater and surface water; institutional controls for soils.
	1C	Institutional controls for soils, excavat and treat sediments, collection and treatment for groundwater and surface water.
	2B	Cap sediments and soils; collection and treatment of groundwater and surface water.
	2C	Cap soils, excavate and treat sediments, collection and treatment of ground water and surface water.
	2D	Cap soils and sediments; institutional controls and monitoring for surface water and groundwater.
	3A	Excavate and treat soils; cap sediments; collection and treatment of ground water and surface water.
	3B	Excavate and treat soils and sediments; collection and treatment of ground water and surface water.
	4A	Excavate and off-site incinerate sediments; cap soils; collection and treatment of groundwater and surface water.

TABLE I-2

SUMMARY OF CONTAMINATED MEDIA FOR EACH AREA OF CONCERN REYNOLDS METALS COMPANY MASSENA, NEW YORK

Area of Concern	Affected Media: Ground Water	Surface Water	Soil/ Sediments	Black Mud	Solid Wastes
Black Mud Pond	X	X	X	X	
Wetlands		X	X		
North Yard	X	X	X		
Landfill	X	X	X		X
Potliner Yard	X	X	X		

TABLE I-3

CONTAMINATED SOIL AND SEDIMENT VOLUME ESTIMATES (cubic yards)
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Area of Concern[C]	PCB Remedial Criteria				Non PCB Specific	Comment
	1 PPM	10 PM	25 PPM	50 PPM		
Black Mud Pond						
Black Mud	B	B	B	B	165,660	Assuming Black Mud averages 15 feet.
Soil	B	B	B	B	22,090	Assuming contamination to only 2 feet below waste.
Sediment	450	205	A	A	--	Assuming contamination to 1-foot deep and only in the drainage sampled.
Wetlands						
Sediment	7,520	1,185	A	A	--	Assuming contamination 1-foot deep and west west drainage only contaminated to the intersection of the west to east flow stream.
North Yard						
Soil	37,125	28,635	23, 185	14,570	--	Assuming contamination to 4 feet deep.
Landfill						
Waste	B	B	B	B	134,055	Averaging cross-sections through landfill.
Soil	B	B	B	B	20,740	Assuming area of landfill is 280,000 ft^2 and contamination to 2 feet below waste.
Former Potliner Storage Area						
Waste	B	B	B	B	23,685	Averaging cross-sections through the Former Potliner Storage Area.
Soil	B	B	B	B	68,150	Assuming area of Former Potliner Storage Area is 230,000 ft^2 and depth of contamination is 8 feet (to clay layer).
Potliner Pad						
Soil	ND	ND	ND	ND	ND	NO DATA AVAILABLE.
Sediment	295	A	A	A	--	Assuming contaminated area is 5 feet wide by 1-foot deep.

Notes:
ND = No Data
A = All analytical results below the specified PCB remedial criteria.
B = Volumes not dependent on PCB criteria.
C = Calculations limited to within each area of concern.

TABLE I-4

TABLE OF ARARs
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

CHEMICAL-SPECIFIC

- 6 NYCRR Part 701-702, Water Quality Criteria for the Protection of Human Health (Surface Water Quality Standards)
- 6 NYCRR Part 703, NYSDEC Groundwater Quality Regulations
- 6 NYCRR Part 257, Air Quality Standards
- New York State Air Guide 1, Guidelines for the Control of Toxic Ambient Air Contaminants

ACTION-SPECIFIC

- 6 NYCRR Part 360 - Solid Waste Management Facilities
  Part 361 - Siting of Industrial Hazardous Waste Facilities
- Article 27, Title 11 of the ECL - Industrial Siting Hazardous Waste Facilities
- 6 NYCRR Part 264 - Waste Transporter Permits
- Proposed Amendments to 6 NYCRR Part 370 and 373
- 6 NYCRR Part 370 - Hazardous Waste Management System: General
  Part 371 - Identification and Listing of Hazardous Wastes
  Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities
- 6 NYCRR Subpart 373-1 - Hazardous Waste Treatment, Storage and disposal Facility Permitting Requirements
  Subpart 373-2 - Final Status Standards for Owners and Operators of Hazardous Waste TSD Facilities

TABLE I-4
(continued)

ACTION-SPECIFIC (continued)

- 6 NYCRR Part 374 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
  Part 375 - Inactive Hazardous Waste Disposal Sites

- 6 NYCRR Part 750-757 - Implementation of NPDES Program in NYS

- 6 NYCRR Part 200 (2006) - General Provisions

- 6 NYCRR Part 211 (211.1) - General Prohibitions

- 6 NYCRR Part 212 - General Process Emission Sources

LOCATION-SPECIFIC

- 6 NYCRR Part 608 - Use and Protection of Waters

- 6 NYCRR Part 662 - Freshwater Wetlands - Interim Permits
  Part 663 - Freshwater Wetlands Permit Requirements
  Part 664 - Freshwater Wetlands Maps and Classifications
  Part 665 - Local Government Implementation of the Freshwater Wetlands Act and State Wide Minimum Land - Use Regulations for Freshwater Wetlands

- 6 NYCRR Part 182 - Endangered and Threatened Species of Fish and Wildlife

- ECL Article 24 and Article 71, Title 23 - Freshwater Wetlands Act

TABLE I-5

ARAR-BASED CHEMICAL-SPECIFIC REMEDIAL GOALS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Remediation Parameter	Surface Water: Intermittent Drainageways	Surface Water: Wetlands	Groundwater	Air
PCBs (Arochlor 1248)	(3)	0.001 ppb (2)	0.1 ppb (4)	0.5 mg/m^3 (7)
2,3,7,8-TCDD	(6)	0.000001 ppb (2)	0.000035 ppb (4)	(6)
PCDFs	(6)	(6)	(6)	(6)
PAHs/Benzo (a)Pyrene	0.002 ppb (10)	0.0012 ppb (10)	ND (4,5)	(6)
Total Non-chlorinated Phenols	5 ppb (1)	5 ppb (2,9)	1 ppb (4,9)	10 ppb (7)
Fluoride	1500 ppb (1)	2300 ppb (2)	1500 ppb (4)	40 mg/kg; 0.8 ug/m^3 (8)
Cyanide, Total	100 ppb (1)		200 ppb (4)	16.7 ug/m^3 (8)
Free		5.2 ppb (2)		

Footnotes:

(1) 6 NYCRR Part 701-702, Water Quality Criteria for the Protection of Human Health
(2) 6 NYCRR Part 701-702, Water Quality Criteria for the Protection of Aquatic Life
(3) Performance Level to be based on SPDES limits, currently in litigation
(4) 6 NYCRR Part 703, for Class GA groundwaters
(5) ND = Not-detect
(6) No value available
(7) New York State Air Guide-1, September 1989
(8) 6 NYCRR Part 257, Air Quality Standards
(9) Or background levels, whichever is higher
(10) NYSDEC Division of Water Technical and Operational Guidance Series, April 1, 1987

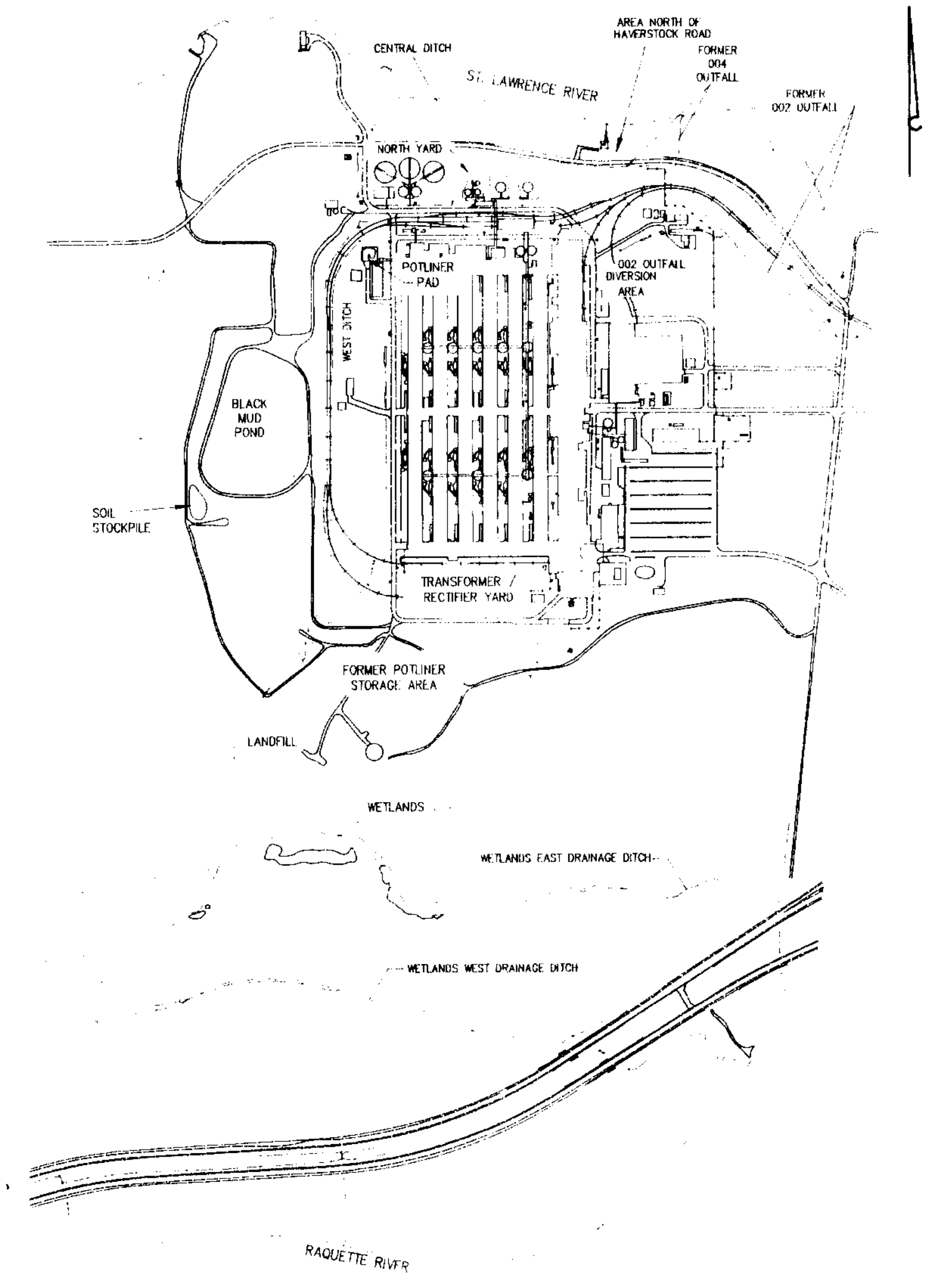
TABLE I-6

NYSDEC-PROPOSED SOIL CLEANUP GOALS[1]
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Parameter	Proposed Goal	Units
Cyanide (total)	site background	--
PCBs (total)		
susceptible[2]	1	ppm
not-susceptible[2]	10	ppm
Benzo(b)fluoranthene	0.33	ppm
Benzo(a)fluoranthene	0.33	ppm
Chrysene	0.33	ppm
Fluoranthene	19	ppm
Pyrene	6.5	ppm
2,3,7,8-TCDD	.0005	ppm

(1) Cleanup goals listed are proposed by the NYSDEC for use as a baseline for comparison and evaluation of remedial alternatives in this FS. As such, the alternatives were designed with the intent of meeting the PCB goals listed above; however, in practice, these goals may not be achievable in all areas.

(2) Susceptibility refers to the potential for PCBs to be transported in surface run-off.



REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

AREAS OF CONCERN
ST. LAWRENCE REDUCTION PLANT

Job No.: 88C2515A-6	Drawing No. 89180373	Date: 05/23/89
Checked by: PRJ	Rev. No.:	
Scale: 0 200 400 FEET		FIGURE I-1

PART II: TECHNOLOGY REVIEW

6.0
REVIEW OF REMEDIAL TECHNOLOGIES

The Revised Preliminary Feasibility Study (July 2, 1990) identified technologies that would be applicable for remediation of the five on-site areas of concern. General categories of remedial technologies and remedial actions identified by the Revised Preliminary FS included:

- Institutional Controls
- Containment
- Removal
- Disposal
- Treatment

This part of the Final FS presents a general discussion of remedial technologies within each of the above categories. These descriptions refer to technologies that may be applied to one or more of the areas of concern. Additional detailed discussions of the applicability of each technology to a given area is included where appropriate.

6.1 INSTITUTIONAL CONTROLS

Institutional controls retained by the screening process in the Revised Preliminary Feasibility Study are described in the following sections.

6.1.1 Access/Deed Restrictions

The majority of the Reynolds site is presently surrounded by a fence to restrict access to the site. Only Reynolds employees and escorted visitors are allowed on the site. The site fencing provides access restrictions between the Reynolds site and the surrounding environment.

Additional fencing within the site boundaries could be installed to further limit access to specific areas of concern. This would limit access by Reynolds employees as well as the general public. Areas such as the Wetlands which are outside the existing fence could be included within the fence to restrict access.

Land use restrictions such as deed restrictions could be instituted to limit the future use of land or water at areas of concern such as the Black Mud Pond and the Landfill. Deed restrictions would be required for some remedial technologies, such as capping, to prevent excavation and subsequent damage to the cap.

Although access and deed restrictions would not reduce contaminant levels, they would limit human access and contact with areas of concern at the site. Thus some level of restriction (isolation) between these areas and the surrounding environment would be provided.

6.1.2 Surface Water and Groundwater Monitoring

Groundwater and surface water in all areas of the plant are presently sampled on a routine basis.

The routine sampling program for groundwater and surface water may be revised somewhat based on the selected remedial alternative for each area of concern. Routine monitoring of surface water and groundwater will continue to some extent after implementation of remedial alternatives to evaluate the progress of the cleanup.

In most cases, existing sampling points would be used for monitoring purposes. Additional sampling points may be required early in the remedial effort for each area of concern to better delineate soil and groundwater contamination. As remediation of each area proceeds, the number of sampling points may be reduced as contaminant levels decrease in the surface water and groundwater.

6.2 CONTAINMENT TECHNOLOGIES

Containment technologies may be instituted to limit the migration of contaminants from specific areas of concern at the site.

6.2.1 Capping and Cover Systems

Capping technologies are designed to minimize percolation of precipitation through waste materials and therefore reduce leachate generation. Capping also prevents direct contact with waste materials and controls migration of contaminants via the air and surface water/sediment pathways.

NYSDEC regulations for caps require that they satisfy the following criteria. They should:

- Provide long-term minimization of the migration of liquids through the capped materials
- Function with minimum maintenance
- Promote drainage and minimize erosion or abrasion of the final cover
- Accommodate settling and subsidence so that the cover integrity is maintained
- Have a permeability less than or equal to the permeability of any bottom liner system or the natural subsoils present

A wide variety of capping materials are available and may include synthetic membranes, low permeability soils, soil admixtures, and asphalt or concrete composites, and multi-layer cover systems. Under the RCRA program, the USEPA requires a multi-layer final cap design (Figure II-1) that includes:

- A top layer consisting of a vegetated component to minimize erosion and a soil layer to act as a subbase for the vegetated layer.

- A soil drainage layer to minimize water infiltration into the underlying low-permeability layer.

- A two-component low-permeability layer that limits water infiltration into the underlying (waste) materials.

- Filter fabric employed between the soil layer and the drainage layer and between the low permeability layer and the waste (see Table II-1 for typical specifications).

For the purposes of this Feasibility Study, the EPA-recommended cap design ("RCRA cap") would be applicable to the capping alternatives described for the Black Mud Pond, Landfill, and Wetlands Areas.

In other areas, such as in the Potliner Pad Area, the North Yard, and selected drainage ditches, capping would consist of either an asphalt-composite cap (Figure II-2), a uniform grouted net for steeply sloped areas, or combination of interlocking blocks and geomembranes for drainageways, to isolate residual contaminants from surface water and direct contact. Use of these caps would include the grading of surface soils and installation of a subbase of granular materials to provide for long-term stability of the cap. The use of the asphalt-composite cap in selected areas would allow continued use of the area by vehicular and other traffic.

The advantages of the asphalt-composite cap design, with regard to its effectiveness and permanence, are discussed below. The design proposed, using a geotextile such as the Petromat fabric (minimum weight 3.6 ounce/square yard), and impregnated with asphalt cement at a rate of 0.25 gallons/square yard, is "basically impervious" when tested in the laboratory according to ASTM test method D-4491, Standard Test Method for Water Permeability of Geotextiles (Guram, 1991). The composite section in combination with the use of a geotextile beneath the base materials can act as a "capillary break" to reduce frost heave. With regard to permanence of the design, use of a composite-asphalt cap would minimize reflective cracking, and will therefore significantly increase the life of the cap over that of asphalt pavement alone (Koerner, 1986).

6.2.2 Groundwater Recovery

Groundwater recovery systems may be used to create hydraulic barriers that would prevent further migration of contaminants and, in some cases, recapture the existing plume(s) of contaminated groundwater.

Because of the relatively low permeability soils at the Reynolds site, groundwater control would be best accomplished by interceptor trenches (Figure II-3) at the Black Mud Pond and Landfill Area. Recovery well(s) would be appropriate at the Potliner Pad Area because most of the contaminated groundwater is restricted to a fairly narrow zone where an old drainage swale has been filled, and therefore has a higher permeability than the adjacent till soils.

Installation of an interceptor trench that fully circumscribes the Black Mud Pond (perimeter drain) would be installed with the bottom of the drain below the water table and below the bottom of the Pond. The trench would be graded toward several collection sumps along its length, which would act as pump stations. A similar trench system, although shallower, would be installed near the Landfill outside of the existing berm. In the Wetlands Area, lateral drains could be used to collected groundwater if the area were capped. The existing North Yard groundwater recovery system is described in Section 5.7.

6.2.3 Surface Water Controls and/or Collection

Surface water controls may be instituted in areas of concern to isolate uncontaminated surface water from contaminated materials. Results of remedial investigations at the site have indicated surface water contamination at various locations. The contamination is perceived to be the result of either surface water run-off or shallow groundwater discharge. Installation of caps over areas of concern would prevent contact of surface water with contaminants and would thereby prevent contamination of surface water run-off. The use of berms or swales, and the construction of new drainageways could also be used to redirect flow away from contaminated areas.

Shallow groundwater discharge from the Black Mud Pond and Landfill may impact surface waters near these areas. Capping and groundwater controls instituted in these areas would reduce or eliminate discharge of shallow groundwater to adjacent surface water drainage ditch. For any of the Black Mud Pond alternatives, a surface water impoundment could be used downgradient to collect surface water for subsequent treatment at the North Yard GAC system, if necessary.

6.3 REMOVAL TECHNOLOGIES

6.3.1 Excavation and Materials Handling

Excavation and handling of contaminated soil, sediment, fill, and/or waste materials may be required as part of the selected remedial measures. Excavation and removal of contaminated materials would typically be performed using standard earthwork equipment and techniques. Non-standard earthwork equipment may be required when implementing specialized tasks. For example, the excavation of perimeter drains near the Black Mud Pond may require specialized equipment to achieve the required depths, or to minimize worker entry into deep excavations; earthworks in the Wetlands, which are underlain by soft sediments, would also require special precautions, such as low-contact pressure equipment, to perform the required tasks, and to avoid cross-contamination of the adjacent and underlying soils.

Selected remedial alternatives may require material segregation and classification. Large boulders and other debris (e.g., construction debris from the Landfill) may need to be removed from the excavated material and staged separately. Large vibratory screens could be used for this purpose. Material screening would also be required for alternatives such as incineration and resource recovery, for which size limitations may be imposed on material to be treated.

6.3.2 Dewatering and Water Control

Excavation of saturated soil and waste materials in contaminated areas would typically require dewatering, and water collection and treatment. During excavation, temporary localized sumps could be used with construction pumps to remove water from the excavations. Alternatively, dewatering systems may necessitate the installation of wellpoints to effectively draw down the water table prior to excavation (Figure II-4). Upon excavation of the soil or waste materials, additional water may be removed by gravity drainage of the materials in a staging area. Filter presses could be used if necessary to further dewater if gravity drainage proved insufficient. Adsorbents and other additives would only be used to adsorb additional free water not removed by gravity drainage, for example if it were necessary for transport and/or placement of the materials in a secure landfill cell.

In some areas, surface water conditions would preclude the dewatering methods described above during excavation. Such areas include the Wetlands, and drainageways for which wet excavation of contaminated sediments may be required. For these areas, water and sediment control during excavation would involve using berms and sumps to collect surface water and sediment. Implementation of the remedial measures in drainageways would proceed in stages, working from upgradient to downgradient sections to ensure adequate collection and control of potentially contaminated water and sediment. Pumps would be used to direct the water collected to temporary storage tanks, or directly to the North Yard GAC system for treatment.

6.3.3 Minimization of Short-Term Impacts

The provisions described in Section 6.3.2 above for water control are required in order to minimize the potential for cross-contamination of clean areas during remediation of the areas of concern. In addition, the water control systems should be designed to minimize spillage. Other precautions should also be taken during the implementation of remedial measures, both for health and safety reasons, as well as to minimize the potential for short-term adverse impacts to the local environment.

Typical practices which could be implemented include the following:

- Demarcation of exclusion zones with temporary fences and posted signs

- Preparation of a health and safety plan with required decontamination procedures and determination of dust-related action levels for upgrading/downgrading levels of personal protection

- Decontamination of trucks and personnel prior to leaving the exclusion area; a decontamination pad or area constructed from which the water used can be collected and treated, as necessary

Silt fences should be used to prevent soils/sediments from leaving the area to be remediated. Temporary staging pads may be constructed for excavated materials such that water which contacts the contaminated materials can be collected and treated if necessary. These staging areas should be covered prior to demobilization daily if the weather conditions demand, i.e., to protect against heavy rainfall, or airborne transport of contaminated material.

Measures should be taken to ensure that the trucks used for transport do not spread contaminants. There are a number of precautionary actions which can be taken in this regard, including the use of trucks with lined beds and sealed tailgates, and the use of decontamination areas.

6.4 DISPOSAL TECHNOLOGIES

Results of the Revised Preliminary Feasibility Study indicated the following disposal options for contaminated material removed during remedial activities:

- On-site disposal in the existing Landfill Area
- On-site disposal in a secure landfill cell
- Off-site disposal in a secure landfill

6.4.1 On-Site Disposal in the Existing Landfill Area

The on-site landfill has historically been used for disposal of various waste materials generated on the Reynolds site. Waste disposal in the on-site landfill was discontinued in 1990. Because use of the Landfill has terminated in accordance with the 1987 Consent Order, the present on-site Landfill would not represent a viable alternative for disposal of contaminated material generated during the plant site remediations.

However, the closure applies to the Landfill proper, and not the adjacent Former Potliner Storage Area. This area requires remediation. (The remedial alternatives described in Section IV encompass both the Landfill and Former Potliner Storage Area.) The controls required for the in-place containment alternative entail the type of long-term management that would be appropriate for soils and sediments with low levels of contamination (e.g., less than 50 ppm of PCBs). These controls include the following:

- Control of rainwater infiltration by means of a RCRA-type cap
- Control of run-on and run-off to and from the capped area by the use of berms and/or swales, and the cap grading
- Well-defined low permeability bottom of the containment unit, i.e., the Former Potliner Storage Area is underlain by about 20 feet of lacustrine deposits which is then underlain by dense glacial till (both of which have permeability values lower than 10^{-6} cm/sec)
- Groundwater/leachate collection and treatment
- Groundwater and surface water monitoring

These measures would be very effective in isolating the contaminated materials. Other low-level contaminated wastes which could be consolidated into the Former Potliner Storage Area for long-term management would be from on-site areas where the contaminants were compatible with those already present in the area. Any materials with PCB concentrations greater than 50 ppm would not be recommended for containment in this area. In addition, the maintenance and monitoring requirements for the area would be designed to give early warning of any problems associated with the containment unit. Therefore, the Former Potliner Storage

Area would be considered a viable disposal site for low-level contaminated materials from various parts of the Reynolds Plant. Given the hydrogeologic setting of this site, and the technologies to be employed in its closing, the environmental effectiveness of isolating low-level PCBs in the Former Potliner Storage Area would be equivalent to disposal in a new secure landfill cell (e.g., as described in Appendix E).

6.4.2 On-Site Disposal in a Secure Landfill Cell

A secure landfill could be constructed on the Reynolds property to serve as a permanent storage area for contaminated material generated as part of remedial activities at the site. The Landfill would need to be constructed in accordance with RCRA standards, which would include installation of a double liner system composed of layers of natural clay and synthetic materials. Separate leachate collection and leak detection systems would be included to drain and subsequently treat accumulated leachate and to monitor the integrity of the liner system. A multi-layer RCRA-style cap (Section 6.2.1) would be installed over the landfill cell upon placement of all wastes. Appendix E presents the on-site landfill design proposed as part of the remedial alternatives for this FS.

According to current NYSDEC policy, it would not be necessary to obtain a RCRA Part B permit prior to construction and filling of the on-site Landfill. However, a TSCA approval from the USEPA would be needed if the wastes contain greater than 50 ppm of PCBs. Waste types that could be placed in the Landfill cell would be controlled by the most recent USEPA land-ban restrictions for land disposal of contaminated materials, but this is not currently thought to be significant with regard to the known waste types. Restrictions on land disposal of materials with free liquids would apply, further necessitating the dewatering described earlier, and possibly requiring solidification/stabilization.

6.4.3 Off-Site Disposal at Secure Landfill

Contaminated soil and fill materials excavated during remedial activities could be disposed of off-site at a commercial landfill, assuming the material is not a land-ban waste at the time of disposal. Off-site disposal would also be contingent on acceptance of the waste materials at the disposal facility, based on data supplied on waste characterization applications. Off-site transport would be performed by licensed hazardous waste haulers, with all shipments tracked and documented with manifests. The procedures outlined by NYSDEC TAGM 3018 would be followed for all off-site disposal remedial actions.

The use of an off-site commercial facility would allow immediate disposal and would avoid some permit-related activities. On-site landfilling of soil and fill materials would necessitate construction of the cell prior to the commencement of remedial activities. Neither the permitting nor the construction constraints would apply to on-site disposal of low-level contaminated materials in the Former Potliner Storage Area. Both on-site and off-site disposal entail some long-term liabilities on Reynolds' behalf for any further problems associated with the waste; however, on-site disposal would give Reynolds greater control over those liabilities.

6.5 TREATMENT TECHNOLOGIES

Treatment technologies would be applicable for remediation of contaminated soil, sediment, surface water, and groundwater. Treatment technologies would destroy organic contaminants or otherwise detoxify contaminated materials.

6.5.1 Groundwater and Surface Water Treatment

The Revised Preliminary Feasibility Study identified technologies which would be applicable for treatment of surface water and groundwater. The following treatment technologies were retained:

- Chemical Precipitation
- Alkaline Chlorination
- Flocculation
- Sedimentation
- Filtration
- Granular Activated Carbon

These treatment technologies are described in more detail in the following sections.

Chemical Precipitation: Chemical precipitation is a process whereby dissolved constituents in the wastewater are transformed into a solid phase. Chemical precipitation is based on alteration of chemical equilibria that affect the solubility of inorganic species. Precipitation would be used for removal of metals by transforming them from a soluble species to insoluble hydroxides and sulfides.

Precipitation may be combined with flocculation and sedimentation to enhance removal efficiency. Chemical precipitation generates sludges which may require further treatment or disposal.

Alkaline Chlorination: Alkaline chlorination is an oxidation method to be used primarily for the detoxification of cyanide. Alkaline chlorination promotes a strong oxidation potential within the waste stream. This in turn, promotes destruction of chemical bonds and results in the reduction of chemical species into their elemental forms.

Alkaline chlorination is a relatively non-selective oxidation method. As a result, some species that are more resistant to oxidation than others may undergo incomplete oxidation and may form more toxic oxidation products.

Flocculation: Flocculation is normally used in conjunction with precipitation to induce settling of insoluble hydroxides and sulfides. Flocculation encourages colloidal particles in a liquid medium to combine (flocculate) into larger particles that settle more readily. Flocculation involves three primary steps:

- Addition of a flocculating agent to the waste stream
- Rapid mixing to ensure complete dispersion of the flocculating agent
- Slow, gentle mixing to allow for contact between small particles

Flocculation is a proven technology in the water treatment industry. As indicated previously, it is often used to enhance the performance of chemical precipitation.

Sedimentation: Sedimentation is a process that relies on the force of gravity to remove suspended solids from an aqueous waste stream. Sedimentation is normally used in conjunction with precipitation and/or flocculation to remove insoluble constituents.

Sedimentation is normally carried out in settling basins, clarifiers, or high rate gravity settlers that are normally designed as continuous processes. Sedimentation usually results in the generation of sludge which must be disposed of separately.

Filtration: Filtration is a physical process whereby suspended solids are removed from solution by forcing fluid through a porus medium (filter bed). Normally, a filter bed consisting of granular media (sand or anthracite coal) is used. As water containing suspended particulates passes through the bed of filter medium, the particles become trapped in the bed. The filter bed is periodically backwashed to remove these particles.

Filters can be used as a polishing step to remove particles not readily removed by sedimentation. Filtration is normally used after sedimentation to reduce the particulate load on the filter.

Granular Activated Carbon: Activated carbon adsorption is a well developed technology that is widely used for removal of mixed organics from aqueous waste streams. For wastewaters generated at the Reynolds site, carbon adsorption would be most applicable for PCB removal. Granular activated carbon (GAC) adsorbs organics and other contaminants by a surface attraction phenomenon-contaminants are attracted to the internal pores of the carbon granules. Upon saturation of the carbon granules, the carbon is either disposed of or is regenerated.

Available On-Site Treatment: Reynolds has implemented several IRMs as a means of mitigating discharge of untreated surface water run-off and partially treated process flow. A granular activated carbon (GAC) treatment system has been installed as part of remedial efforts associated with Outfall 003 (see Section 5.3). A separate water treatment system has also been installed in the North Yard Area (North Yard GAC system) to treat surface water and shallow groundwater discharges from this area (see Section 5.7) and also to treat former Outfall 004 discharges.

The North Yard GAC system was designed and constructed with additional capacity available for future treatment requirements. The treatment system includes:

- Phase separation to remove free oil
- Coagulation, flocculation, sedimentation, and filtration to remove colloidal and suspended solids
- Activated carbon adsorption to remove organic contaminants such as PCBs

The North Yard GAC system was installed with the primary purpose of PCB removal from surface water and shallow groundwater discharges from the North Yard Area. The phase separation step and the coagulation, flocculation, sedimentation, and filtration steps essentially act as pretreatment steps for removal of colloidal and suspended solids as well as free oil, with carbon adsorption acting as the "polishing" step for removal of PCBs and other organics. Therefore, although this system is referred to as the "North Yard GAC system," it includes activated carbon filtration as well as other unit processes applicable for removal of free oil, colloidal solids and suspended solids.

Since the primary contaminants of concern at the Reynolds site are PCBs, the North Yard GAC system would, in general, be applicable for treatment of surface water and groundwater from other areas of the site. The pretreatment steps described above would also be applicable from removal of cyanide, fluoride, and aluminum which are present in suspended or complexed form.

Treatability tests would need to be performed to verify the applicability of the North Yard GAC system to treat contaminated water from other areas of the site. For the purposes of this FS, it was assumed that the North Yard GAC system would be applicable for treatment of contaminated water from other areas of the Reynolds site.

With regard to hydraulic capacity, it was assumed for the purposes of this FS that the North Yard GAC system has sufficient capacity to treat both surface water and shallow groundwater from the North Yard as well as additional contaminated water from other areas of the Reynolds site. Upon selection of the proposed remedial alternatives for all areas of concern on-site, design calculations would be done to assess the adequacy of the North Yard GAC system capacity for the design storm. If necessary, a temporary holding tank or lined pond could be constructed to increase the surge capacity of the system. Such a lined pond is discussed in Appendix E for the proposed on-site landfill.

6.5.2 Soil and Sediments Treatment

The following treatment technologies for soil and sediment were retained in the Revised Preliminary Feasibility Study:

- Bioremediation
- Solvent Extraction
- Alkaline Polyethylene Glycolate (APEG)
- Incineration
- Resource Recovery

Further research and discussion with technology vendors has led to a refined list that eliminates bioremediation and solvent extraction. Those eliminations are primarily due to these technologies' lack of proven track record on the contaminants present at Reynolds.

Alkaline Polyethylene Glycolate (APEG): The APEG-plus process developed by Galson Remediation Corporation is a variation of the traditional soil washing technique which uses a combination of potassium polyethylene glycolate (KPEG) and dimethyl sulfoxide (DMSO) to dechlorinate certain classes of chlorinated organics. The APEG process was considered for treatment of PCB, PCDF, and PCDD contaminated soils from the North Yard. The results of the treatability study done on the North Yard soils for this process are discussed in Section 19.1.

The process, shown schematically in Figure II-5 involves treatment of contaminated soils after preliminary screening of material to remove rocks and debris. The soil is then transferred into a heated reactor where KPEG and DMSO are mixed with the soil to form a slurry. After sufficient reaction time, the excess reagent is decanted and the soil is washed several times with water to remove excess reagent and the products of the reaction. The treated soil is then removed from the reactor, dewatered, and considered suitable for use as clean backfill (assuming regulatory acceptance). The decanted reagent and wash is recycled during the process to treat additional soil and is disposed of as a TSCA waste upon completion of the remediation.

Incineration: Thermal destruction of organic contaminants is a proven technology for treatment of both liquids and solids. Various methods of incineration have been developed, and including:

- Fluidized bed incineration
- Rotary kiln incineration
- Infrared thermal treatment
- Wet air oxidation
- Pyrolytic incineration

Advantages of thermal treatment include volume reduction, detoxification, energy recovery, and in some cases, materials recovery. Thermal treatment methods are generally expensive compared to other alternatives mainly because of the fuel costs, and the long-term management of the treated residuals, which is often required. Incineration can be performed on-site using either a transportable unit or by a dedicated system constructed locally. On-site incineration requires permitting; and typically encounters public resistance. Commercial facilities are available (off-site) but most facilities generally require the material to be shipped in containers (i.e., drums), as they are generally not equipped to handle bulk materials. In addition, for large volumes of contaminated materials, special scheduling provisions would likely be difficult at a commercial facility, and off-site incineration is not likely to be cost-effective.

One primary incineration type (infrared) was considered for the purposes of this FS. Infrared incineration, shown schematically in Figure II-6, is discussed in more detail in Appendix C, along with the results of a site-specific treatability study test performed. Rotary kiln incineration may also be considered. The two primary advantages of the infrared mobile unit over a comparable sized rotary kiln unit are its 1) shorter mobilization and set-up time, and 2) precise waste retention time. In addition, for treatment of materials up to about 30,000 tons, it is competitively priced. The use of a larger rotary kiln mobile unit may be preferable to treat larger quantities of material.

Resource Recovery: Various contaminated materials viewed as waste by one company may be useful as raw or recyclable material to another company. Traditionally, waste exchanges have been formed to provide a market for potentially useable waste materials.

Reynolds has previously been able to ship limited quantities of black mud as a raw material to a cement producer located near Albany, New York. The black mud is high in alumina, which is useful in the production of cement. Reynolds presently gravity drains the black mud and combines it with excess "roaster ore" to improve the characteristics of the black mud for use by the cement producer. Reynolds is responsible for preparation and transport of the black mud to the cement producer. The cement producer in turn reimburses Reynolds a nominal cost for the material.

It is currently unlikely that this program could be expanded to handle larger volumes of black mud. An impediment to continuation of resource recovery of the black mud is that it may be classified as a hazardous waste according to NYSDEC regulations (based on the derivation of black mud from potliner, which may soon be a listed waste). If so, the waste would have to be delisted or exempted from the regulations in order to continue with the resource recovery option. As of December 31, 1990, Reynolds has discontinued off-site shipments of black mud due to regulatory uncertainties.

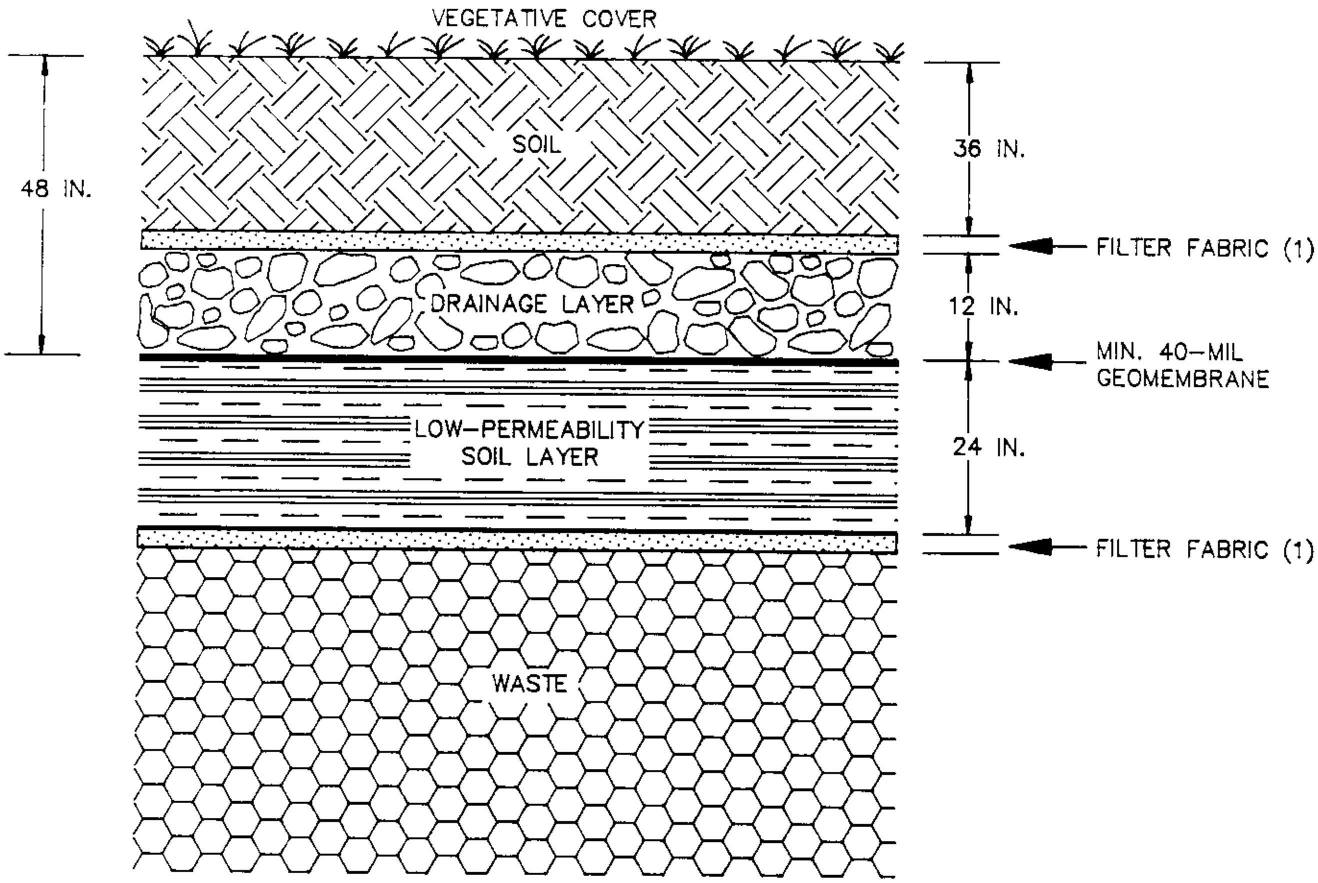
TABLE II-1

TYPICAL SPECIFICATIONS
SOIL STABILIZATION FILTER FABRIC
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Weight	4.0 oz./yd.^{2}	ASTM D1910
Thickness	15 mils	ASTM D1777
Grab Tensile	130 lbs.	ASTM D1682
Elongation to Break	62%	ASTM D1682
Trapezoidal Tear	70 lbs.	ASTM D2263
Mullen Burst	170 psi	ASTM D774-46
Specific Gravity	0.95	--
Equivalent Opening Size (EOS)	70 to 100 U.S. Std. Sieve	Corps of Engineers/ ASTM D422
Modulus	1200 lbs.	ASTM D1682

NON-PROPRIETARY DESCRIPTION:

A sheet structure composed entirely of preferentially oriented isotactic polypropylene continuous filaments thermally bonded mostly at the crossover points and weighting 4.0 + 0.5 oz./yd.^{2}.



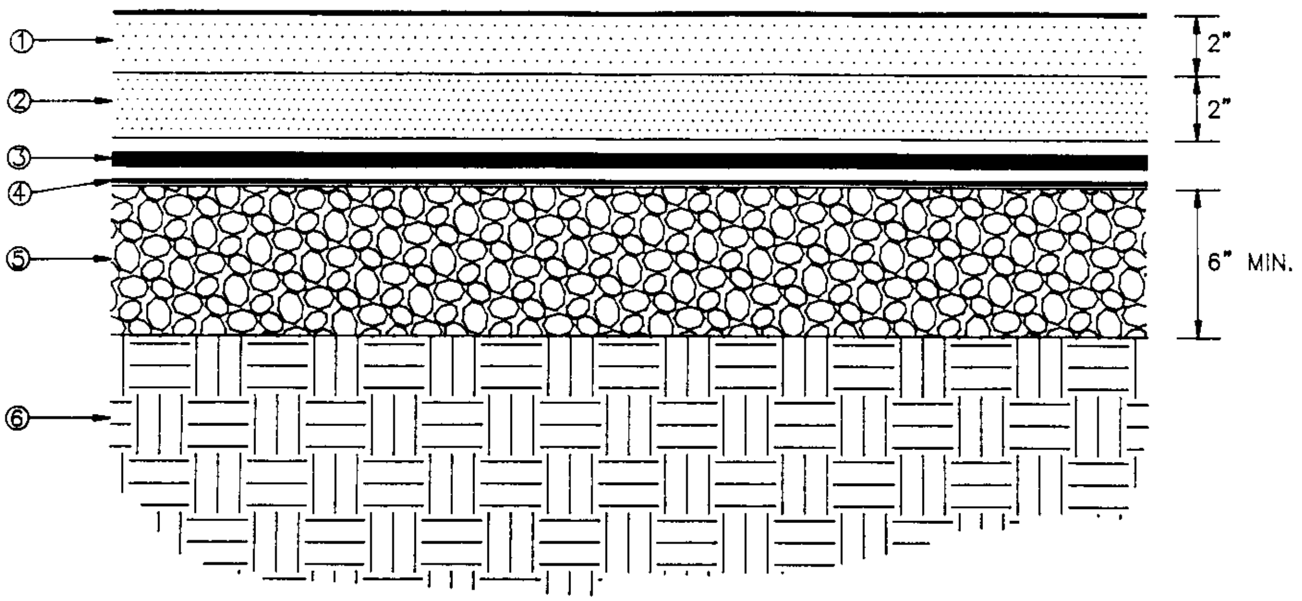
NOTE: (1) SEE TABLE II-1 FOR TYPICAL FILTER FABRIC SPECIFICATIONS

Rev. No.	Date	Type of Revision	Checked by:

TYPICAL RCRA CAP CROSS-SECTION
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-4	Drawing No. 95152102	Date: 4/22/91
Drawn by: D.E.G.	Checked by: D.M.H.	FIGURE II-1
Scale: AS NOTED		



LEGEND:

① ASPHALT TOP COAT

② ASPHALT BASE COAT

③ ASPHALT-IMPREGNATED NON WOVEN POLYPROPYLENE GEOTEXTILE

④ SPRAY SEALANT APPLICATION

⑤ COARSE STONE SUBBASE

⑥ GRADED, COMPACTED, CONTAMINATED SUBSOIL

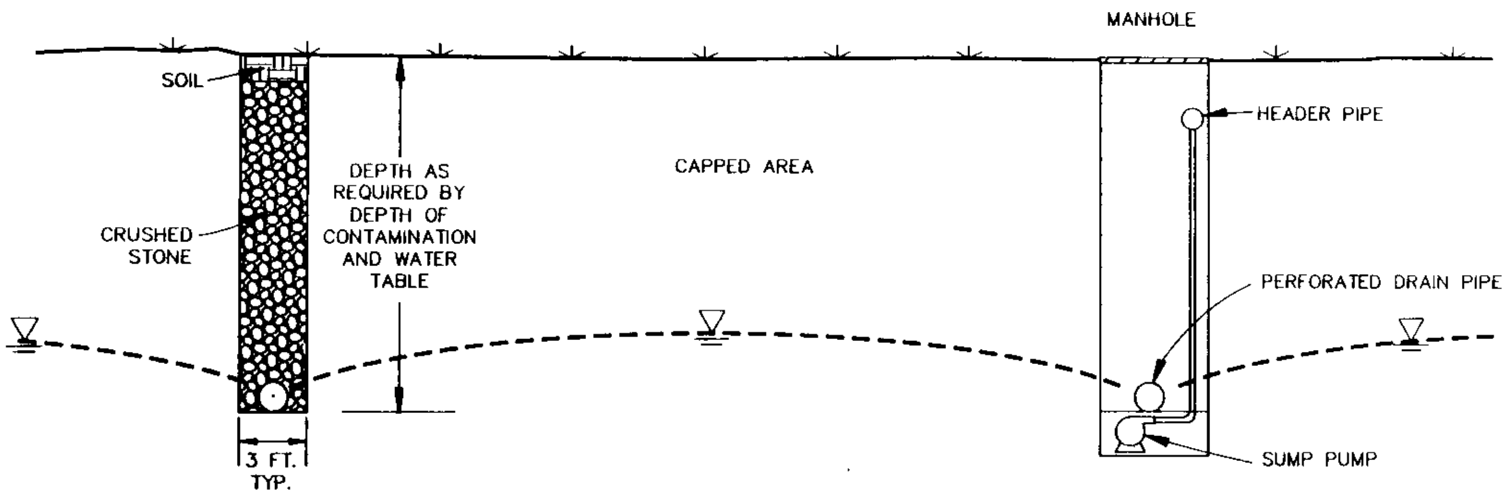
11:42

Rev. No.	Date	Type of Revision	Checked by:

TYPICAL ASPHALT-COMPOSITE CAP
CROSS-SECTION
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-4	Drawing No. 95154040	Date: 05/23/91
Drawn by: D.E.G.	Checked by: D.M.H.	FIGURE II-2
Scale: NOT TO SCALE		



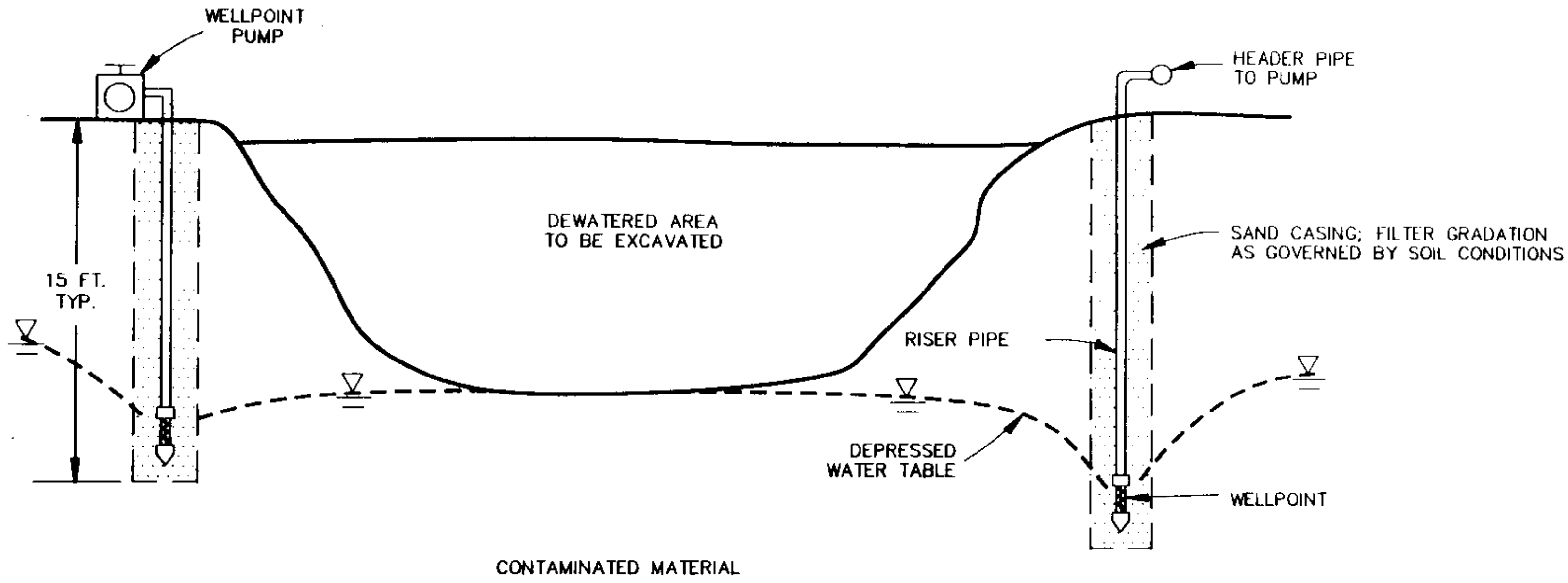
10:42

Rev. No.	Date	Type of Revision	Checked by:

PERIMETER DRAIN CONCEPTUAL DESIGN
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-4	Drawing No. 95152120	Date: 05/07/91
Drawn by: T.P.	Checked by: D.M.H.	FIGURE II-3
Scale:	NTS	



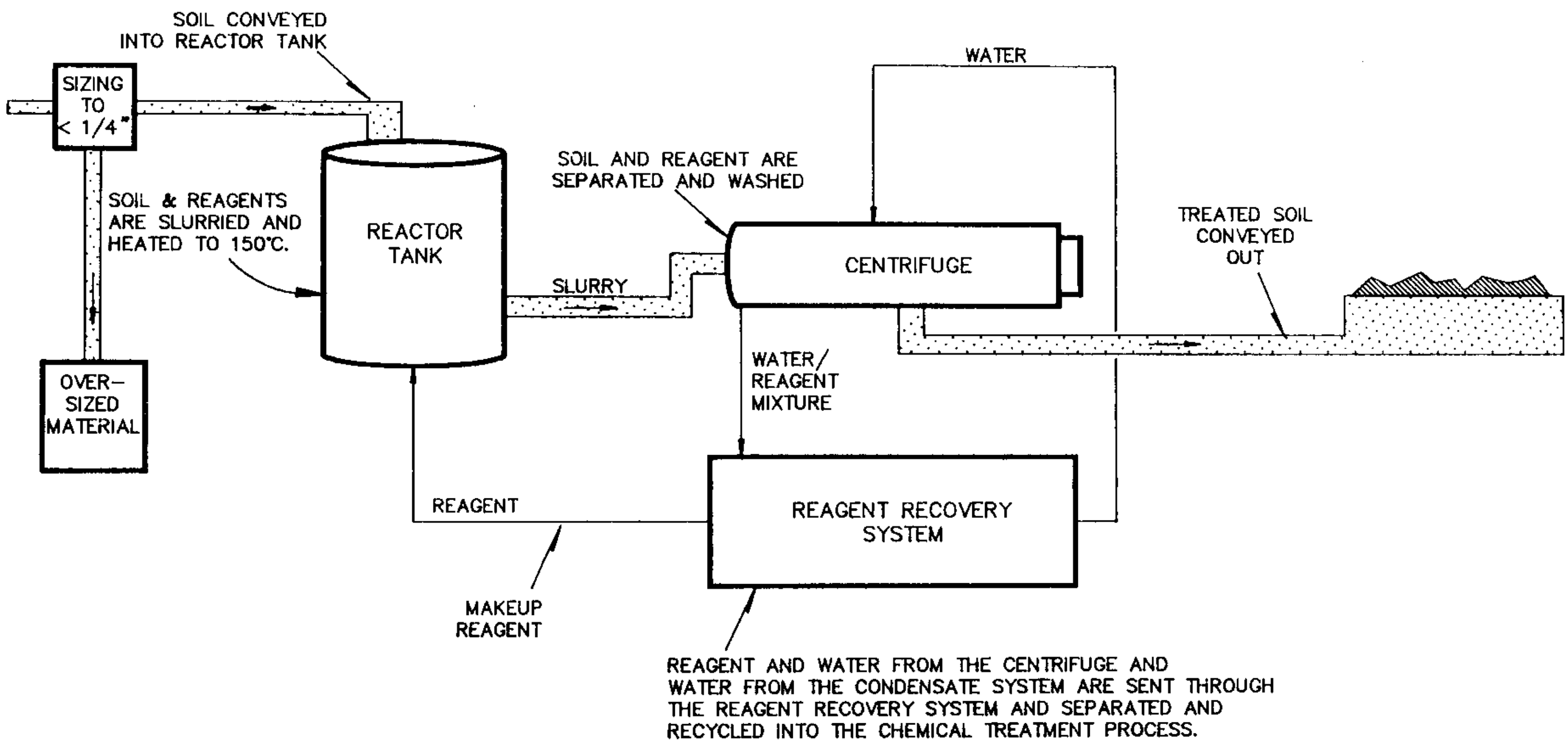
11:34

Rev. No.	Date	Type of Revision	Checked by:

TYPICAL WELLPOINT INSTALLATION
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2514A-4	Drawing No. 95152130	Date: 11/23/90
Drawn by: T.P.	Checked by: D.M.H.	FIGURE II-4
Scale: N.T.S.		



SOURCE: ADAPTED FROM GALSON REMEDIATION CORPORATION.

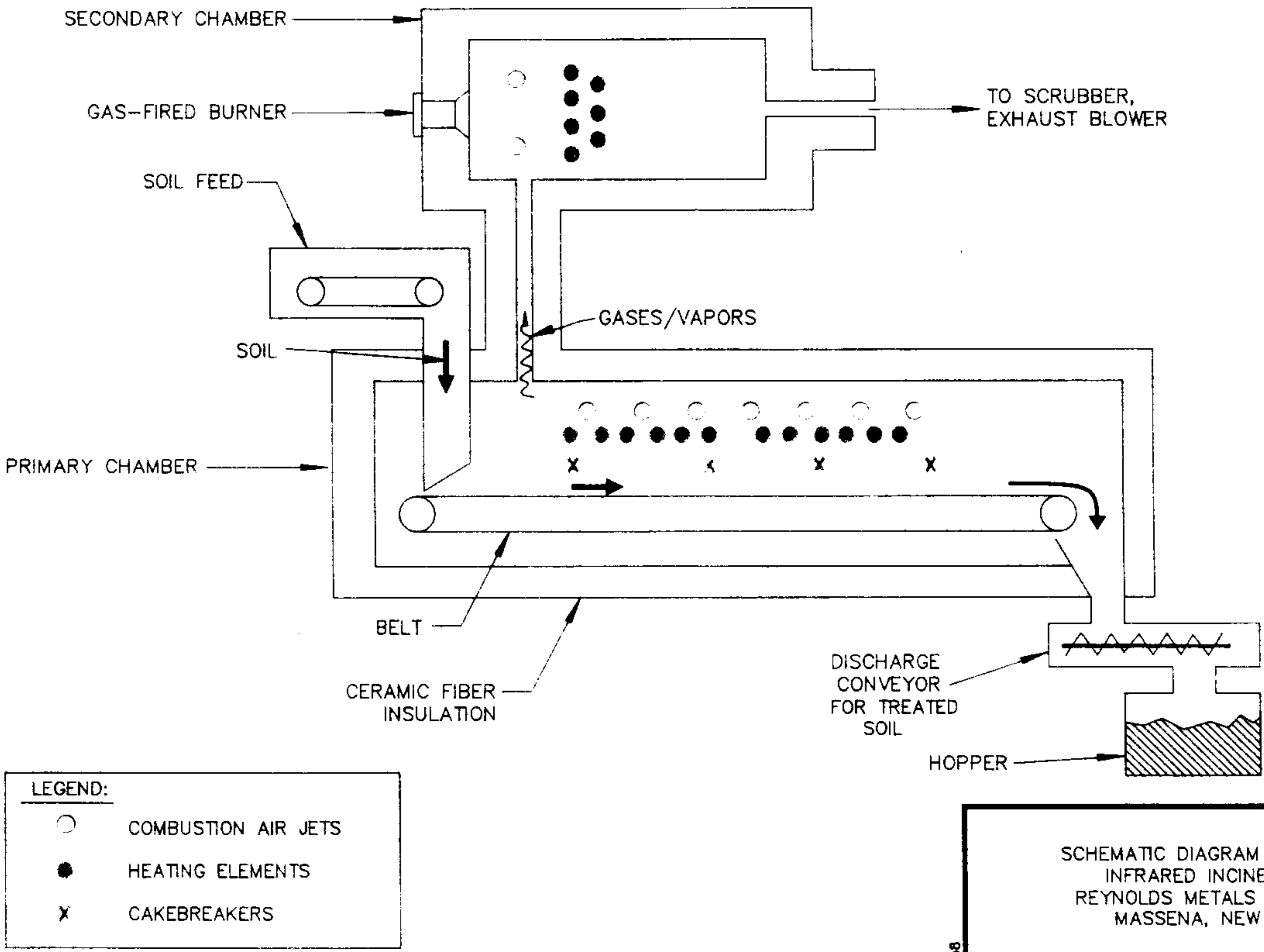
11:25

Rev. No.	Date	Type of Revision	Checked by:

SCHEMATIC DIAGRAM OF THE APEG–PLUS DECHLORINATION PROCESS
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-4	Drawing No. 95152110	Date: 11/20/90
Drawn by: D.E.Q.	Checked by: D.M.H.	FIGURE II-5
Scale:		



SOURCE: ADAPTED FROM THE HAZARDOUS WASTE CONSULTANT, 1988.

Rev. No.	Date	Type of Revision	Checked by:

10:58

SCHEMATIC DIAGRAM OF MOBILE INFRARED INCINERATOR
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2151A-4	Drawing No. 95152000	Date: 11/20/90
Drawn by: D.E.G.	Checked by: D.M.H.	FIGURE II-6
Scale:		

PART III: BLACK MUD POND

7.0
ANALYSIS OF ALTERNATIVES

The Preliminary Feasibility Study developed a total of ten remedial alternatives for the Black Mud Pond. This section provides a description of key components for each remedial alternative. Each alternative is also assessed with regard to the following seven evaluation criteria:

- Short-term impacts and effectiveness
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Implementability
- Compliance with ARARs
- Overall protection of human health and the environment
- Cost

The materials of concern in the Black Mud Pond Area are 1) the black mud, and 2) the adjacent and underlying soils which may be contaminated, termed "residual soils." The black mud is a treatment residual from potliner, which was listed by the USEPA as a hazardous waste (K088). The residual soils include buried contaminated soils to the southwest of the Pond which were identified in the Final RI (Section 4.2.4). The soil stockpile to the southwest of the Pond is addressed in Part VIII. Contaminants of concern in the Black Mud Pond Area include most of the site indicator parameters.

Eight of the ten alternatives for the Black Mud Pond are (e.g., pairs, with and without groundwater collection). The paired alternatives are grouped together and presented with the other alternatives in the subsections that follow.

7.1 ALTERNATIVES 1A AND 1B

7.1.1 Alternative Definitions

Remedial alternative 1A consists of the following key components:

- Monitor groundwater and surface water
- Dewater and excavate black mud and residual contaminated soils
- Recycle black mud at resource recovery facility
- Dispose of residual soils in on-site RCRA-type landfill
- Backfill grade, and seed excavated area

Alternative 1B provides all of the remedial measures described above and, in addition, requires the collection and treatment of contaminated groundwater and surface water.

A process flow diagram for components of these alternatives is presented in Figure III-1. This diagram serves to illustrate some aspects of the remedial measures that may affect selection of the appropriate alternative. Activities shown by dashed lines indicate those which will occur off-site. For alternatives 1A and 1B, black mud and residual soils within the pond (approximately 200,000 tons) would be excavated, staged, and dewatered. The black mud would be transported and used at a facility which could use it as a raw material in its process (i.e., resource recovery). These operations would be performed in a manner similar to the method currently used at the site, but on an expanded program. The residual soils would be disposed of in an on-site RCRA landfill cell.

The present method of dewatering the black mud is by gravity drainage within the pond. This would be modified, most likely to incorporate a combination of in-place methods, such as localized sumps near the excavation areas, as well as temporary well points. Black mud would be further dewatered after excavation by gravity drainage utilizing dedicated staging areas. All liquids generated during dewatering activities would be collected and treated at the North Yard GAC system.

The black mud would be mixed with roaster ore (as it is currently) prior to shipment to the resource recovery facility. Roaster ore is partially treated, calcined spent potliner. It is assumed that a facility would be able to accept the black mud for the duration of the project. Based on the current rate of resource recovery of the black mud, approximately thirty years would be required to completely empty the Black Mud Pond. Note that with NYSDEC's assistance and approvals, there may be opportunities to completely empty the Pond of black mud in 3 to 5 years. One important constraint on expediting this program is the long-term availability of roaster ore, which is mixed with the wet black mud and makes the overall product more easily handled.

After the removal of black mud from the Pond Area, the excavated areas would be backfilled with clean fill and graded to promote effective surface water drainage of the remediated area. The area would be seeded to reduce erosion and would be available for future use.

For both alternatives 1A and 1B, existing wells near the Black Mud Pond would be used to monitor groundwater quality. Surface water sampling locations would be selected.

For alternative 1B, additional remedial measures are required to address the groundwater and surface water quality. The methods for groundwater recovery and surface water collection are described below, followed by a generalized discussion of the treatment required for the contaminated water.

Groundwater recovery would be performed by a perimeter drain installed around the Black Mud Pond. The drain would be designed to intercept the groundwater that comes into contact with the Black Mud Pond's residual contaminated soils. A conceptual design for the perimeter drain is illustrated in Figure III-2. The plan view shows that ten sumps would be used to collect and pump the groundwater to the North Yard GAC system for treatment. The section view shows the perimeter drain in relation to existing features of the Black Mud Pond. It is expected that the depth of the perimeter drain would average 20 feet, depending on the local topography and seasonal low groundwater levels. Cross-sections of the Black Mud Pond Area which show soil stratigraphy and groundwater elevations can be found in the Phase I RI Report (Figures 16 - 18), and in the Final RI Report (Figure 34). The perimeter drain width is assumed to be constructed 3 feet wide using conventional methods of excavation for the purposes of this study. The soil from the perimeter drain excavation would be disposed of in an on-site RCRA landfill cell. A perforated pipe would be placed in the bottom of the excavation, and would be graded to induce drainage toward the ten sumps along its length. The drain would be backfilled with clean crushed stone. The top foot of the excavation, would be backfilled with a low permeability fill material to limit rainwater infiltration.

Surface water collection would be performed by an impoundment designed to collect surface water run-off for the watershed in which the Black Mud Pond lies, estimated to be 11.5 acres. Collection would be performed in the drainage area south of the Black Mud Pond, where results of surface water sampling have indicated the presence of contaminants. The water would be collected at the most downgradient point of the watershed in a lined impoundment (see Figure IX-2). The detention basin would be sized adequately to contain run-off from a 25-year storm, assuming the majority of flow as storm water run-off with minimal base flow.

If needed, treatment of groundwater and surface water would be performed by the North Yard GAC system. If the ditches adjacent to the Black Mud Pond were remediated, this and the source removal could eliminate the need for on-going surface water treatment.

7.1.2 Short-Term Impacts and Effectiveness

The short-term impacts associated with alternatives 1A and 1B are primarily those which result from materials-handling operations associated with volume of black mud and contaminated soils (i.e., approximately 200,000 tons). The potential impacts could result from excavation and on-site activities as well as from transport of the waste to the resource recovery facility. Approximately 10,000 to 20,000 truck loads would be required to transport the black mud off-site. If an accident occurred, the transport of these wastes could pose a risk to human health and the environment.

Dust generated as a result of excavation activities may be contaminated. Thus, dust that migrated from the immediate area of the Black Mud Pond could transport contaminants off-site or to other areas of the site. Contaminated dust could potentially cause health hazards to workers in the immediate area as well as workers in areas adjacent to the Black Mud Pond. However, short-term impacts caused by contaminated dust would be minimized through dust control measures common to the construction industry. If conditions warrant protection against dust inhalation, workers involved with the remedial program would use personal protective equipment, as necessary.

All contaminated water collected during remedial activities would be treated. Measures would be instituted to directly channel or pump the water to an temporary collection facility prior to treatment by the North Yard GAC system. However, contaminated water generated during excavation and dewatering activities could result in spillage and leakage which could contaminate areas adjacent to the Black Mud Pond. Measures would be instituted to minimize spillage and leakage during materials handling operations.

Alternatives 1A and 1B provide the same degree of short-term effectiveness, primarily associated with excavation of the black mud and residual contaminated soils. This source removal effectively mitigates any potential contact with contaminated materials.

7.1.3 Long-Term Effectiveness and Permanence

As noted above, implementation of alternatives 1A or 1B could take up to 30 years to complete. Thus, the short-term effects noted above (e.g., truck traffic, dust, contaminated dust) would be spread over this time frame. Implementation of alternatives 1A and 1B would remove the contaminated material from the Black Mud Pond Area and would thus mitigate further leachate generation and resulting groundwater contamination near the pond.

Alternative 1B uses the perimeter drain to intercept the groundwater for treatment. Because of the removal of source material in the Black Mud Pond Area, rainwater inflow to the perimeter drain through the clean fill material would not be contaminated. Thus, the only contaminated groundwater inflow into the perimeter drain would be entering from adjacent areas. The groundwater collected would be treated at the North Yard GAC system. The low permeability of the glacial till soils (about 10^{-6} cm/sec) results in low groundwater flow rates (about 3 feet per year with existing gradients). Consequently, the predominant component of inflow into the perimeter drain would be from rainwater inflow through clean soils adjacent to the drain.

7.1.4 Reduction of Toxicity, Mobility, or Volume

Use of the black mud as a raw material at the resource recovery facility would eliminate the majority of contaminants from the area. Organic contaminants within the black mud would be destroyed during processing, thus providing treatment of the waste and reducing the toxicity of the contaminants. Containment of the residual contaminated soils in an on-site RCRA-type landfill cell would mitigate contaminant transport from the soils.

For both alternatives 1A and 1B, treatment of the contaminated water from the dewatering process would reduce the volume of contaminants available for migration from the black mud and residual soils. Alternative 1B also requires that the groundwater and surface water be collected and treated. However, because the water table is below the permeable fill layer, the quantity of contaminated groundwater inflow would be very small. Surface water run-off in the Pond Area would no longer be in contact with contaminated materials as a result of source removal. Thus, no significant reduction in toxicity, mobility, or volume of waste would be added by the additional water treatment.

7.1.5 Implementability

Excavation, dewatering, and transport of the black mud and residual soils could be performed using conventional earthwork and construction practices. The technology used by the resource recovery facility is well-established; however, at current rates, implementation of this remediation would take place over approximately 30 years, unless expedited by a more conducive regulatory framework. Disposal of the residual soils in an on-site landfill would not pose any significant implementability constraints. Treatment of the water resulting from dewatering would be done by the North Yard GAC system.

The most significant consideration for implementing alternative 1A or 1B is the regulatory status of the black mud. Reynolds has pursued a "beneficial reuse" determination with the

NYSDEC and the USEPA. If the resource recovery of black mud is determined to be a beneficial reuse, the material will not be considered a hazardous waste, and shipments can resume to the currently-available facility. If this determination is not made, resource recovery could only occur at a RCRA-permitted TSDF cement kiln. WCC has preliminarily investigated this possibility (as documented in Appendix H). It is likely that such TSDFs would accept the black mud as a waste for disposal, with a cost commensurate with this approach.

For alternative 1B, the surface water impoundment and the perimeter drain for groundwater recovery could be implemented with the use of standard construction practices.

7.1.6 Compliance With ARARs

For alternatives 1A and 1B, the black mud would be treated by resource recovery, and the on-site area would be backfilled with clean fill and capped. Thus, both ARARs and the remedial action objectives of minimizing the potential for contaminant transport would be met. As a result of source removal for both alternatives, water quality would be expected to improve over time, and the water quality monitoring program would assess progress in attaining the applicable New York State Standards Criteria and Guidelines (SCGs). Following closure of the Pond, remediation of the nearby ditches by capping or removal of contaminated sediments would further improve surface water quality.

7.1.7 Overall Protection of Human Health and the Environment

Alternatives 1A and 1B would provide overall protection of human health and the environment by removing the source of contamination. Resource recovery required by alternatives 1A and 1B would result in the removal and treatment of the black mud. The residual soils would be isolated by disposal in an on-site secure landfill.

7.1.8 Cost

Details of the assumptions made for estimates of capital and O&M costs are presented in Appendix A.

Estimated capital costs for alternatives 1A and 1B are included on Table III-1. The table itemizes the components of the direct and indirect capital costs for all alternatives under consideration for the Black Mud Pond. The total estimated capital cost for alternative 1A is approximately $2,800,000; for alternative 1B it is $3,500,000. The difference can be accounted by the water collection and treatment provisions of alternative 1B.

Estimated operation and maintenance (O&M) costs for alternatives 1A and 1B are included on Table III-2. For alternative 1A, they include resource recovery operations over 30 years ($550,000 per year) and monitoring over 60 years ($120,000 per year). These costs are estimated at $550,000 and $200,000 per year for alternative 1B, respectively. The difference can be accounted by costs for on-going groundwater collection and treatment.

Capital and O&M costs are summarized on Table III-3. Present worth costs for the alternatives have been computed for a 30 year period using a 4 percent interest rate. The present worth cost estimated for alternative 1A is $15,000,000. For alternative 1B, it is $18,000,000.

7.2 ALTERNATIVES 2A AND 2B

7.2.1 Alternative Definitions

Alternative 2A consists of the following key components:

- Monitor groundwater and surface water
- Dewater the black mud in place, and
- Install a RCRA cap

Alternative 2B provides the remedial measures described above and, in addition, requires the collection and treatment of contaminated groundwater and surface water.

A process flow diagram for the components of these alternatives is presented in Figure III-3. For both alternatives, monitoring of the shallow groundwater and surface water in the Black Mud Pond vicinity would continue at the existing monitoring wells and surface water monitoring locations. For both alternatives 2A and 2B, water collected from dewatering and/or groundwater and surface water recovery would be treated by the North Yard GAC system. As necessary, backfilling, compacting, and grading of the area would be performed to provide an adequate subbase for installation of the RCRA cap. The cap would comply with RCRA specifications and would be installed as described in Section 6.2.1.

Alternative 2B requires on-going groundwater and surface water collection and treatment. The perimeter drain that would be used for groundwater recovery and the impoundment for surface water collection would be essentially the same as those described in Section 7.1.1.

7.2.2 Short-Term Impacts and Effectiveness

The short-term impacts of alternatives 2A and 2B would be minimal. Potential contact with contaminated groundwater during dewatering would be minimized by precautionary measures to control spillage and leakage. Cap installation would involve the potential for dust generation and/or contact with contaminated solids only at the beginning of installation. Standard health and safety practices would be implemented, as necessary, to minimize exposure to the workers.

7.2.3 Long-Term Effectiveness and Permanence

Maintenance of the cap integrity (Section 7.1.3) would ensure that it has the long-term ability to isolate the contaminated materials in the Black Mud Pond. The cap would maintain a barrier, eliminating contact of the contaminated materials with surface water run-off and infiltration. After placement of the cap, less than 0.1 percent of the annual precipitation would be expected to percolate through the cap. The rest would run-off the cap surface, drain laterally through the cap's drainage layer, or be accounted for by evapotranspiration (see Appendix F).

For alternative 2B, surface water and groundwater collection and treatment would be required. The surface water impoundment described in Section 7.1.1 would be effective in mitigating contaminant transport, and is proposed for alternative 2B. For the long-term, however, following capping of the Black Mud Pond Area, remediation of the ditches adjacent to the Black Mud Pond by capping or removing contaminated sediments would further improve surface water quality. With regard to groundwater recovery, dewatering, which would be required prior to cap installation, would recover much of the contaminated groundwater from the Black Mud Pond Area for treatment. During a transition period after cap installation, the residual water content in the contaminated, capped materials would drain into the perimeter drain proposed for alternative 2B. However, the infiltration rate through the cap is expected to be negligible, as estimated quantitatively in Appendix F. In addition, the permeability of the till is on the order of 10^{-6} cm/sec, thus, after the transition period, it is anticipated that the groundwater flow rate into the perimeter drain would be on the order of one gallon per minute.

7.2.4 Reduction of Toxicity, Mobility, or Volume

The installation of a cap, in conjunction with the existing containment wall, would restrict the infiltration of rainwater and the subsequent leaching of contaminants from the Black Mud Pond. The cap would prevent direct contact between the surface water run-off and the black mud, thereby limiting surface water transport of contaminants. Thus, the most important contaminant transport pathways would be eliminated.

The black mud and residual soils would be left in-place, with a volume reduction of contaminated material as a result of dewatering. Alternative 2B also requires long-term groundwater and surface water collection and treatment. However, because the water table is below the permeable fill layer, it is anticipated that the quantity of contaminated groundwater flow would be very small. In addition, as mentioned above, surface water would no longer be in contact with contaminated materials as a result of capping. Thus, no significant reduction in toxicity, mobility, or volume of waste would be account for the additional water treatment provisions required by alternative 2B.

7.2.5 Implementability

The cap installation required by alternatives 2A and 2B would be implemented using standard practices. No schedule delays would be anticipated. Cap maintenance would be required to ensure the integrity of the cap. Also, monitoring of the shallow groundwater levels and water quality would be used to verify the continued performance of the remedial measures. Neither treatment nor a treatability variance would be required under the RCRA rules, thereby expediting the administrative implementation. Off-site TSD services would not be required for this alternative. The work tasks required for completion could be provided by more than one vendor to provide competitive bids.

For alternative 2B, the surface water impoundment and the perimeter drain for groundwater recovery could be implemented with the use of standard practices.

7.2.6 Compliance With ARARs

For alternatives 2A and 2B, the installation of a RCRA-style cap would prevent rainwater infiltration, thus minimizing contaminant mobility by potentially isolating the black mud. These alternatives would meet the remedial action objectives, and water quality would be expected to improve over time as a result of the cap installation. The water quality monitoring program would assess progress in attaining the applicable New York State SCGs. Following closure of the Pond, remediation of the nearby ditches would further improve surface water quality. Thus, ARARs would be met by these alternatives.

7.2.7 Overall Protection of Human Health and the Environment

Alternatives 2A and 2B provide overall protection of human health and the environment. Installation of the cap required by alternatives 2A and 2B would partially isolate the black mud and residual soil, and would limit contact between contaminants and the surrounding environment by maintaining a physical barrier. Treatment of the contaminated groundwater from the dewatering process, in conjunction with the restriction of rainwater infiltration, would reduce the potential for continued groundwater contamination. Surface water run-off would no longer be in direct contact with the black mud, therefore it would be effectively isolated from the contaminant source. Ditch remediation would further reduce surface water contamination. The long-term effectiveness of the remedial measures required for these alternatives would be ensured by regular inspection and maintenance as well as monitoring of the shallow groundwater and surface water in the Black Mud Pond Area.

7.2.8 Cost

The estimated direct and indirect capital costs for alternatives 2A and 2B are itemized in Table III-1. The costs for cap installation represent the majority of the direct capital costs. The total estimated capital costs for the remedial measures required by alternative 2A are $2,300,000 and for alternative 2B, $3,000,000. O&M costs for these alternatives are summarized in Table III-2. The costs associated with groundwater and surface water monitoring for alternative 2A total $170,000 annually. For alternative 2B, the addition of water treatment increases O&M costs to $250,000 annually. Present worth costs were calculated for a 30 year period at an interest rate of 4 percent and are given in Table III-3. They total $5,200,000 for alternative 2A and $7,300,000 for alternative 2B. Appendix A summarizes the assumptions made to estimate both the capital and O&M costs for these alternatives.

7.3 ALTERNATIVE 4C

7.3.1 Alternative Definitions

Alternative 4C consists of the following key components:

- Dewater and excavate the black mud and residual soils for thermal treatment at an off-site commercial incinerator (with subsequent disposal of residual ash)

- Backfill, grade and seed the excavated area

- Collection and treatment of groundwater and surface water
- Monitor groundwater and surface water

A process flow diagram for this alternative is presented in Figure III-4. Dewatering of the black mud and residual soils would proceed as described in Section 7.1.1 and would incorporate a combination of localized sumps (near the excavation areas) and temporary well points. Gravity drainage would occur later in designated staging areas. Dewatered liquor would be treated by the North Yard GAC system.

The dewatered black mud would be transported to a commercial incinerator for treatment and disposal. The excavated area on-site would then be backfilled with clean fill and graded to promote effective surface water drainage of the remediated area. The area would then be seeded to reduce erosion.

Groundwater would be recovered by use of a perimeter drain, and surface water would be collected in an impoundment, as described in Section 7.1.1. The collected water would be treated, as necessary, in the North Yard GAC system. If the ditches south of the Black Mud Pond were remediated, this and the source removal could eliminate the need for on-going surface water treatment. Groundwater and surface water monitoring would continue.

7.3.2 Short-Term Impacts and Effectiveness

The potential short-term impacts associated with alternative 4C are primarily those that result from materials-handling operations for both solids and liquids from the excavation and dewatering. In addition to these potential impacts, which apply to many of the alternatives under consideration, the air emissions from the incineration process pose a potential hazard to the environment. Emission control equipment is typically used to minimize this potential hazard.

The volume of materials to be incinerated is approximately 200,000 tons. It is estimated that more than 10,000 truckloads would be required to transport the soils and black mud. If an accident occurred, the transport of these wastes would pose a risk to human health and the environment. With this number of truck loads, the number of accidents (fatal and non-fatal) likely to occur is statistically significant, based on insurance industry data. In addition, the farther the distance to the facility, the higher the accident rate would be.

Contact with contaminated water generated during the dewatering process could be a potential risk to the workers involved in the remediation. Contact with the water would be minimized by controlling spillage and leakage during the dewatering process. Standard health and safety procedures would be implemented as necessary to minimize any exposure to the workers involved in the remediation.

7.3.3 Long-Term Effectiveness and Permanence

Implementation of alternative 4C would remove both the black mud and the residual soils, thus eliminating the potential for further groundwater or surface water contamination. In addition, backfilling and grading of the area after excavation would make the land available for future use. Collection and treatment of the groundwater and surface water, as necessary, would further ensure the long-term effectiveness of the remediation. However, because of source removal, groundwater recovery may not be cost-effective in the long-term.

7.3.4 Reduction of Toxicity, Mobility, or Volume

Removal and transport of the black mud and residual soils to a commercial incinerator for treatment would ensure that no additional groundwater or surface water contamination would occur on-site as a result of the Black Mud Pond Area. Treatment of the water from the dewatering process would decrease the volume of contaminated material. In addition, incineration of these contaminated soils and black mud would destroy the organic contaminants in the waste, thereby significantly reducing the toxicity of the waste. The ash remaining from the process would be approximately the same volume of material to be disposed assuming the ash needed to be stabilized.

7.3.5 Implementability

The dewatering, excavation and transport of the black mud and residual contaminated soils required by alternative 4C would be conducted using standard practices. Waste manifests and tracking procedures would be prepared and followed throughout the remediation process. Incineration of organics such as those in the black mud and residual soils is a well-established technology. However because of the large volume of materials which would require treatment, special scheduling provisions would be required to ensure incinerator availability.

7.3.6 Compliance With ARARs

For alternative 4C, treatment of the black mud by off-site incineration would meet the ARARs and the remedial action objectives for the pond solids. In addition, as a result of source removal and the collection of surface water and groundwater, water quality would be expected to improve, and the water quality monitoring program would assess progress in attaining the applicable New York State SCGs.

The most unfavorable aspect of this remedial alternative is the potential for non-compliance with both the ARARs and the remedial action objectives during its implementation. The Black Mud Pond is located within the Reynolds plant boundary fence, and is not in an active plant area. Thus, at present, neither the public, nor the plant workers are exposed to the contaminants associated with the black mud. Implementation of this remedial alternative would require removal of the black mud, which would significantly increase the potential for exposure to the workers involved in the remediation. Non-compliance with air ARARs could occur during implementation of the remedial alternative as a result of the dust generated on-site, or as a result of emission control problems at the off-site incinerator.

7.3.7 Overall Protection of Human Health and the Environment

The excavation and treatment of the black mud and residual soils, in addition to the backfilling and seeding of the excavated area, would ensure that there would not be any further physical contact with the residual soils and black mud. Further groundwater and surface water contamination in the area would also be mitigated, and collection and treatment of surface water would mitigate transport of any residual contaminants. During the incineration, air emissions and the disposal of the ash after treatment would be handled by the incineration facility. Monitoring of the groundwater and surface water would be used to evaluate the effectiveness of the remediation.

7.3.8 Cost

The estimated capital costs for alternative 4C, are itemized in Table III-1 and are considered prohibitive. The total is $320,000,000. It is apparent that the capital costs associated with off-site incineration are much higher than the costs for other alternatives. The O&M costs for groundwater and surface water collection monitoring and treatment are itemized in Table III-2 and total $200,000, annually. Table III-3 summarizes the capital and O&M costs, and gives the estimated present worth cost for alternative 4C as $320,000,000 (O&M costs are negligible compared to the total). Appendix A summarizes the assumptions and sources used for the capital and O&M cost estimates.

7.4 ALTERNATIVES 5A AND 5B

7.4.1 Alternative Definitions

Alternative 5A consists of the following key components:

- Dewater and excavate the black mud and residual soils for disposal at an off-site commercial landfill
- Backfill, grade, and seed the excavated area
- Monitor groundwater and surface water

Alternative 5B provides all of the remedial measures described above and requires the collection and treatment of contaminated groundwater and surface water. A process flow diagram for the components of these alternatives is presented in Figure III-5.

Dewatering and excavation of the black mud and soils would proceed as described in Section 7.1.1. For alternatives 5A and 5B, the water generated from the dewatering process would be treated by the North Yard GAC system. A suitable commercial landfill would be selected to dispose of the black mud and residual soils. The dewatered black mud and residual soils would be transported in bulk to the facility. For the purposes of the FS, it is assumed that solidification of the black mud would not be necessary beyond the dewatering previously discussed. The excavated area on-site would be backfilled with clean fill and graded to promote effective surface water drainage of the remediated area. The area would be seeded to reduce erosion and would be available for future use. Groundwater and surface water monitoring would continue.

For alternative 5B, the perimeter drain used for groundwater recovery and the impoundment used for surface water collection would be the same as those described in Section 7.2.1. If the ditches south of the Black Mud Pond were remediated, this and the source removal could eliminate the need for on-going surface water treatment.

7.4.2 Short-Term Impacts and Effectiveness

The short-term impacts associated with alternatives 5A and 5B are primarily those that result from materials handling operations for the large volume of black mud and residual soils. These impacts are the same as those discussed in Section 7.3.2 for alternative 4C. The potential for contact with contaminated water resulting from the dewatering process would be minimized by measures aimed at direct channeling or pumping of the water to the on-site treatment facility. Standard health and safety procedures would be implemented as necessary to minimize exposure to the workers.

Alternatives 5A and 5B provide the same degree of effectiveness in the short-term. The effectiveness is primarily associated with the excavation of the black mud and residual soils and placement in a secure landfill. However, the potential for adverse short-term impacts outweighs the short-term effectiveness.

7.4.3 Long-Term Effectiveness and Permanence

Alternatives 5A or 5B would require the removal of both the black mud and the residual soils, thus eliminating further groundwater or surface water contamination. In addition, backfilling and grading of the area after excavation would make the land available for future use.

7.4.4 Reduction of Toxicity, Mobility, or Volume

For alternatives 5A and 5B, removal and disposal of the black mud and residual soils at a secure landfill would mitigate the potential for continued contaminant transport from the area, and would ensure that no additional groundwater or surface water contamination would occur.

Alternative 5B also requires long-term groundwater and surface water collection and treatment. However, because the water table is below the permeable fill layer, it is anticipated that the quantity of groundwater flow would be very small. In addition, as mentioned above, surface water would no longer be in contact with contaminated materials as a result of capping. Thus, there would be no significant reduction in toxicity, mobility, or volume of waste by the additional water treatment provisions required by alternative 5B.

7.4.5 Implementability

The dewatering, excavation and transport of the black mud and residual soils required by both alternatives 5A and 5B would be conducted using standard practices. Waste manifests and tracking procedures would be prepared and followed throughout the remediation process, and the disposal would be conducted in compliance with the requirements outlined in the NYSDEC TAGM 3018 (October 1990). WCC has not yet located a RCRA TSDF that would accept the black mud for disposal. In addition, either treatment sufficient to meet land disposal requirements, or a treatability variance would be required prior to disposal.

For alternative 5B, the surface water impoundment and the perimeter drain could be implemented with the use of standard practices.

7.4.6 Compliance With ARARs

For alternatives 5A and 5B, off-site landfilling of the black mud and residual soils would satisfy the site-specific ARARs and remedial action objectives. As a result of source removal, water quality would be expected to improve, and the water quality monitoring program would assess progress in attaining the applicable New York State SCGs. Following closure of the Pond, remediation of the nearby ditches could further improve surface water quality.

The most unfavorable aspect of this remedial alternative is the potential for non-compliance with both ARARs and the remedial action objectives during its implementation. The Black Mud Pond is located within the Reynolds plant boundary fence, and is not in an active plant area, thus, at present, neither the public, nor the plant workers are exposed to the contaminants associated with the black mud. Implementation of this remedial alternative would require removal of the black mud, which would significantly increase the potential for exposure to the workers involved in the remediation. Non-compliance with air ARARs could occur during implementation of the remedial alternative as a result of the dust generated during excavation and transport.

7.4.7 Overall Protection of Human Health and the Environment

Disposal of the waste at a commercial landfill would ensure a high level of protection of human health and the environment. The excavation and disposal of the black mud and the residual soils in a secure landfill would eliminate any potential physical contact with the soils and black mud. In addition, removal of these materials from the site would mitigate any further contamination of groundwater or surface water.

7.4.8 Cost

The estimated direct and indirect capital costs for alternatives 5A and 5B are itemized in Table III-1. The costs for transport and disposal of the solid wastes at an off-site landfill are prohibitively high. They represent the majority of the total costs for these alternatives. The total estimated capital cost for the remedial measures required by alternative 5A are

$81,000,000. For alternative 5B, the costs associated with water collection and treatment increase the capital cost to $82,000,000. O&M costs for alternatives 5A and 5B are $120,000 and $200,000 per year, respectively, and are summarized in Table III-2. Present worth costs were calculated for alternatives 5A and 5B and are given in Table III-3 ($83,000,000 and $85,000,000, respectively). Appendix A summarizes the assumptions and sources used for the capital and O&M cost estimates. None of these costs include the costs of treatment prior to disposal, which may be required per RCRA rules.

7.5 ALTERNATIVES 6A AND 6B

7.5.1 Alternative Definitions

Alternative 6A consists of the following key components:

- Dewater and excavate the black mud and residual soils for disposal in an on-site RCRA-style landfill cell to be constructed
- Backfill, grade and seed the excavated area
- Monitor groundwater and surface water

Alternative 6B provides all of the remedial measures described above and, in addition, requires the collection and treatment of groundwater and surface water. Process flow diagrams for these alternatives are presented in Figure III-6.

Dewatering and excavation of the soils and black mud would proceed as described in Section 7.1.1. For alternative 6A, the water generated from the dewatering process would be treated at the North Yard GAC system, as would the collected groundwater and surface water for alternative 6B. A landfill would be constructed on-site meeting the technical requirements of RCRA with a RCRA-equivalent cap. Details of the proposed on-site landfill design are presented in Appendix E. Leachate would be pumped to the North Yard GAC system. The landfill would be filled as a monofill with the dewatered black mud (assuming no further solidification would be required). The excavated Black Mud Pond Area would be backfilled with clean fill, graded, and seeded as necessary to promote good drainage and prevent erosion.

For alternative 6B, the perimeter drain used for groundwater recovery and the impoundment used for surface water collection would be the same as those described in Section 7.2.1. If the ditches south of the Black Mud Pond were remediated, this and the source removal could eliminate the need for on-going surface water treatment.

7.5.2 Short-Term Impacts and Effectiveness

The short-term impacts associated with alternatives 6A and 6B are primarily those associated with the materials handling of the black mud and residual soils. Exposure of the workers to the contaminated materials would be minimized as described in Section 7.4.2.

7.5.3 Long-Term Effectiveness and Permanence

The long-term effectiveness of the on-site RCRA-style landfill cell and cap would be ensured by regular maintenance. Piping from the leachate collection system in the cell would be directed to the North Yard GAC system for treatment. Repairs to the cell would be made as necessary. The witness layer would be monitored to ensure that no leachate leaks from the cell. Required maintenance of the cap is described in Section 7.1.3. Disposal of the materials in an on-site cell would effectively isolate the contaminants indefinitely. Source removal from the Pond Area would make the land available for future use.

Following closure of the area, remediation of the adjacent ditches by capping or removal of contaminated sediments would further improve surface water quality. This would be confirmed by monitoring of the surface water run-off from these ditches.

7.5.4 Reduction of Toxicity, Mobility, or Volume

Removal and disposal of the black mud and residual soils in an on-site RCRA-style landfill cell would greatly reduce the potential for contaminant transport from the area. Treatment of water from the dewatering process would decrease contaminant volume.

Alternative 6B also requires long-term groundwater and surface water collection and treatment. However, because the water table is below the permeable fill layer, it is anticipated that the quantity of contaminated groundwater flow would be very small. In addition, as mentioned above, surface water would no longer be in contact with contaminated materials as a result of capping. Thus, no significant reduction in toxicity, mobility, or volume of waste would be added by the additional water treatment provisions required by alternative 6B.

7.5.5 Implementability

The construction of an on-site RCRA-style landfill cell would require detailed design specifications and permitting before construction of the cell. Current regulations require that a RCRA cell be located at least 5 feet above the 100-year flood zone and at least 5 feet above the seasonal high water table. Location of the RCRA cell at the Reynolds site would not be restricted on-site by the 100-year flood zone, however, careful design and location of the on-site cell would be required to ensure that the seasonal high water table would not be within 5 feet of the constructed cell. The proposed landfill location is near the borrow pit; the design and siting requirements are discussed in Appendix E. After permitting of the cell, construction would proceed using standard landfill construction practices.

For alternative 6B, the surface water impoundment and the perimeter drain could be implemented using standard practices.

7.5.6 Compliance With ARARs

For alternatives 6A and 6B, treatment of the black mud and residual soils by on-site landfilling would meet site-specific ARARs and remedial action objectives. As a result of source removal, water quality would be expected to improve, and the water quality monitoring program would assess progress in attaining the applicable New York State SCGs. Following closure of the Pond, remediation of the nearby ditches could further improve surface water quality.

The most unfavorable aspect of this remedial alternative is the potential for non-compliance with both ARARs and the remedial action objectives during its implementation. Non-compliance with air ARARs could occur as a result of dust generated during excavation and on-site transport, thus increasing the exposure risks to plant and remediation workers.

7.5.7 Overall Protection of Human Health and the Environment

Disposal of the black mud and residual soils in an on-site secure landfill cell would provide overall protection to human health and the environment by prohibiting contact with the contaminated materials. Groundwater and surface water monitoring would enable periodic assessments of the progress of the remediation.

7.5.8 Cost

The total estimated capital costs for the remedial measures required by alternatives 6A and 6B are $23,000,000 and $14,900,000, respectively (Table III-1). O&M costs for these alternatives, summarized in Table III-2, are the costs associated with groundwater and surface water monitoring, landfill cell and cap maintenance (post-closure), and long-term water treatment for alternative 6B. Present worth costs were calculated for each alternative for a 30-year period at an interest rate of 4 percent, and are given in Table III-3 ($26,000,000 and $20,000,000, respectively). Appendix A summarizes the assumptions and sources used for the capital and O&M cost estimates.

7.6 ALTERNATIVE 7

7.6.1 Alternative Definition

Alternative 7 consists of the following key components:

- Dewater and excavate black mud and residual soil
- Incinerate contaminated materials on-site
- Place treated residuals in an on-site RCRA-type landfill cell
- Backfill, grade, and pave excavated area
- Collect and treat groundwater and surface water
- Monitor groundwater and surface water

A process flow diagram for alternative 7 is presented in Figure III-7. Dewatering and excavation of the black mud would proceed as described in Section 7.1.1. For the large volume of material which would require treatment (approximately 200,000 tons) it is expected that a rotary kiln unit would be the most applicable. For the purposes of this FS, it is assumed that treated residuals would still be considered hazardous due to inorganic contaminant levels and because of the "derived from" RCRA rules. Therefore, construction of an on-site RCRA-equivalent landfill is proposed as part of this alternative to provide permanent containment of the treated residuals. If possible, however, the treated residuals may be used as backfill for the Black Mud Pond Area. The area would be compacted, graded and seeded, as necessary, to promote good drainage and to minimize erosion.

The principal equipment which would be associated with the thermal destruction system would likely consist of 1) a rotary kiln, the primary chamber for incineration of the black mud and soils, 2) venturi scrubbers for removal of particulates from the emissions; 3) scrubber towers for caustic scrubbing for acid mist absorption of exhaust gases; and 4) instrumentation for automatic monitoring and control of the system. In addition, the support systems which would be required include temporary staging areas for the material to be treated and for the ash generated; storage and feed facilities for the caustic required by the scrubber towers; utilities; process water and drain system; on-site laboratory facilities for compliance monitoring; fire protection systems; and an emergency power system.

After siting, design, and construction of the on-site incinerator, the system would require testing to ensure proper functioning of mechanical equipment and instrumentation. A trial burn would be conducted to demonstrate the destruction efficiency of the incinerator, compliance with ARARs, and to determine process conditions for full-scale operation. After operation of the system for remediation is completed, the incinerator would need to be decommissioned and decontaminated as required.

For alternative 7, the perimeter drain used for groundwater recovery and the impoundment used for surface water collection would be the same as those described in Section 7.2.1. If the ditches south of the Black Mud Pond were remediated, this and the source removal could eliminate the need for on-going surface water treatment.

7.6.2 Short-Term Impacts and Effectiveness

The potential short-term impacts are those which result from the construction and operation of the system, and the materials handling of the large volume of black mud. Exposure of the construction and remediation workers would be minimized by the use of personal protective equipment, as necessary. Potential short-term impacts to the environment could occur as a result of equipment failures during the incineration process, which could result in accidental untreated air emissions. Adverse impacts which could occur as a result of spillage or leakage of untreated water from the process flow would be minimized by the use of precautionary measures, e.g., bermed areas for equipment, emergency spill procedures, etc.

The short-term effectiveness of alternative 7 is minimal, as the intrusive and operational activities required for thermal treatment preclude the remedial measures' effectiveness in the short-term.

7.6.3 Long-Term Effectiveness and Permanence

Implementation of alternative 7 would require the removal and treatment of both the black mud and the residual soils, thus eliminating the potential for future groundwater or surface water contamination. In addition, backfilling and grading of the area after excavation would make the land available for future use. Incineration would result in permanent destruction of the organic contaminants from the black mud and residual soils. If inorganic contaminant levels in the treated residuals were low enough, the treated residuals would be used as backfill in the Black Mud Pond Area. Otherwise, placement of the materials in a RCRA-type on-site landfill would provide effective long-term containment of the materials.

7.6.4 Reduction of Toxicity, Mobility or Volume

For alternative 7, removal and treatment of the black mud and residual soils would ensure that no additional groundwater or surface water contamination would occur as a result of the Black Mud Pond Area, thus mitigating these contaminant transport pathways. Incineration of the black mud and residual soils would destroy the organic contaminants in the waste, thereby reducing the toxicity of the waste. In addition, the treated residuals from the process would be a smaller volume of material (assuming stabilization of the treated residuals were not required). Collection and treatment of surface water and groundwater during and after implementation of the remedial measures would ensure that contaminant transport from the area would be eliminated.

7.6.5 Implementability

The dewatering and excavation of the black mud and residual soils would be implemented using standard practices with the necessary health and safety precautions. The material would be staged temporarily in designated areas prior to feeding into the incinerator for treatment.

For on-site incineration, the administrative feasibility of implementation is questionable, and would involve substantial planning and negotiation at a minimum. The technical feasibility of rotary kiln incineration is well-accepted, and its emission control equipment would be designed and tested to ensure its effectiveness. Design and construction of the thermal destruction system would be expected to require about two years, and incineration of the material would require about four additional years. Disposal or re-use of the treated residual may require additional administrative and technical considerations, such as delisting, or approvals and permitting for disposal in an on-site RCRA-type landfill.

7.6.6 Compliance With ARARs

Construction of the thermal destruction unit would be completed in compliance with all of the federal and state action-specific ARARs for construction, e.g., dust and noise restrictions, etc. Air emissions would be treated and monitored to comply with ARARs during remediation.

Excavation and treatment of the black mud and residual soils would satisfy site-specific ARARs, TBCs, and remedial action objectives. Groundwater and surface water quality would be expected to improve as a result of source removal. Both groundwater and surface water would be collected and treated, as necessary, to meet New York State SCGs.

7.6.7 Overall Protection of Human Health and the Environment

The removal and treatment of black mud and residual soils would ensure that there would no longer be potential for physical contact with the contaminants from the area. Thus, further groundwater and surface water contamination from the area would be mitigated. During implementation of the remedial measures, dust control, air emissions, and water treatment would be carefully controlled parts of the remediation. Collection and treatment of groundwater and surface water from the area, as necessary, would ensure overall protection of the environment in the long-term. The water quality monitoring required for alternative 7 would ensure that any significant changes in conditions could be addressed as appropriate.

7.6.8 Cost

The capital cost estimates for alternative 7 are itemized in Table III-1, and total $71,800,000. The majority of these costs are associated with the costs of on-site incineration. Estimated

O&M costs for alternative 7 are given in Table III-2, and total $250,000 per year. The estimated costs of the alternatives are summarized in Table III-3, and present worth costs are approximately $76,000,000. Appendix A summarizes the assumptions made to estimate the capital and O&M costs for this alternative.

8.0
COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, the ten alternatives available for the Black Mud Pond are compared against each other. The comparison is based on the seven evaluation criteria in Section 7.0. The comparison of alternatives for the Black Mud Pond will facilitate the presentation of conclusions and recommendations in Section 9.0.

A direct comparison between alternatives for the Black Mud Pond is summarized in Table III-4. A compilation of scores for each alternative, scored according to NYSDEC TAGM Tables 5-2 through 5-7, is presented in Table III-5. The table format allows for easy comparisons of the alternatives on each criterion. A brief discussion for each criteria is presented below. Two elements not addressed here are the criteria of state and community acceptance, which the NYSDEC will evaluate prior to selecting the final remedy.

8.1 SHORT-TERM IMPACTS AND EFFECTIVENESS

Potential short-term impacts associated with alternatives 2A and 2B are minimal. There are potentially significant short-term impacts related to all other Black Mud Pond alternatives (1A, 1B, 4C, 5A, 5B, 6A, 6B and 7). The potential impacts result from materials handling operations for such a large volume of contaminated material. Additionally, air emission and treated residuals resulting from alternatives 1A, 1B, 4C and 7 could pose a threat to the environment. Control measures would be taken during implementation of any of the remediation alternatives to minimize releases to the environment.

8.2 LONG-TERM EFFECTIVENESS AND PERMANENCE

All ten alternatives for the Black Mud Pond would be effective in eliminating, or limiting contact with contaminants over the long-term. Alternatives 1B, 2B, 5B, 6B and 7 involve collection and treatment of surface and groundwater. Collection and treatment of waters would eliminate migration of contaminants via water transport. However, because groundwater flow rates are very low and surface water would be isolated from contaminated materials by all alternatives, the benefits of water collection at the Black Mud Pond are considered minimal. The pond is located on a groundwater divide; placing a cap on the pond may lower groundwater levels such that groundwater would no longer contact the black mud. Additionally, the permeability of the glacial till surrounding the pond is on the order of 10^{-6} cm/sec; seepage velocities are noted to be on the order of 3 feet per year. At these flow rates the contaminated groundwater would require approximately 500 years to reach the closest plant boundary, which is the St. Lawrence River. However, after installation of the impermeable cap required by alternatives 2A and 2B, the groundwater would no longer be recharged by rainwater infiltration from the contaminated areas, thus the hydraulic gradient from the Pond would decrease significantly. This would increase the travel time of the contaminated groundwater as follows. If the gradient were to decrease by a factor of ten as a result of the reduced recharge, the travel time would increase by an order of magnitude. In addition, over this course of time, dispersion, dilution and retardation would lower contaminant levels in the flow such that no detectable contaminants would be anticipated at the groundwater discharge point. Alternatives 1A, 1B, 4C and 7 would permanently destroy organic contaminants in the black mud.

8.3 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

The collection and treatment of water associated with alternatives 1B, 2B, 5B, 6B and 7 would not significantly reduce the toxicity, mobility or volume of contamination. Alternatives 2A, 2B, 5A, 5B, 6A, and 6B involve containment for the contaminated material and therefore would reduce the number of available pathways for contaminant transport. Alternatives 1A, 1B, 4C and 7 would, to some extent, reduce the toxicity, mobility, and volume of contaminants associated with black mud by destruction of the organic contaminants present. All alternatives would reduce contaminant volume by dewatering.

8.4 IMPLEMENTABILITY

Alternatives 2A and 2B are the most easily implemented alternatives. Alternatives 5A, 5B, 6A, and 6B are considered implementable; they are technically feasible although administrative feasibility is less clear. Alternatives 1A, 1B, 4C and 7 are technically feasible but the administrative feasibility is less certain. Problems may include obtaining appropriate approvals for resource recovery (1A, 1B) or waste treatment (4C, 7).

8.5 COMPLIANCE WITH ARARs

Implementation of removal alternative 1A, 1B, 4C, 5A, 5B, 6A, 6B or 7 would satisfy site-specific ARARs and remedial action objectives by treating or isolating the contaminated pond solids. Implementation of capping alternative 2A or 2B would meet the remedial action objectives by minimizing contaminant mobility. In addition, implementation of any of these alternatives would result in improved water quality in the area, and would include a monitoring program to assess progress in attaining the applicable New York State SCGs.

Although all of the appropriate control measures would be taken (see Section 6.3.3), an important concern with respect to ARARs is related to air quality ARAR compliance during implementation of the remedial measures. For alternatives which require removal of pond solids the dust generated during excavation could result in non-compliance with ARARs, thus posing a potential risk to remediation and plant workers. Off-site transport alternatives could result in increased risks to the public in the event of improper material handling en route, or accidents. ARAR exceedances could also occur for treatment alternatives in the event of emission control equipment problems. Capping alternatives would comply with air ARARs during the remediation process.

8.6 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All ten Black Mud Pond alternatives would be protective to human health and the environment by eliminating contact with the contaminants, and minimizing contaminant transport.

8.7 COST

The total estimated present worth cost associated with the ten alternatives for the Black Mud Pond range from $5,200,000 for alternative 2A to $320,000,000 for alternative 4C. Costs are summarized in Tables III-1 through III-3, and details of assumptions and estimates used to determined costs are presented in Appendix A.

9.0 CONCLUSIONS AND RECOMMENDATIONS

Section 8.0 provides a comparative analysis of alternatives available for the Black Mud Pond. This section uses that analysis to recommend a particular alternative for the Black Mud Pond. Aspects of the recommended alternative may change, or be modified, based on NYSDEC input and/or during review of the recommended remedial alternatives with a site-wide perspective. The recommended alternative is intended to satisfy the remedial action objectives presented in Section 3.1.

For the Black Mud Pond, alternative 2A is recommended. Alternative 2A includes the following main components:

- Dewater the black mud in-place
- Install a permanent cap
- Monitor groundwater and surface water

A review of alternative 2A with regard to the seven evaluation criteria indicates that it has minimal potential for short-term impacts, and for the short- and long-term, is effective in eliminating contact with contaminants. It therefore provides overall protection of human health and the environment. The alternative is easily implemented, and it is technically and administratively feasible. Alternative 2A, relative to other alternatives for the Black Mud Pond, is considered to be cost-effective. The total estimated cost for alternative 2A is $5,200,000.

Alternative 2A, when scored according to NYSDEC TAGM tables, scores within a close group of alternatives. The scores are 88 for alternative 1A, 88 for alternative 1B, 76 for alternative 2A, 77 alternative 2B, 71 for alternative 4C, 71 for alternative 5A, 73 for alternative 5B, 71 for alternative 6A, 73 for alternative 6B and 84 for alternative 7 (Table III-5). Although some alternatives score slightly higher than 2A, some of them require water treatment, which is considered to be unwarranted in the Black Mud Pond Area (see Section 8.2). Alternatives 1A and 1B have serious implementability constraints which could impede progress of the remediation, thus potentially delaying remediation of downgradient areas (i.e., the Wetlands). As for alternative 6B, the construction of a landfill liner and cap would give only marginal improvement over the capping option, as the existing subsurface soils in the area have extremely low permeabilities, and the cap would be of the same design. Thus, the alternative would not be cost effective in relative terms.

Alternative 2A meets the remedial action objectives (Section 3.1) by:

1) Considering means to permanently immobilize contaminants (capping)

2) Preventing migration of contaminants in groundwater and surface water on or beyond the Reynolds' plant boundaries (by minimizing water flow rate and contact with the black mud, as described in Section 8.2)

3) Minimizing the mobility of contaminants and preventing continued groundwater and surface water contamination

TABLE III-1
CAPITAL COST ESTIMATE SUMMARY
BLACK MUD POND

REMEDIAL ACTION	UNITS	UNIT COST	ALTERNATIVE 1A QUANTITY	ALTERNATIVE 1A COST	ALTERNATIVE 1B QUANTITY	ALTERNATIVE 1B COST	ALTERNATIVE 2A QUANTITY	ALTERNATIVE 2A COST	ALTERNATIVE 2B QUANTITY	ALTERNATIVE 2B COST	ALTERNATIVE 4C QUANTITY	ALTERNATIVE 4C COST
***************	*****	****	********	****	********	****	********	****	********	****	********	****
A. SITE PREPARATION												
1. Dewatering	LS	$250,000						$250,000		$250,000		$250,000
B. EXCAVATION/HANDLING OF CONTAMINATED MATERIALS												
1. Excavate Black Mud	ton	$5									165,660	$828,300
2. Excavate Residual Soils	ton	$5	38,969	$60,071 b	38,969	$60,071 b					38,969	$194,845
3. Excavate Perimeter Drain	lf	$20			3,000	$60,000			3,000	$60,000		
C. TRANSPORT AND TREATMENT/ DISPOSAL OF CONTAMINATED MATERIALS												
1. Transport/Treat at Commercial Incinerator	ton	$1,500									204,629	$306,943,500
2. Dispose at On-Site Landfill	ton	$30	38,969	$1,169,070	38,969	$1,169,070						
3. On-Site Hauling	ton	$2	38,969	$77,938	38,969	$77,938						
D. COLLECTION/TREATMENT OF WATER												
1. Surface Water Impoundment	LS	$150,000				$150,000				$150,000		$150,000
2. Install Perimeter Drain	LS	$230,000				$230,000				$230,000		$230,000
3. Piping to NY GAC	LS	$50,000				$50,000				$50,000		$50,000
E. SITE RESTORATION												
1. Backfill and Compact	ton	$5	281,892	$434,537 b	281,892	$434,537 b					281,892	$1,409,460
2. Install RCRA Cap	sq ft	$5					261,360	$1,306,800	261,360	$1,306,800		
3. Grade and Seed	sq ft	$2	261,360	$161,155 b	261,360	$161,155 b					261,360	$522,720
DIRECT CAPITAL COSTS				$1,902,770		$2,392,770		$1,556,800		$2,046,800		$310,578,825
INDIRECT CAPITAL COSTS	(% of Direct Capital Costs)											
A. Implementation	(10%)			$190,277		$239,277		$155,680		$204,680		$1,000,000 a
B. Administration	(15%)			$285,415		$358,915		$233,520		$307,020		$1,500,000 a
C. Contingency	(20%)			$380,554		$478,554		$311,360		$409,360		$2,000,000 a
TOTAL ESTIMATED CAPITAL COSTS				$2,800,000		$3,500,000		$2,300,000		$3,000,000		$320,000,000

Notes: a. Estimated costs not based on a percentage of capital costs.
b. Costs adjusted to present worth cost for closure at year 30 (4% interest rate assumed).

TABLE III-1
(continued)

REMEDIAL ACTION	UNITS	UNIT COST	ALTERNATIVE 5A QUANTITY	ALTERNATIVE 5A COST	ALTERNATIVE 5B QUANTITY	ALTERNATIVE 5B COST	ALTERNATIVE 6A QUANTITY	ALTERNATIVE 6A COST	ALTERNATIVE 6B QUANTITY	ALTERNATIVE 6B COST	ALTERNATIVE 7 QUANTITY	ALTERNATIVE 7 COST
***************	*****	****	********	****	********	****	********	****	********	****	********	****
A. SITE PREPARATION												
1. Dewatering	LS	$250,000		$250,000		$250,000		$250,000		$250,000		$250,000
B. EXCAVATION/HANDLING OF CONTAMINATED MATERIALS												
1. Excavate Black Mud	ton	$5	165,660	$828,300	165,660	$828,300	165,660	$828,300	165,660	$828,300	165,660	$828,300
2. Excavate Residual Soils	ton	$5	38,969	$194,845	38,969	$194,845	38,969	$194,845	38,969	$194,845	38,969	$194,845
3. Excavate Perimeter Drain	lf	$20			3,000	$60,000			3,000	$60,000	3,000	$60,000
C. TRANSPORT AND TREATMENT/ DISPOSAL OF CONTAMINATED MATERIALS												
1. Transport/Dispose at Commercial Landfill	ton	$360	204,629	$73,666,440	204,629	$73,666,440						
2. Treat in On-Site Incinerator	ton	$200									204,629	$40,925,800
3. Dispose in On-Site Landfill	ton	$30					204,629	$6,138,870	204,629	$6,138,870	153,472 c	$4,604,160
4. On-Site Hauling	ton	$2					204,629	$409,258	204,629	$409,258	153,472 c	$306,944
D. COLLECTION/TREATMENT OF WATER												
1. Surface Water Impoundment	LS	$150,000				$150,000				$150,000		$150,000
2. Install Perimeter Drain	LS	$230,000				$230,000				$230,000		$230,000
3. Piping to NY GAC	LS	$50,000				$50,000				$50,000		$50,000
E. SITE RESTORATION												
1. Backfill and Compact	ton	$5	281,892	$1,409,460	281,892	$1,409,460	281,892	$1,409,460	281,892	$1,409,460	281,892	$1,409,460
2. Install RCRA Cap	sq ft	$5										
3. Grade and Seed	sq ft	$2	261,360	$522,720	261,360	$522,720	261,360	$522,720	261,360	$522,720	261,360	$522,720
DIRECT CAPITAL COSTS				$76,871,765		$77,361,765		$9,753,453		$10,243,453		$49,532,229
INDIRECT CAPITAL COSTS	(% of Direct Capital Costs)											
A. Implementation	(10%)			$1,000,000 a		$1,000,000 a		$975,345		$1,024,345		$4,953,223
B. Administration	(15%)			$1,500,000 a		$1,500,000 a		$1,463,018		$1,536,518		$7,429,834
C. Contingency	(20%)			$2,000,000 a		$2,000,000 a		$1,950,691		$2,048,691		$9,906,446
TOTAL ESTIMATED CAPITAL COSTS				$81,000,000		$82,000,000		$14,100,000		$14,900,000		$71,800,000

Notes: a. Estimated costs not based on a percentage of capital costs.
b. Costs adjusted to present worth cost for closure at year 30 (4% interest rate assumed).
c. Assume 25% volume reduction, and landfilling of the ash is required.

TABLE III-2
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS
BLACK MUD POND

REMEDIAL ACTION	ALT. 1A	ALT. 1B	ALT. 2A	ALT. 2B	ALT. 4C	ALT. 5A	ALT. 5B	ALT. 6A	ALT. 6B	ALT. 7
A. Groundwater Monitoring	$50,000 a	$50,000 a	$50,000	$50,000	$50,000	$50,000	$50,000	$70,000	$70,000	$60,000
B. Surface Water Monitoring	$50,000 a	$50,000 a	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000
C. Groundwater Recovery		$20,000 a		$20,000	$20,000		$20,000		$20,000	$20,000
D. Conveyance to NY GAC		$5,000 a		$5,000	$5,000		$5,000		$5,000	$5,000
E. Water Treatment (NY GAC)		$40,000 a		$40,000	$40,000		$40,000		$40,000	$40,000
F. Transport/Recycle Black Mud at Resource Recovery Facility	$460,000 b	$460,000 b								
G. RCRA Landfill Maintenance								$20,000	$20,000	$10,000
H. RCRA Cap Maintenance			$40,000	$40,000				$30,000	$30,000	$20,000
DIRECT O&M COSTS	$100,000 a $460,000 b	$165,000 a $460,000 b	$140,000	$205,000	$165,000	$100,000	$165,000	$170,000	$235,000	$205,000
INDIRECT O&M COSTS										
A. Administration (10% of O&M Costs)	$10,000 a $46,000 b	$16,500 a $46,000 b	$14,000	$20,500	$16,500	$10,000	$16,500	$17,000	$23,500	$20,500
B. Contingency (10% of O&M Costs)	$10,000 a $46,000 b	$16,500 a $46,000 b	$14,000	$20,500	$16,500	$10,000	$16,500	$17,000	$23,500	$20,500
TOTAL ESTIMATED O&M COSTS	$120,000 a $552,000 b	$198,000 a $552,000 b	$170,000	$250,000	$200,000	$120,000	$200,000	$200,000	$280,000	$250,000

Notes: a. Costs incurred from years 1 to 60.
b. Costs incurred from years 1 to 30.

TABLE III-3
SUMMARY OF REMEDIAL ALTERNATIVES
BLACK MUD POND

ALTERNATIVE	KEY COMPONENTS	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH (a)
1A	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater/Excavate Black Mud and Residual Soils D. Transport/Recycle Black Mud at Resource Recovery Facility E. Dispose Residual Soils in On-Site Landfill F. Backfill, Grade and Seed Excavated Area	$2,800,000	$120,000 b $552,000 c	$15,000,000
1B	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater/Excavate Black Mud and Residual Soils D. Transport/Recycle Black Mud at Resource Recovery Facility E. Dispose Residual Soils in On-Site Landfill F. Backfill, Grade and Seed Excavated Area G. Groundwater Recovery/Treatment H. Surface Water Collection/Treatment	$3,500,000	$198,000 b $552,000 c	$18,000,000
2A	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater Black Mud In Place D. Install RCRA Cap	$2,300,000	$170,000	$5,200,000
2B	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater Black Mud In Place D. Install RCRA Cap E. Groundwater Recovery/Treatment F. Surface Water Collection/Treatment	$3,000,000	$250,000	$7,300,000

Notes: a. 30-year post-closure period, 4% discounted rate-of-return.
b. Costs incurred from years 1 to 60.
c. Costs incurred from years 1 to 30.

TABLE III-3
(continued)

ALTERNATIVE	KEY COMPONENTS	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH (a)
4C	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater/Excavate Black Mud and Residual Soils D. Transport/Dispose Black Mud and Residual Soils at Commercial Incinerator E. Backfill, Grade and Seed Excavated Area F. Groundwater Recovery/Treatment G. Surface Water Collection/Treatment	$320,000,000	$200,000	$320,000,000
5A	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater/Excavate Black Mud and Residual Soils D. Transport/Dispose Black Mud at Commercial Landfill E. Backfill, Grade and Seed Excavated Area	$81,000,000	$120,000	$83,000,000
5B	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater/Excavate Black Mud and Residual Soils D. Transport/Dispose Excavated Material at Commercial Landfill E. Backfill, Grade and Seed Excavated Area F. Groundwater Recovery/Treatment G. Surface Water Collection/Treatment	$82,000,000	$200,000	$85,000,000
6A	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater/Excavate Black Mud and Residual Soils D. Dispose Black Mud/Residual Soils in On-Site RCRA Cell E. Backfill, Grade and Seed Excavated Area	$23,000,000	$200,000	$26,000,000

Notes: a. 30-year post closure period, 4% interest rate.

TABLE III-3
(continued)

ALTERNATIVE	KEY COMPONENTS	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH (a)
6B	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater/Excavate Black Mud and Residual Soils D. Dispose Black Mud/Residual Soils in On-Site RCRA Cell E. Backfill, Grade and Seed Excavated Area F. Groundwater Recovery/Treatment G. Surface Water Collection/Treatment	$14,900,000	$280,000	$20,000,000
7	A. Monitor Existing Wells B. Monitor Surface Water C. Dewater/Excavate Black Mud and Residual Soils D. Treat in On-Site Incinerator E. Place Treated Residuals in On-Site RCRA Cell F. Backfill, Grade and Seed Excavated Area G. Groundwater Recovery/Treatment H. Surface Water Collection/Treatment	$71,800,000	$250,000	$76,000,000

Notes: a. 30-year post-closure period, 4% discounted rate-of return assumed.

TABLE III-4

COMPARISON OF BLACK MUD POND
REMEDIAL ALTERNATIVES
REYNOLDS METALS, MASSENA, NEW YORK

Criteria	Alternative 1A (Resource Recovery)	Alternative 1B (Resource Recovery & Water Treatment)	Alternative 2A (Cap)
Short-Term Impacts and Effectiveness	Potential short-term impacts during removal and transport.	Potential short-term impacts during removal and transport.	Minimal potential short-term impacts.
Long-Term Effectiveness and Permanence	Effective in eliminating contact with, and migration of, contaminants. Permanent solution for most of the contaminated material.	Effective in eliminating contact with, and migration of, contamination. Permanent solution for most of the contaminated material.	Effective in eliminating contact with contaminants.
Reduction of Toxicity, Mobility or Volume	Resource recovery for black mud would reduce contaminant toxicity, mobility and volume.	Resource recovery for black mud would reduce contaminant toxicity, mobility and volume.	Cap will reduce contaminant migration potential.
Implementability	Technically feasible. Administrative feasilibilty is uncertain, problems may include obtaining appropriate approvals for resource recovery.	Technically feasible. Administrative feasiblity is uncertain, problems may include obtaining appropriate approvals for resource recovery.	Easily implemented. Technically and administratively feasible.
Compliance with ARARs	ARARs would be satisifed.	ARARs would be satisifed.	ARARs would be satisfied.
Overall Protection of Human Health and the Environment	Protective to human health and the environment by eliminating contact with contaminants.	Protective to human health and the environment by eliminating contact with, and migration of, contaminants.	Protective to human health and the environment by eliminating contact with contaminants.
Cost	Total present worth cost is approximately $15,000,000.	Total present worth cost is approximately $18,000,000.	Total present worth cost is approximately $5,200,000.

TABLE III-4
(continued)

Criteria	Alternative 2B (RCRA Cap and Water Treatment)	Alternative 4C (Incineration)	Alternative 5A (Off-Site Landfill)
Short-Term Impacts and Effectiveness	Minimal potential short-term impacts.	Potential short-term impacts during removal, transport and incineration.	Potential short-term impacts during removal and transport.
Long-Term Effectiveness and Permanence	Effective in eliminating contact with, and migration of, contaminants.	Effective in eliminating contact with, and migration of, contaminants; will destroy organic contaminants.	Effective in eliminating contact with contaminants.
Reduction of Toxicity, Mobility or Volume	Cap will reduce contaminant migration potential.	Incineration will reduce the toxicity and volume of the treated residuals.	Off-site landfilling will reduce contaminant migration potential.
Implementability	Easily implemented. Technically and administratively feasible.	Difficult to implement. Technically feasible; Administrative feasibility uncertain; problems may include obtaining appropriate approvals for waste treatment.	Implementable. Technically feasible, adminstrative feasibility is less clear.
Compliance with ARARs	ARARs would be met.	ARARs would be met.	ARARs would be met.
Overall Protection of Human Health and the Environment	Protective to human health and the environment by eliminating contact with, and migration of, contaminants.	Protective to human health and the environment by eliminating contact with contaminants.	Protective to human health and the environment by eliminating contact with contaminants.
Cost	Total present worth cost is approximately $7,300,000.	Total present worth cost is approximately $320,000,000.	Total present worth cost is approximately $83,000,000.

TABLE III-4
(continued)

Criteria	Alternative 5B (Off-Site Landfill with Water Treatment)	Alternative 6A (On-Site Landfill)	Alternative 6B (On-Site Landfill with Water Treatment)
Short-Term Impacts and Effectiveness	Potential short-term impacts during removal and transport.	Potential short-term impacts during removal and transport.	Potential short-term impacts during removal and transport.
Long-Term Effectiveness and Permanence	Effective in eliminating contact with, and migration of, contaminants.	Effective in eliminating contact with, and migration of, contaminants.	Effective in eliminating contact with, and migration of, contaminants.
Reduction of Toxicity, Mobility or Volume	Off-site landfilling will reduce contaminant migration potential.	On-site landfilling will reduce contaminant migration potential.	On-site landfilling will reduce contaminant migration potential.
Implementability	Implementable. Technically feasible, administrative feasibility is less clear.	Implementable. Technically feasible, administrative feasibility is less clear.	Implmenetable. Technically feasible, administrative feasibility is less clear.
Compliance with ARARs	ARARs would be met.	ARARs would be met.	ARARs would be met.
Overall Protection of Human Health and the Environment	Protective to human health and the environment by eliminating contact with, and migration of, contaminants.	Protective to human health and the environment by eliminating contact with contaminants.	Protective to human health and the environment by eliminating contact with, and migration of, contaminants.
Cost	Total present worth cost is approximately $85,000,000.	Total present worth cost is approximately $26,000,000.	Total present worth cost is approximately $20,000,000.

TABLE III-4
(continued)

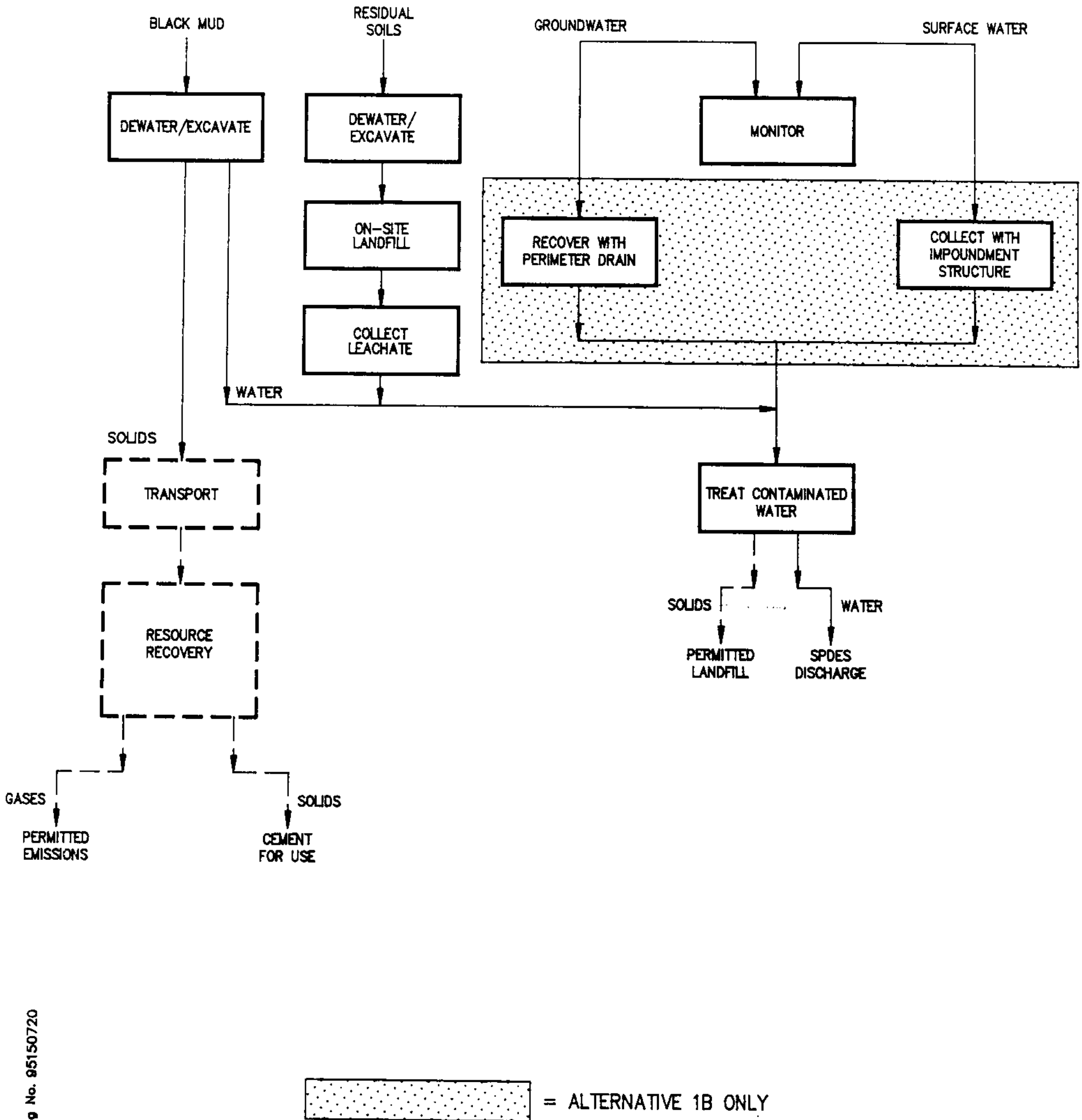
Criteria	Alternative 7 (On-Site Incineration)
Short-Term Impacts and Effectiveness	Potential short-term impacts during removal, transport and incineration.
Long-Term Effectiveness and Permanence	Effective in eliminating contact with, and migration of, contaminants; will destroy organic contaminants.
Reduction of Toxicity, Mobility or Volume	Incineration will reduce the toxicity and volume of treated residuals.
Implementability	Difficult to implement. Technically feasible; Administrative feasibility uncertain; problems may include obtaining appropriate approvals for waste treatment
Compliance with ARARs	ARARs would be met.
Overall Protection of Human Health and the Environment	Protective to human health and the environment by eliminating contact with contaminants.
Cost	Total present worth cost is approximately $76,000,000.

TABLE III-5

SCORING OF BLACK MUD POND REMEDIAL ALTERNATIVES ACCORDING TO NYSDEC TAGM REYNOLDS METALS COMPANY MASSENA, NEW YORK

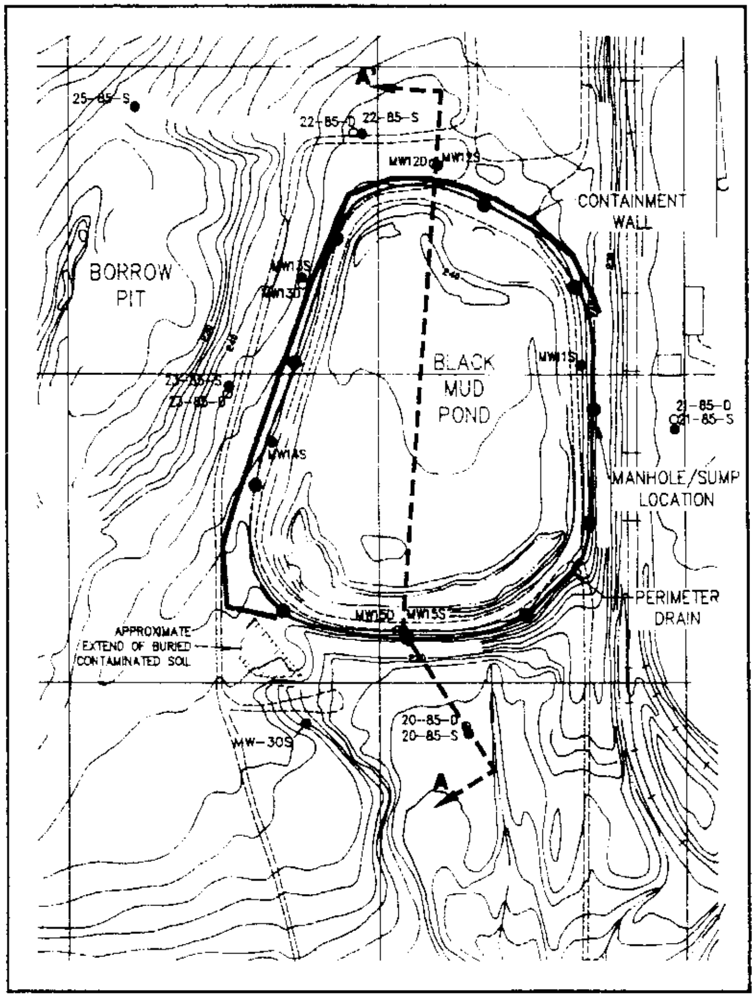
	Alternatives									
	1A	1B	2A	2B	4C	5A	5B	6A	6B	7
Short-Term Impacts and Effectiveness (10)	7	7	10	10	6	8	8	8	8	6
Long-Term Effectiveness and Permanence (15)	14	14	7	7	15	10	11	7	7	16
Reduction of Toxicity, Mobility or Volume (15)	14	14	0	0	11	0	0	0	0	12
Implementability (15)	9	9	14	15	9	12	13	12	14	9
Compliance with ARARs (10)	10	10	10	10	10	10	10	10	10	10
Protection of Human Health and the Environment (20)	20	20	20	20	20	20	20	20	20	20
Cost (15)	14	14	15	15	0	11	11	14	14	11
TOTAL	88	88	76	77	71	71	73	71	73	84

FIGURE III-1
BLACK MUD POND
PROCESS FLOW DIAGRAM
ALTERNATIVES 1A AND 1B



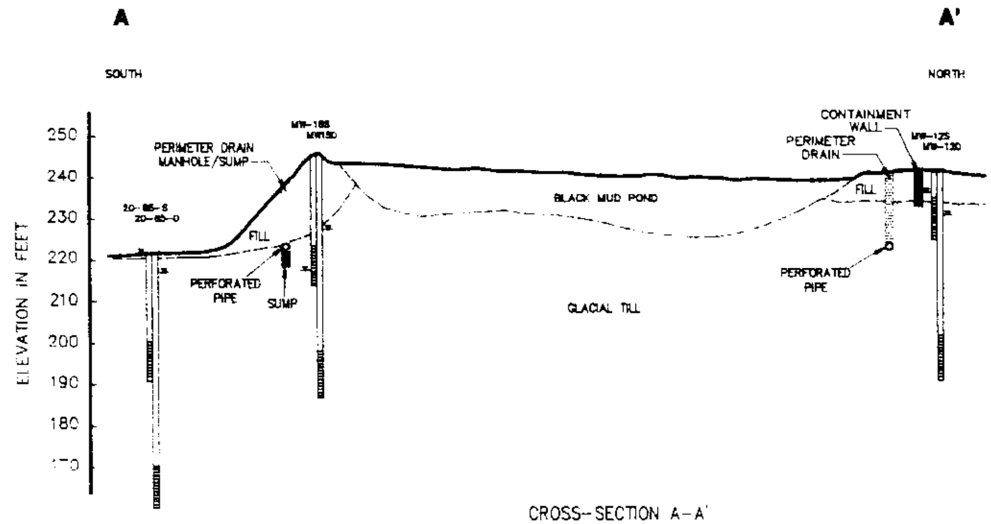
NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

Drawing No. 95150720



TOPOGRAPHIC MAP AND PLAN VIEW

0 200 FEET



CROSS-SECTION A-A'

NOT TO SCALE

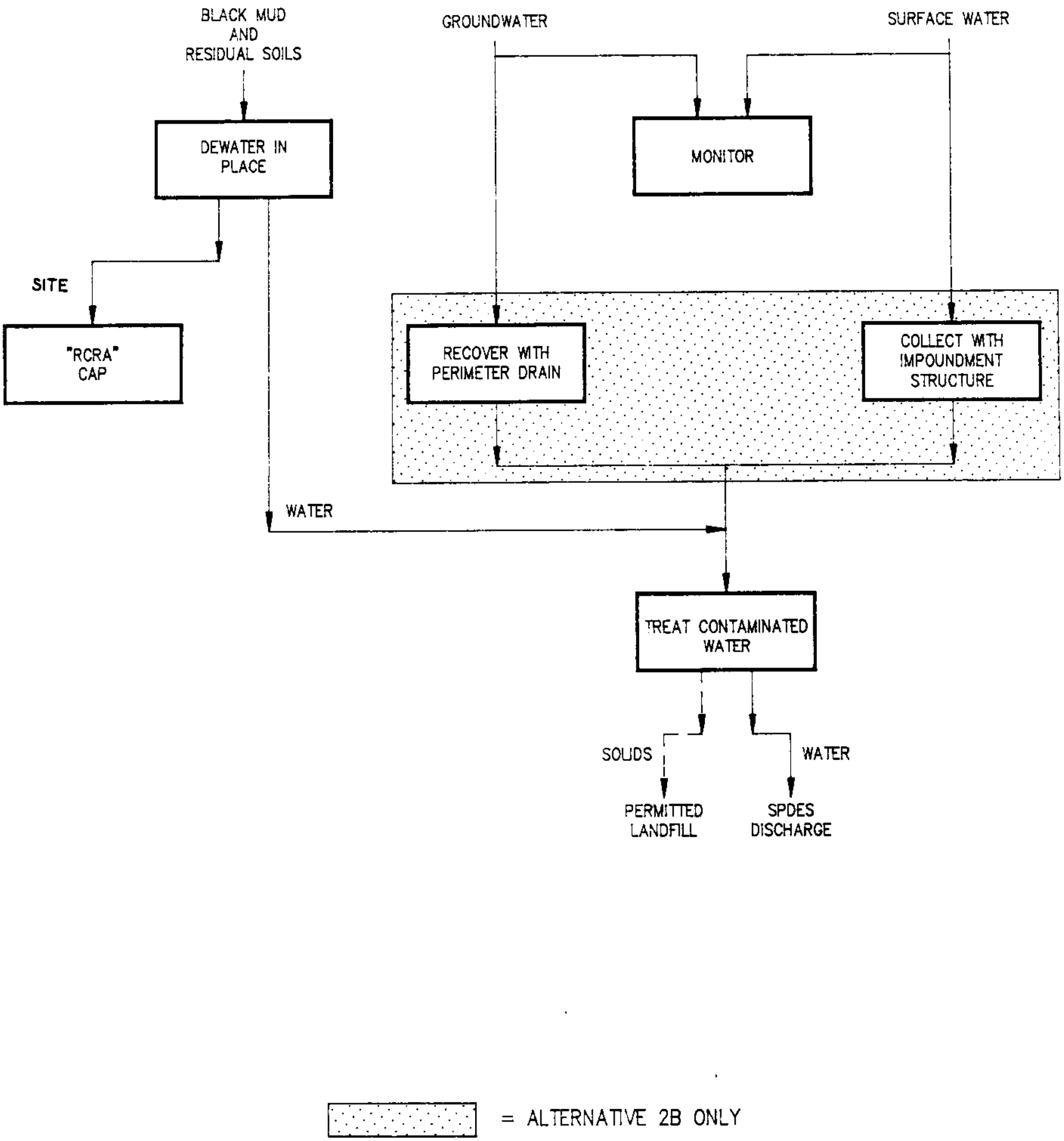
Rev. No.	Date	Type of Revision	Checked by:

BLACK MUD POND AREA AND
PERIMETER DRAIN CONCEPTUAL DESIGN
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-5	Drawing No. 95150700	Date: 5/16/91
Drawn by: D.E.G.	Checked by: D.M.H.	
Scale: AS NOTED		FIGURE III-2

FIGURE III-3
BLACK MUD POND
PROCESS FLOW DIAGRAM
ALTERNATIVES 2A AND 2B



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

FIGURE III-4
BLACK MUD POND
PROCESS FLOW DIAGRAM
ALTERNATIVE 4C

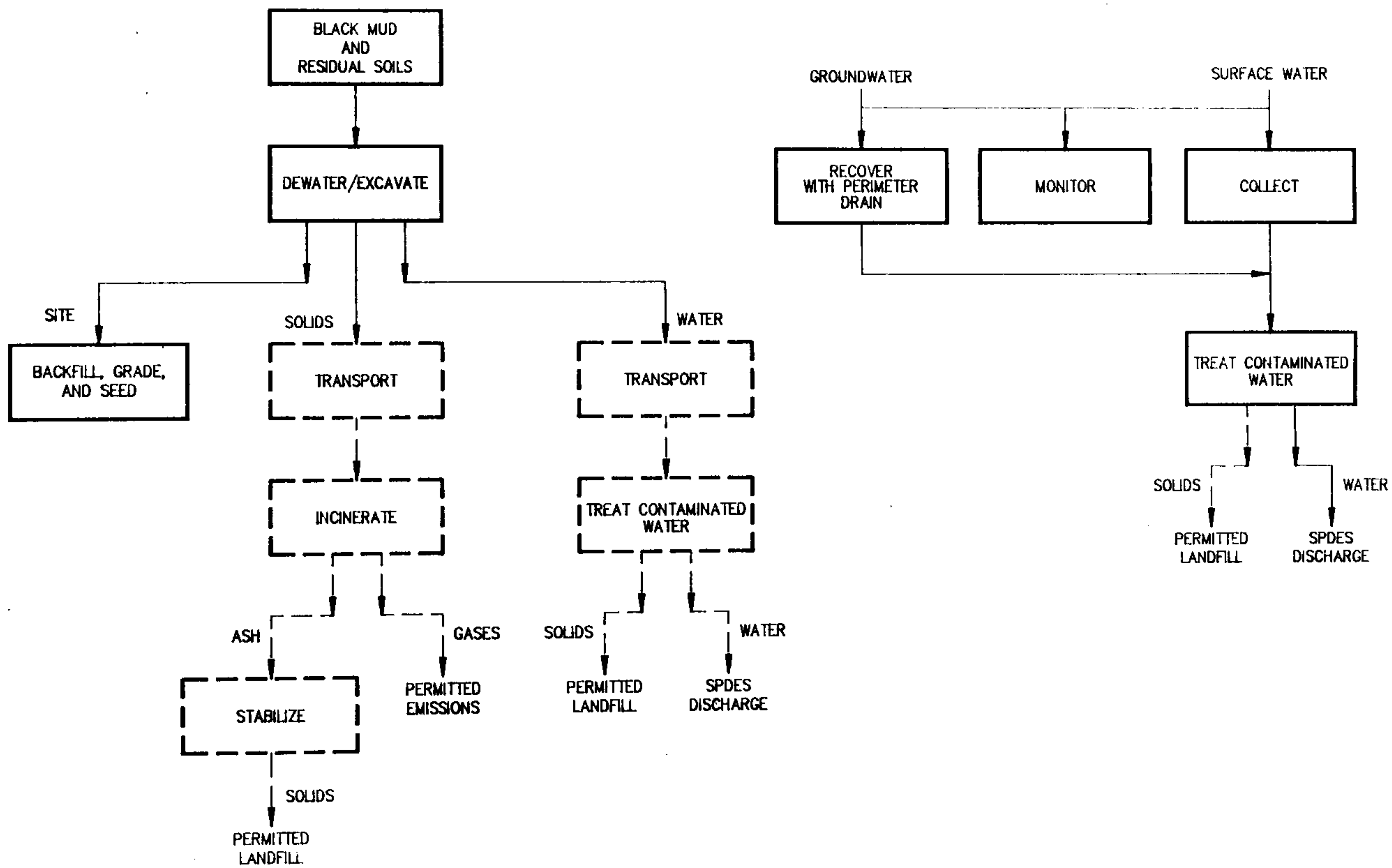
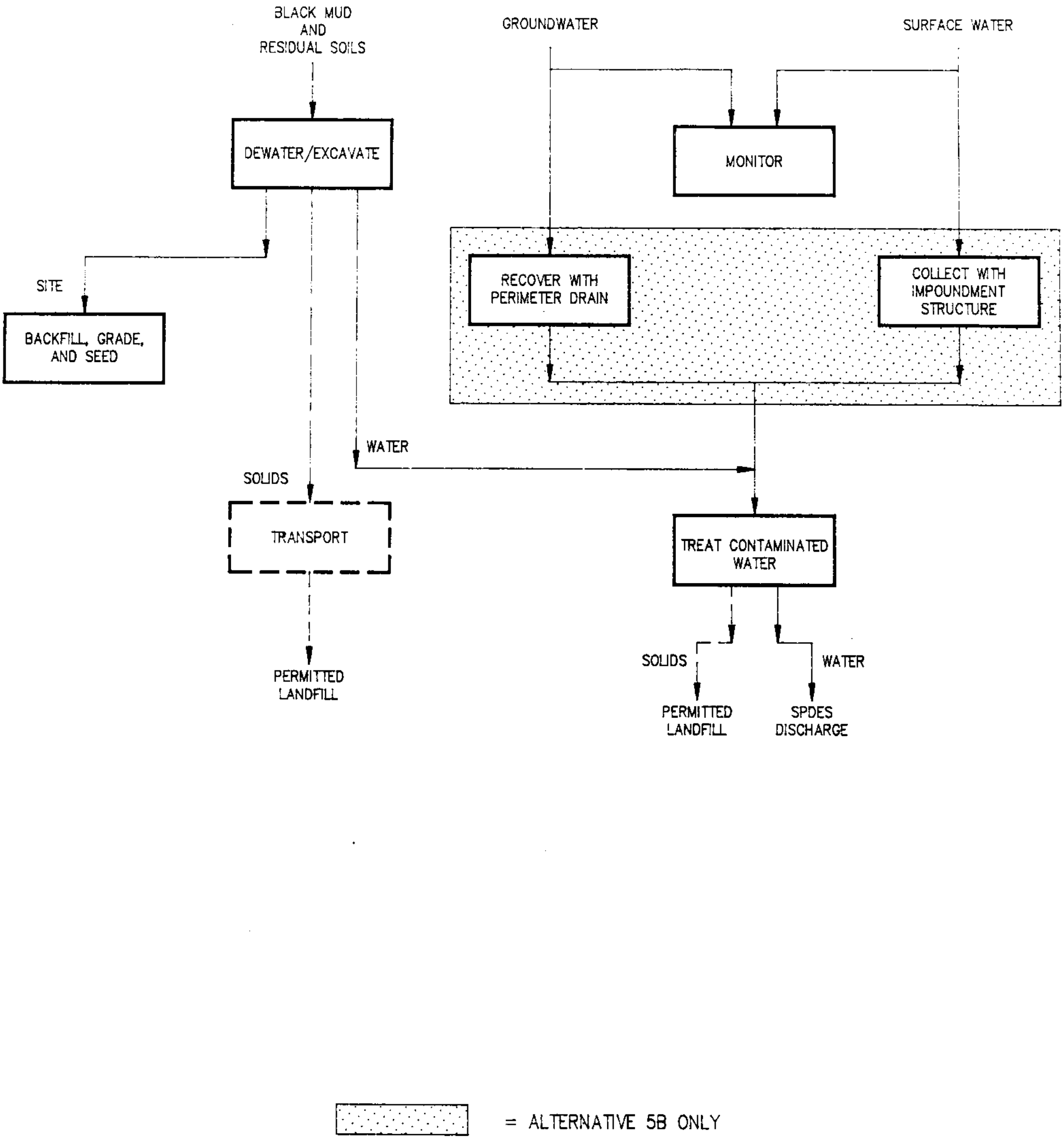
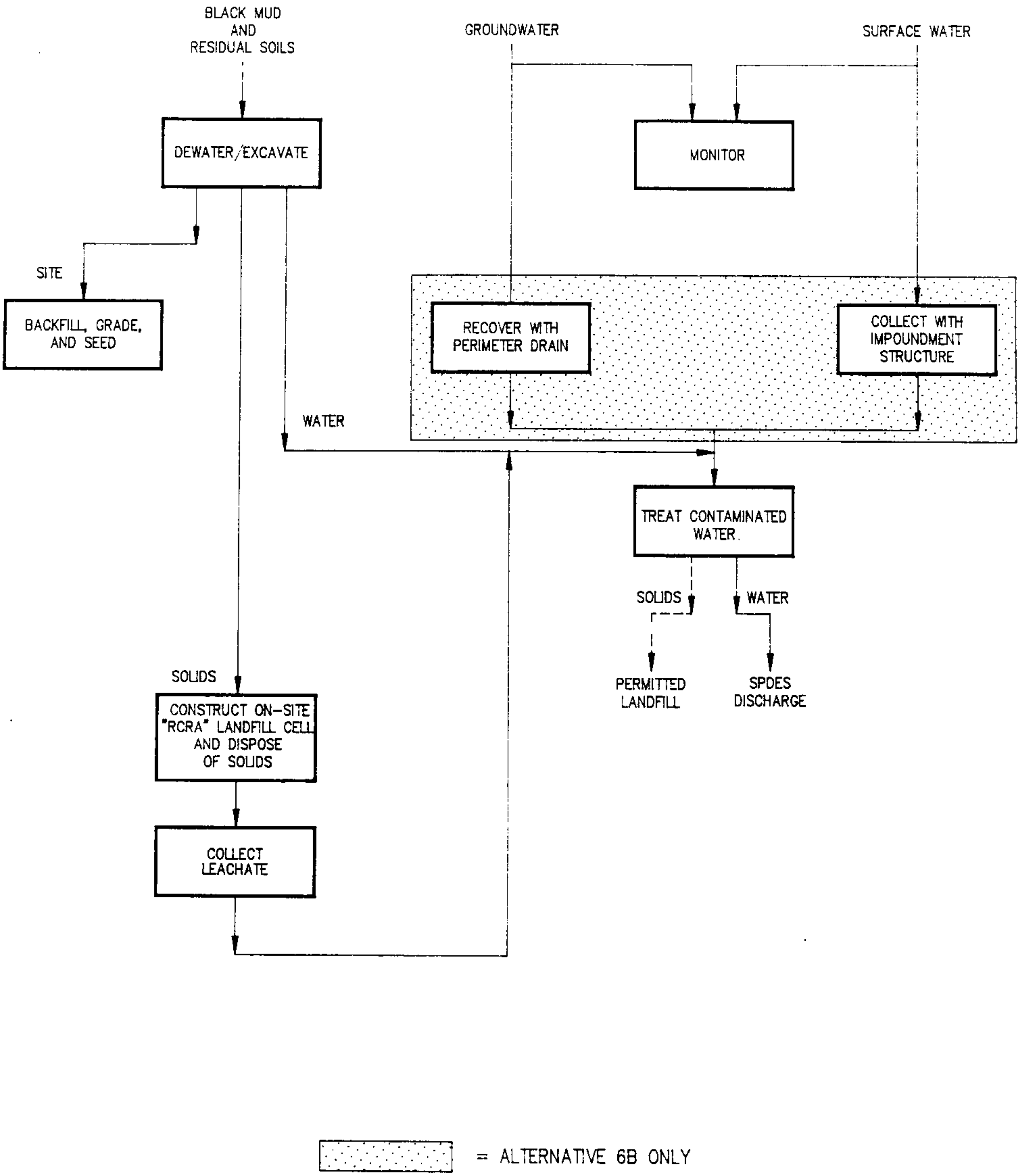


FIGURE III-5
BLACK MUD POND
PROCESS FLOW DIAGRAM
ALTERNATIVES 5A AND 5B



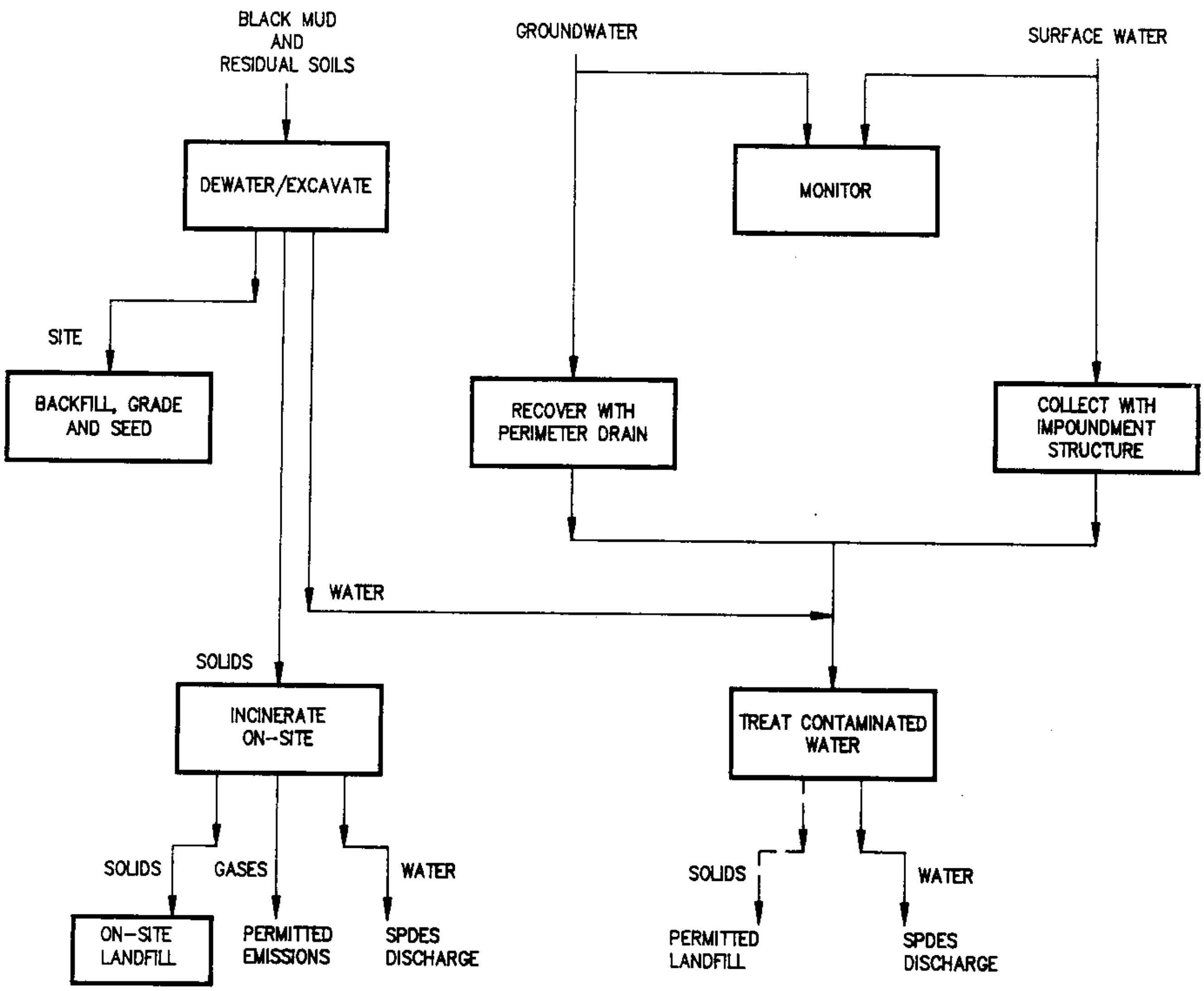
NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

FIGURE III-6
BLACK MUD POND
PROCESS FLOW DIAGRAM
ALTERNATIVES 6A AND 6B



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

FIGURE III-7
BLACK MUD POND
PROCESS FLOW DIAGRAM
ALTERNATIVE 7



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

Drawing No. 95155000

PART IV: LANDFILL AND FORMER POTLINER STORAGE AREA

10.0
ANALYSIS OF ALTERNATIVES

The results of the Preliminary FS indicated four remedial alternatives for the Landfill and Former Potliner Storage Area. For the purposes of these discussions, the "Landfill Area" consists of the Landfill and berm as well as the Former Potliner Storage Area. Discussion of each alternative follows, including consideration of the following seven NYSDEC evaluation criteria required for this FS:

- Short-Term Impacts and Effectiveness
- Long-Term effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Implementability
- Compliance with ARARs
- Overall Protection of Human Health and the Environment
- Cost

10.1 ALTERNATIVE 1B - LANDFILL CAP

10.1.1 Alternative Definition

Remedial alternative 1B consists of the following key components:

- Control surface water run-on/run-off
- Dewater waste/soil in-place as needed
- Install a perimeter drain to recover and treat groundwater/leachate
- Install a RCRA-equivalent cap
- Monitor groundwater and surface water

A process flow diagram for the components of this alternative is presented in Figure IV-1. Components shown by dashed lines are those which would occur off-site.

A permanent perimeter drain, as described in Section 6.2.2, would be installed at the base of the Landfill Area to collect contaminated groundwater/leachate for treatment. Figure IV-2 shows a plan view of the perimeter drain to illustrate the intended design. The drain would be installed around the Landfill Area along the outside of the existing berm, which would be capped. Cross-sections of the Landfill Area which show soil stratigraphy and groundwater elevations can be found in the Phase I RI Report (Figures 14, 15 and 18), and in the Final RI Report (Figures 27 and 28). As is apparent from the cross-sections, the soil outside of the existing berm is a glaciolacustrine clay; it is into this soil that the perimeter drain would be installed. The drain would be installed to a depth of 2-3 feet below the toe of the berm. The drain is not necessary around the upgradient side of the Landfill Area since there is little upgradient inflow to the area. The soils excavated to install the perimeter drain would be placed in the Landfill Area prior to installation of the Landfill cap. The perimeter drain would include a geotextile liner, crushed stone, and a perforated pipe at the bottom, and would be graded to induce drainage to approximately ten sumps along its length. The water collected from the drain would be pumped to the existing North Yard GAC system for treatment.

Surface water run-on and run-off controls are required by all of the remedial alternatives for the Landfill Area. The surface water run-on would be directed away from the Landfill Area, by swales to the south, towards the Raquette River. Run-off from the Landfill cap would be directed away from the perimeter drain and the Wetlands Area.

After installation of the perimeter drain, a RCRA-style cap will be installed over the entire area, including the existing berms. The subbase for the cap would be graded to inhibit flow onto the Landfill Area, and would promote drainage of the surface water run-off. The cap design would be as described in Section 6.2.1.

10.1.2 Short-Term Impacts and Effectiveness

The short-term impacts of this alternative would be minimal, as implementation of alternative 1B would not require the handling or transport of large volumes of contaminated soils or waste. Cap installation would involve potential contact with the contaminated solids only at the beginning of installation. Any contact with the contaminated groundwater/leachate would be minimized by measures to control spillage and leakage during operations. Standard health and safety practices would be implemented to minimize worker exposure.

10.1.3 Long-Term Effectiveness and Permanence

Cap maintenance would ensure that it has the long-term ability to restrict contact with the contaminated materials in the Landfill Area. This maintenance would include monthly inspections and repair, as necessary, and a periodic surface survey to monitor settlement, as discussed in detail in Section 6.2.1. The cap is expected to effectively maintain its integrity in the long-term, thus providing an effective barrier to surface water contamination and rain water infiltration, as well as to human and animal contact with the wastes. Because surface water would no longer come into contact with the wastes, installation of the RCRA-style cap is expected to enhance the surface water quality in the Landfill Area.

Reduced rain water infiltration should also result in reduced quantities of contaminated leachate over time. During a transition period after cap installation, the residual water content in the contaminated materials would drain by gravity into the perimeter drain. Because surface water infiltration into the contaminated materials would be mitigated by the cap, minimal recharge would occur; thus the rate of flow of this leachate into the drain would gradually decrease. Because of the inherent variability of the fill/wastes/soils in the Landfill Area, quantitative estimates of residual water content and leachate flow rates during the transition period described above are impractical. The infiltration rate through the cap is expected to be negligible, and is estimated quantitatively in Appendix F. Thus, in the long-term with the appropriate maintenance of the cap and the leachate recovery system, the implementation of these remedial measures should be very effective in mitigating potential adverse environmental impacts from the area.

10.1.4 Reduction of Toxicity, Mobility or Volume

The installation of a RCRA-type cap would act to isolate the wastes in the Landfill Area. This, in conjunction with surface water controls, and groundwater recovery and treatment, would effectively mitigate contaminant transport pathways from the area. Treatment of the dewatering liquids would reduce the volume of the contaminants in the area.

10.1.5 Implementability

The cap installation would be implemented using standard construction practices and the appropriate health and safety measures. The perimeter drain installation and construction of surface water control swales would also be implemented using standard practices.

It is not anticipated that any implementability issues would cause schedule delays for this alternative. However, implementation of the remedial measures would need to be coordinated with remediation of the adjacent Wetlands Area. Off-site TSD services would not be required for this alternative. It is assumed that construction services would be available from several vendors at the time of construction.

10.1.6 Compliance With ARARs

All ARARs would be met with this alternative, as described below.

Water treatment would reduce contaminant levels in the leachate to comply with the applicable New York State SCGs. Monitoring of the groundwater would be used to assess progress in attaining the ARARs in the vicinity.

Surface water quality would be expected to improve significantly because the cap and surface water controls would no longer allow surface water to contact the contaminated materials in the Landfill Area. Routine monitoring of the surface water would determine whether or not ARARs are achieved.

10.1.7 Overall Protection of Human Health and the Environment

Installation of the RCRA-style cap required by alternative 1B would protect human health and the environment. The cap would eliminate any potential contact with the Landfill Area wastes.

The cap integrity would be ensured by regular maintenance procedures. The controls for groundwater and surface water would eliminate contaminant transport from the area. The treatment of groundwater would effectively mitigate any long-term risks associated with the leachate from the Landfill Area.

10.1.8 Cost

The direct and indirect capital costs for all alternatives for the Landfill Area are itemized in Table IV-1. The estimated capital cost for alternative 1B is $4,000,000. O&M costs are summarized on Table IV-2, they are estimated to be $220,000, which would allow for regular cap maintenance as well as leachate collection and treatment. The present worth costs for this alternative are estimated to be $7,800,000, based on a 4 percent interest rate over a 30-year period. Table IV-3 summarizes all of the above costs. Appendix A describes the assumptions used to estimate both capital and O&M costs in the Landfill Area.

10.2 ALTERNATIVE 2A - INCINERATION

10.2.1 Alternative Definition

Alternative 2A would effect "clean closure" of the Landfill Area and consists of the following key components:

- Install temporary systems to collect leachate from the Landfill Area for treatment
- Control surface water run-on/run-off
- Excavate Landfill Area wastes and contaminated soils
- Sort wastes/soils for incineration or disposal
- Backfill, grade and seed excavated area

A process flow diagram for the components of this alternative is presented in Figure IV-3. Excavation of the Landfill Area wastes would proceed with the use of local sumps when saturated areas are encountered to dewater the waste materials. All excavated wastes would be sorted to remove large materials not suitable for incineration. The incinerable wastes would be transported in bulk for treatment at an off-site incinerator. Upon completion of the remedial measures, groundwater collection and treatment would not be feasible because the remediation would remove the only water-bearing strata (fill and wastes) above the low permeability natural soil (glaciolacustrine clay).

Sorting of the Landfill materials would be required to separate non-incinerable materials from the bulk of the waste. Non-incinerable materials would include construction debris such as large pieces of structural steel and concrete, and other such heavy materials that have been disposed of in the Landfill. Some oversized materials, such as large pieces of wood or other miscellaneous construction debris, could be shredded prior to incineration. The RI Report estimated the construction debris to comprise 30 percent of the Landfill volume.

The excavated area would be backfilled to provide a base for seeding and would be graded to promote effective surface water drainage from the area. Swales and/or berms would be constructed as necessary to prevent run-on of surface water from adjacent areas.

10.2.2 Short-Term Impacts and Effectiveness

The potential short-term impacts associated with alternative 2A are significant and are primarily those resulting from materials handling operations for such a large volume of contaminated materials (i.e., approximately 350,000 tons of wastes/soils). The potential impacts would result from contact with the materials during excavation, sorting, and transport to the incineration facility. It is estimated that more than 12,000 truck loads would be required to transport the wastes and soils. This additional truck traffic could adversely effect plant scheduling. In addition, if an accident occurred, the transport of these wastes could pose a threat to human health and/or the environment, as discussed in Section 7.3.2. The air emissions and treated residuals resulting from the incineration process could pose a threat to the environment at the incinerator location. Emission control equipment and proper management of the treated residuals would minimize the threat to the local environment.

Besides the routine construction hazards of such large-scale materials handling operations, any dust generated during excavation activities would likely be contaminated. This would be a health consideration for area workers and a potentially harmful impact on the local environment if it were to migrate from the immediate area. Therefore, dust control measures common to the construction industry would be implemented, in addition to health and safety precautions deemed necessary for workers in the area.

Contact with contaminated leachate collected during implementation of the remediation measures would be minimized. Pumping of the water to the on-site treatment facility would be instituted to minimize spillage and leakage of the contaminated water.

The short-term effectiveness of alternative 2A is primarily associated with removal of the contaminated materials from the Landfill Area, which thereby prohibits contact with the materials. The potential short-term impacts associated with the implementation of these remedial measures, however, outweigh their short-term benefits.

10.2.3 Long-Term Effectiveness and Permanence

Implementation of the remedial measures required by alternative 2A would prove effective in the long-term for the Landfill Area. Removal and treatment of the contaminated materials would prohibit contact with those materials. In addition, backfilling and grading of the remediated area would make it available for future use. Long-term management of the incinerator ash may be required.

10.2.4 Reduction of Toxicity, Mobility, or Volume

Incineration of these contaminated materials would destroy the organic contaminants in the waste, thereby reducing their toxicity with respect to organics. However, the air emissions and the ash generated are potentially toxic by-products of incineration. Removal and transport of the Landfill Area wastes/soils to a commercial incinerator for treatment would mitigate any potential for contaminant transport from the area via all media. The treated residuals would be smaller in volume than the original materials; however this may be offset if stabilization were required prior to the ultimate disposal of the ash.

10.2.5 Implementability

The implementability of the remedial measures required by alternative 2A is uncertain with respect to both technical and administrative aspects. The technical aspects of excavating and sorting the Landfill material are not clear. Administratively, disposal approvals would have to be obtained for both material which could be incinerated and material which cannot be incinerated, and the incinerator would have to be TSCA-approved. Based on the heterogeneous nature of the material, it is unlikely that the necessary approvals could be obtained. The most uncertain aspect of this alternative is the amount of non-incinerable materials likely to be encountered. In addition, because of the large volume of materials which would require treatment, special scheduling provisions would be required to ensure incinerator availability.

Implementation of these remedial measures would need to be completed prior to remediation of the adjacent Wetlands.

10.2.6 Compliance with ARARs

This alternative could be implemented to meet all ARARs. It is anticipated that surface water quality in the area would improve significantly because run-off would no longer be in contact with the contaminated materials of the Landfill Area. In addition to source removal, collection and treatment of the contaminated leachate during the remediation process would improve local groundwater quality.

10.2.7 Overall Protection of Human Health and the Environment

Alternative 2A would provide overall protection of human health and the environment. The removal and treatment of the Landfill Area wastes/soils at a commercial incinerator would prohibit contact with, or leachate generated from the materials in the long-term. In addition, backfilling and grading of the area would make the land available for future use.

10.2.8 Cost

The estimated capital costs for alternative 2A are itemized in Table IV-1. They are prohibitively high, totalling $540,000,000. The capital costs associated with off-site incineration are much higher than costs for the other alternatives. There are no significant O&M costs for this alternative after implementation of the remedial measure has been completed. Appendix A summarizes the assumptions and sources used for the cost estimates.

10.3 ALTERNATIVES 3A AND 3B - LANDFILL DISPOSAL

10.3.1 Alternative Definitions

Alternatives 3A and 3B consist of the following key components:

- Control surface water run-on/run-off
- Collect and treat leachate from the Landfill Area
- Excavate Landfill Area wastes and contaminated soils with dewatering as necessary
- Dispose of the wastes in a permitted landfill
- Backfill, grade, and seed excavated area

The primary difference between alternatives 3A and 3B is that alternative 3A requires disposal at on off-site landfill, whereas alternative 3B requires construction of a new on-site landfill cell for disposal of the wastes and contaminated soils. Figures IV-4 and IV-5 show process flow diagrams for the components of both alternatives. For alternative 3B, an on-site cell would be designed, constructed and permitted so that all wastes, debris and contaminated soil could be disposed of in a secure RCRA-like facility. The conceptual design of the on-site cell is included as Appendix E.

Other components of alternatives 3A and 3B would proceed as described for alternative 2A, above, which also requires excavation of materials, leachate collection and treatment, surface water controls and restoration of the excavated area. Both of these alternatives would result in "clean closure" of the Landfill Area.

10.3.2 Short-Term Impacts and Effectiveness

The potential short-term impacts associated with alternatives 3A and 3B are similar to those described in Section 10.2.2 for alternative 2A and are considered significant. Off-site operations would differ, as evident when Figures IV-4 and IV-5 are compared. Because alternative 3B requires construction of an on-site landfill cell, the short-term risks of transportation of the wastes would be reduced. Exposure of the workers to the contaminated materials would be minimized as described in Section 10.2.2.

Alternatives 3A and 3B both provide the same degree of short-term effectiveness. The effectiveness is primarily associated with the removal of the Landfill materials from their current location, thus preventing future contact with the materials. However, the short-term impacts of materials handling of the contaminated materials outweigh the short-term benefits.

10.3.3 Long-Term Effectiveness and Permanence

Implementation of alternative 3A or 3B would require the excavation of the Landfill Area wastes and contaminated soils. Disposal of the wastes in a secure landfill would eliminate the potential for contact with the materials, and would ensure that no further surface water or groundwater contamination would occur in the Landfill Area. In addition, leachate would be collected and treated during the remediation. Backfilling and grading of the Landfill Area after excavation and disposal of the materials would make the area available for future use.

For Alternative 3B, regular maintenance and monitoring of the landfill cell and cap would be required to ensure continued performance over the long-term. Required long-term operation and maintenance of the cell and cap are as described in Section 6.2.2.

10.3.4 Reduction of Toxicity, Mobility, or Volume

For alternatives 3A and 3B, removal and disposal of the contaminated materials in a secure landfill would mitigate the potential for contaminant transport. Water collection and treatment associated with both alternatives would reduce the volume of contaminated materials.

10.3.5 Implementability

The implementability of measures required by alternatives 3A and 3B is uncertain with respect to both technical and administrative aspects. The technical aspects of excavating and sorting the Landfill materials are not clear. Administratively, disposal and/or construction approvals would have to be obtained for both the off-site and on-site Landfill alternatives. Obtaining the necessary approvals is uncertain. Waste manifests and tracking procedures would be prepared and followed throughout the remediation process, and the off-site disposal would be conducted in compliance with the NYSDEC TAGM 3018 (October 1990).

10.3.6 Compliance With ARARs

It is anticipated that surface water quality in the area would improve significantly because the surface water run-off would no longer be in contact with the contaminated materials of the Landfill Area. In addition, source removal and collection and treatment of the contaminated leachate during the remediation process would improve local groundwater quality. These measures would be implemented in a manner to assure that the alternative meets all ARARs.

10.3.7 Overall Protection of Human Health and the Environment

Alternatives 3A and 3B provide overall protection of human health and the environment. The removal and disposal of the Landfill Area wastes/soils at a secure landfill cell would prohibit any contact with the contaminated materials. In addition, removal of these source materials would mitigate further contamination of groundwater and surface water.

10.3.8 Cost

The estimated direct and capital costs for alternatives 3A and 3B are itemized in Table IV-1. As is apparent from the table, the costs for transport and disposal at an off-site facility (total capital cost of $130,000,000) are higher than the costs of on-site disposal (total capital cost of $21,000,000). O&M costs for disposal in an on-site cell ($108,000 per year) are higher than for off-site disposal (no O&M costs) (Table IV-2). Present worth costs are estimated over a 30-year period with a 4 percent interest rate (Table IV-3). These costs show that the O&M costs incurred over a 30-year period for the on-site cell are insignificant compared to the initial capital costs associated with the approximately 350,000 tons of wastes and soils. Appendix A summarizes the assumptions and sources used for the capital and O&M cost estimates.

11.0
COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, the four alternatives available for the Landfill Area are compared. The comparison is based on the seven evaluation criteria established by NYSDEC. The alternatives were evaluated against the seven criteria in Section 10.0. The comparison of alternatives for the Landfill will facilitate the presentation of conclusions and recommendations in Section 12.0.

A direct comparison between alternatives for the Landfill is summarized in Table IV-4. A compilation of scores for each alternative, scored according to NYSDEC TAGM Tables 5-2 through 5-7, is presented in Table IV-5. The table format allows for easy comparisons of the alternatives on each criterion. A brief discussion for each criteria is presented below. Two elements not addressed here are the criteria of state and community acceptance, which the NYSDEC will evaluate prior to selecting the final remedy.

11.1 SHORT-TERM IMPACTS AND EFFECTIVENESS

Potential short-term impacts for alternative 1B are minimal. There are significant potential short-term impacts related to alternatives 2A, 3A and 3B as a result of materials handling operations for such a large volume of contaminated materials. Additionally, air emissions and treated residuals resulting from the incineration process for alternative 2A could pose a threat to the environment. All four alternatives would be effective in eliminating contact with, and migration of contaminants, and would be implemented with the necessary controls to minimize adverse impacts to the environment during the remediation.

11.2 LONG-TERM EFFECTIVENESS AND PERMANENCE

All four alternatives would be effective in eliminating contact with, and migration of contaminants over the long-term. Alternatives 1B, 3A and 3B would not permanently destroy the contaminants. Alternative 2A would destroy the organic contaminants, but they constitute a small proportion of the total Landfill Area volume, and the presence of inorganic contaminants would ultimately necessitate land disposal of treated residuals in a secure landfill.

11.3 REDUCTION OF TOXICITY, MOBILITY OR VOLUME

The remedial measures required by alternatives 1B, 3A and 3B would reduce the potential for contaminant transport, but would not significantly reduce the toxicity or volume of contaminated waste/soil. Alternative 2A would reduce the mobility, toxicity, and possibly, the volume of contaminated waste/soil. The collection and treatment of water associated with all four alternatives would slightly reduce the toxicity, mobility and volume of contamination.

11.4 IMPLEMENTABILITY

Alternative 1B could be implemented easily; implementability issues would not cause schedule delays. Alternatives 2A, 3A, and 3B are considered difficult to implement, given the complexities of excavating a more than 30-year-old landfill.

11.5 COMPLIANCE WITH ARARs

Implementation of removal alternative 2A, 3A or 3B would satisfy site-specific ARARs and remedial action objectives by treating or isolating the waste and contaminated soils from the Landfill Area. Implementation of capping alternative 1B would meet the remedial action objectives by minimizing the contaminant mobility. Water quality is expected to improve upon implementation of any of the alternatives: for alternative 1B by on-going groundwater/leachate treatment and isolation of the waste, and for alternatives 2A, 3A and 3B by source removal.

During implementation of the removal alternatives, there is potential for non-compliance with both ARARs and the remedial action objectives. The Landfill Area is in a remote location with respect to plant operations and the public. Thus neither the plant workers, nor the public are currently exposed to the contaminant associated with the area. The alternatives which require removal of the Landfill wastes and soils would result in a significantly increased risk of exposure for plant workers. For alternatives 2A and 3A, which would likely require transport hundreds of miles off-site, the potential for exposure to the public would also increase significantly. For alternatives 2A, 3A and 3B the dust generated during excavation could result in non-compliance with air ARARs. In addition, for the incineration alternative, 2A, non-compliance could occur as a result of emission control system problems at the off-site incinerator. For the capping alternative, 1B, air ARARs would be met during implementation.

11.6 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The four alternatives would be equally protective upon completion of remediation because all four would eliminate contact with, and migration of contaminants. Protection of human health and the environment during removal, transport and incineration of contaminants associated with alternative 2A is contingent on sound transportation and management practices.

11.7 COST

The total present worth cost associated with alternatives 1B, 2A, 3A and 3B are $7,800,000, $540,000,000, $130,000,000 and $23,000,000, respectively. The costs associated with alternatives 2A and 3A are prohibitively high.

12.0
CONCLUSIONS AND RECOMMENDATIONS CONCERNING LANDFILL AND FORMER POTLINER STORAGE AREA

Section 11.0 provides a comparative analysis of alternatives available for the Landfill and Former Potliner Storage Area (Landfill Area). This section uses that analysis to recommend a particular alternative for the Landfill. The recommended alternative is intended to satisfy the remedial action objectives presented in Section 3.1. Aspects of the recommended alternative may change based on NYSDEC input and/or during a review of the recommended alternatives with a site-wide perspective.

For the Landfill, alternative 1B is recommended. Alternative 1B includes the following main components:

- Dewater the waste/soil in-place by installation of an improved leachate collection system
- Install a permanent cap with design details equivalent to RCRA standards
- Control surface water run-on/run-off
- Recover and treat groundwater/leachate
- Monitor groundwater and surface water

A review of alternative 1B in regards to the seven evaluation criteria indicate that it has minimal potential short-term impacts and, for the short- and long-term, is effective in eliminating contact with, and migration of contaminants, thereby providing the overall protection of human health and the environment required. Collection and treatment of groundwater/leachate, in conjunction with installation of the RCRA-type cap, would eliminate the contaminant transport pathways. Alternative 1B is technically and administratively feasible, and there are no implementability issues that would cause schedule delays. Water treatment would reduce contaminant levels to comply with ARARs. The alternative is considered, relative to other alternatives for the Landfill, to be cost-effective. The total estimated cost for remedial alternative 1B is $7,800,000.

Alternative 1B, when scored and totalled according to NYSDEC TAGM tables, scores higher than alternatives 2A, 3A and 3B. The scores are 76 for alternative 1B, 66 for alternative 2A, 70 for alternative 3A and 69 for alternative 3B (Table IV-5).

Alternative 1B meets the remedial action objectives (Section 3.1) by:

1) Considering means (water treatment and capping) to permanently treat, reduce or immobilize contaminants in soil, sediment and waste

2) Preventing the migration of contaminants in groundwater and surface water on or beyond the Reynolds' plant boundaries

3) Minimizing the mobility of contaminants and preventing groundwater, surface water and air contamination

In addition, alternative 1B would not disrupt plant operations during remediation activities. This alternative is also consistent with federal policies of closure in place for high volume landfills where there is low risk to human health and environment after closure.

TABLE IV-1
CAPITAL COST ESTIMATE SUMMARY
LANDFILL AND FORMER POTLINER STORAGE AREA

REMEDIAL ACTION	UNITS	UNIT COST	ALTERNATIVE 1B QUANTITY	ALTERNATIVE 1B COST	ALTERNATIVE 2A QUANTITY	ALTERNATIVE 2A COST	ALTERNATIVE 3A QUANTITY	ALTERNATIVE 3A COST	ALTERNATIVE 3B QUANTITY	ALTERNATIVE 3B COST
***************	*****	****	********	****	********	****	********	****	********	****
A. SITE PREPARATION										
1. Dewatering	LS	$75,000				$75,000		$75,000		$75,000
B. EXCAVATION/HANDLING OF CONTAMINATED MATERIALS										
1. Excavate Landfill and FPSA Wastes/Soils	ton	$5			352,732	$1,763,660	352,732	$1,763,660	352,732	$1,763,660
2. Excavate Perimeter Drain	lf	$3	1,100	$3,300						
C. TRANSPORT AND TREATMENT/DISPOSAL OF CONTAMINATED MATERIALS										
1. Transport/Dispose at Commercial Incinerator	ton	$1,500			352,732	$529,098,000				
2. Transport/Dispose at Commercial Landfill	ton	$360					352,732	$126,983,520		
3. Dispose at On-Site Landfill	ton	$30							352,732	$10,581,960
4. On-Site Hauling	ton	$2							352,732	$705,464
D. COLLECTION/TREATMENT OF WATER										
1. Run-On/Run-Off Control for Surface Water	LS	$50,000		$50,000		$50,000		$50,000		$50,000
2. Install Perimeter Drain	LS	$100,000		$100,000						
3. Piping to NY GAC	LS	$100,000		$100,000		$50,000 b		$50,000 b		$50,000
E. SITE RESTORATION										
1. Backfill and Compact	ton	$5			30,000	$150,000	30,000	$150,000	30,000	$150,000 b
2. Install RCRA Cap	sq ft	$5	496,584	$2,482,920						
3. Grade and Seed	sq ft	$2			496,584	$993,168	496,584	$993,168	496,584	$993,168
DIRECT CAPITAL COSTS				$2,736,220		$532,179,828		$130,065,348		$14,369,252
INDIRECT CAPITAL COSTS	(% of Direct Capital Costs)									
A. Implementation		(10%)		$273,622		$1,000,000 a		$1,000,000 a		$1,436,925
B. Administration		(15%)		$410,433		$1,500,000 a		$1,500,000 a		$2,155,388
C. Contingency		(20%)		$547,244		$2,000,000 a		$2,000,000 a		$2,873,850
TOTAL ESTIMATED CAPITAL COSTS				$4,000,000		$540,000,000		$130,000,000		$21,000,000

Notes: a. Estimated costs not based on a percentage of the capital costs.
b. Temporary water storage and transport for treatment.

TABLE IV-2

ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS

LANDFILL AND FORMER POTLINER STORAGE AREA

REMEDIAL ACTION	ALT. 1B	ALT. 2A	ALT. 3A	ALT. 3B
A. Groundwater Monitoring	$35,000			$35,000
B. Surface Water Monitoring	$25,000			
C. Conveyance to NY GAC	$10,000			
D. Collection of Contaminated Groundwater/Leachate	$20,000			
E. Water Treatment (NY GAC)	$20,000			
F. RCRA Landfill Maintenance				$20,000
G. RCRA Cap Maintenance	$75,000			$35,000
DIRECT O&M COSTS	$185,000	$0	$0	$90,000
INDIRECT O&M COSTS				
A. Administration (10% of O&M Costs)	$18,500	$0	$0	$9,000
B. Contingency (10% of O&M Costs)	$18,500	$0	$0	$9,000
TOTAL ESTIMATED O&M COSTS	$220,000	$0	$0	$108,000

TABLE IV-3
SUMMARY OF REMEDIAL ALTERNATIVES
LANDFILL AND FORMER POTLINER STORAGE AREA

ALTERNATIVE	KEY COMPONENTS	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH (a)
1B	A. Monitor Existing Wells B. Monitor Surface Water C. Install RCRA Cap D. Groundwater/Leachate Recovery/Treatment E. Run-On/Run-Off Controls for Surface Water	$4,000,000	$220,000	$7,800,000
2A	A. Dewater/Excavate Wastes and Soils B. Transport/Treat at Commercial Incinerator C. Run-On/Run-Off Controls for Surface Water D. Backfill, Grade and Seed Excavated Area	$540,000,000	$0	$540,000,000
3A	A. Dewater/Excavate Wastes and Soils B. Transport/Dispose at Commercial Landfill C. Run-On/Run-Off Controls for Surface Water D. Backfill, Grade and Seed Excavated Area	$130,000,000	$0	$130,000,000
3B	A. Dewater/Excavate Wastes and Soils B. Dispose in On-Site Landfill C. Run-On/Run-Off Controls for Surface Water D. Backfill, Grade and Seed Excavated Area	$21,000,000	$108,000	$23,000,000

Notes: a. 30-year post-closure period, 4% discounted rate-of-return assumed.

TABLE .

COMPARISON OF LANDFILL AND FORMER STORAGE AREA
REMEDIAL ALTERNATIVES
REYNOLDS METALS, MASSENA, NEW YORK

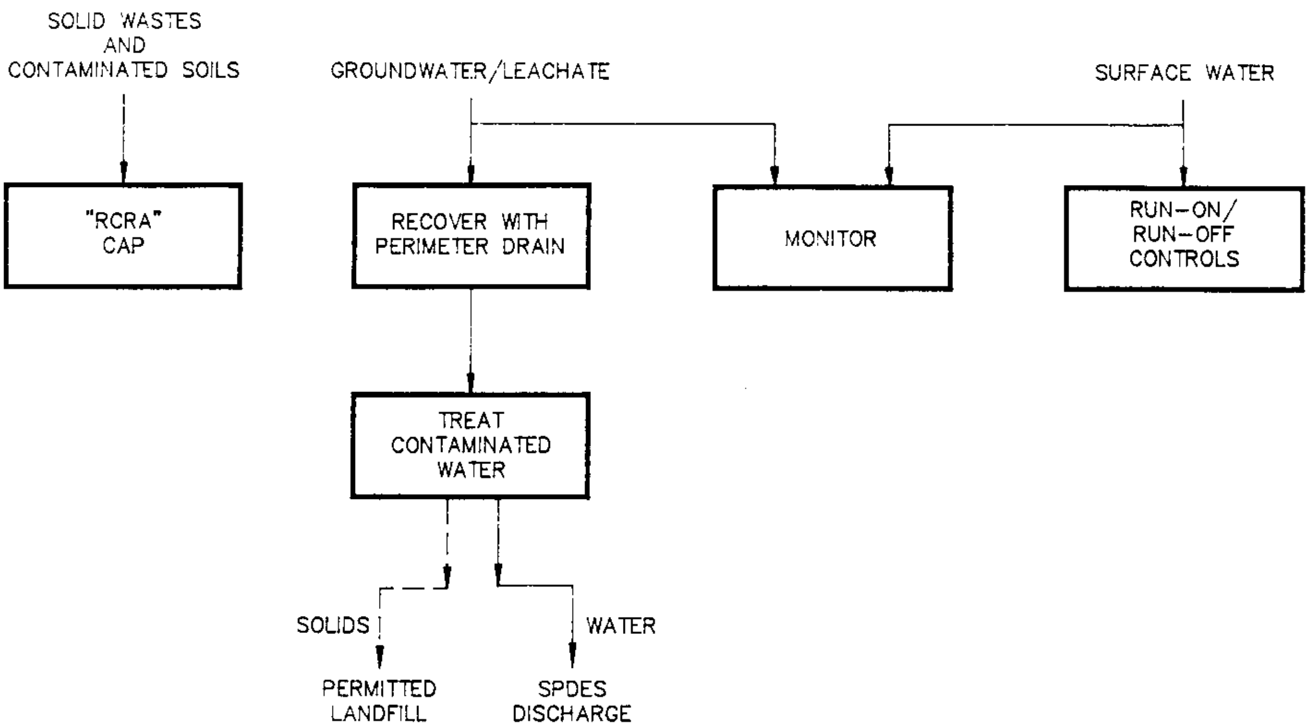
Criteria	Alternative 1B (Cap)	Alternative 2A (Off-Site Incineration)	Alternative 3A (Off-Site Landfill)	Alternative 3B (On-Site Landfill)
Short-Term Impacts and Effectiveness	Minimal potential short-term impacts.	Significant potential short-term impacts during removal, transport, and incineration.	Significant potential short-term impacts during removal and transport.	Significant potential short-term impacts during removal and transport.
Long-Term Effectiveness and Permanence	Effective in eliminating contact with, and migration of, contaminants.	Effective in eliminating contact with, and migration of, contaminants; will destroy organic contaminants only.	Effective in eliminating contact with, and migration of, contaminants.	Effective in eliminating contact with, and migration of, contaminants.
Reduction of Toxicity, Mobility, or Volume	The cap will reduce contaminant migration potential.	Incineration will reduce the toxicity of the organic constituents.	Off-site landfilling will reduce contaminant migration potential.	On-site landfilling will reduce contaminant transport potential.
Implementability	Easily implemented. Implementability issues would not cause schedule delays.	Difficult to implement. Technical feasiblity uncertain; waste would need to be sorted. Administrative feasibility uncertain, problems may include obtaining appropriate approvals for waste treatment.	Difficult to implement. Technically feasible. Administrative feasiblity uncertain, problems may include obtaining appropriate approvals for waste disposal.	Implmenetable. Technically feasible.
Compliance with ARARs	ARARs will be met.	ARARs will be met.	ARARs will be met.	ARARs will be met.
Overall Protection of Human Health and the Environment	Protective by eliminating contact with, and migration of, contaminants.	Protective by eliminating contact with, and migration of, contaminants.	Protective by eliminating contact with, and migration of, contaminants.	Protective by eliminating contact with, and migration of, contaminants.
Cost	Total present worth cost is approximately $7,800,000.	Total present worth cost is approximately $540,000,000.	Total present worth cost is approximately $130,000,000.	Total present worth cost is approximately $23,000.

TABLE IV-5

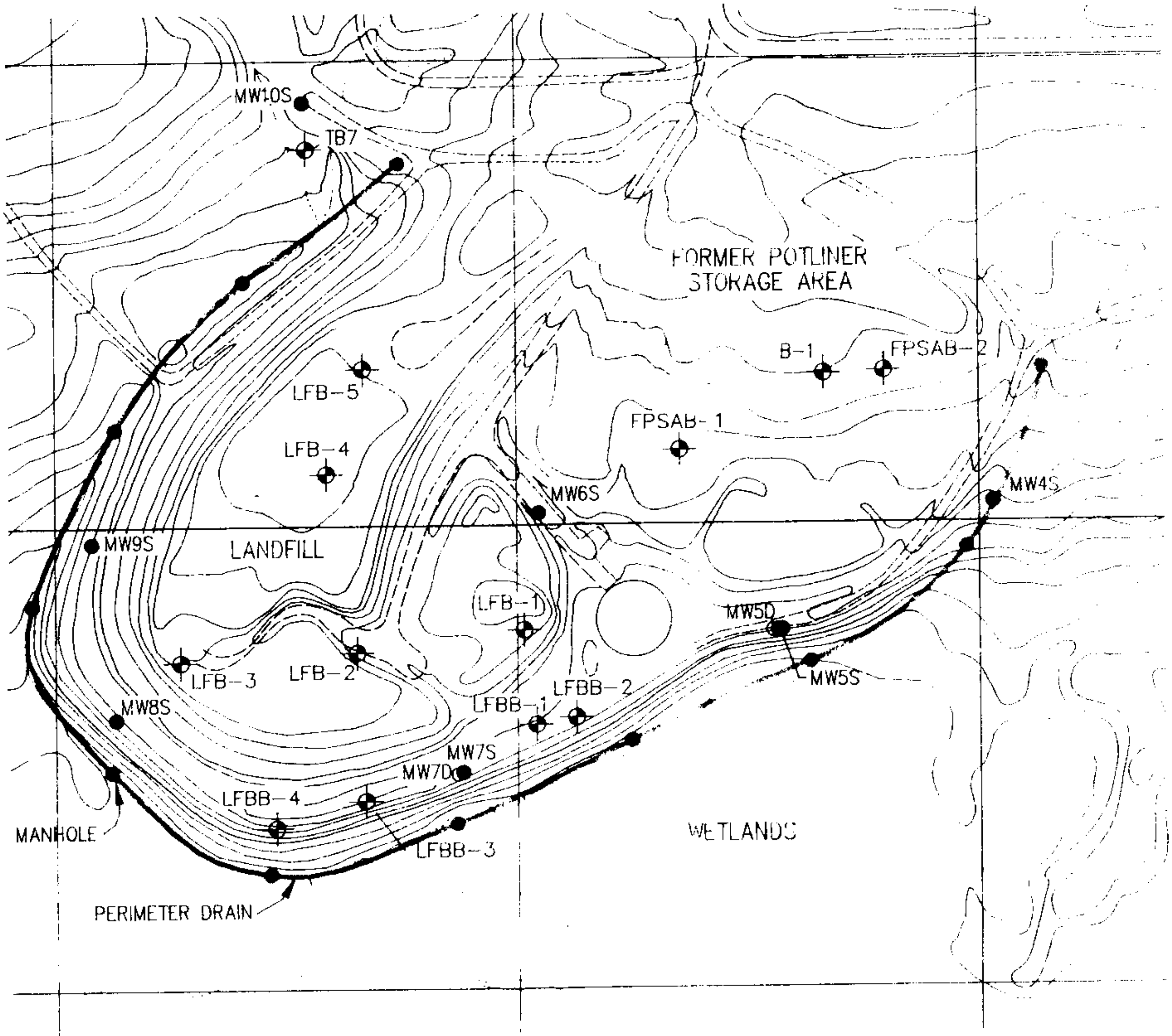
SCORING OF LANDFILL AND FORMER POTLINER STORAGE AREA REMEDIAL ALTERNATIVES ACCORDING TO NYSDEC TAGM REYNOLDS METALS COMPANY MASSENA, NEW YORK

	Alternatives			
	1B (Cap)	2A (Incineration)	3A (Off-Site Landfill)	3B (On-Site Landfill)
Short-Term Impacts and Effectiveness (10)	10	7	8	9
Long-Term Effectiveness and Permanence (15)	7	13	12	7
Reduction of Toxicity, Mobility, or Volume (15)	0	10	0	0
Implementability (15)	14	6	8	8
Compliance with ARARs (10)	10	10	10	10
Overall Protection of Human Health and the Environment (20)	20	20	20	20
Cost (15)	15	0	11	14
TOTAL	76	66	69	68

FIGURE IV-I
LANDFILL AND FORMER POTLINER STORAGE AREA
PROCESS FLOW DIAGRAM
ALTERNATIVE 1B



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.



LANDFILL AREA
PERIMETER DRAIN CONCEPTUAL DESIGN
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

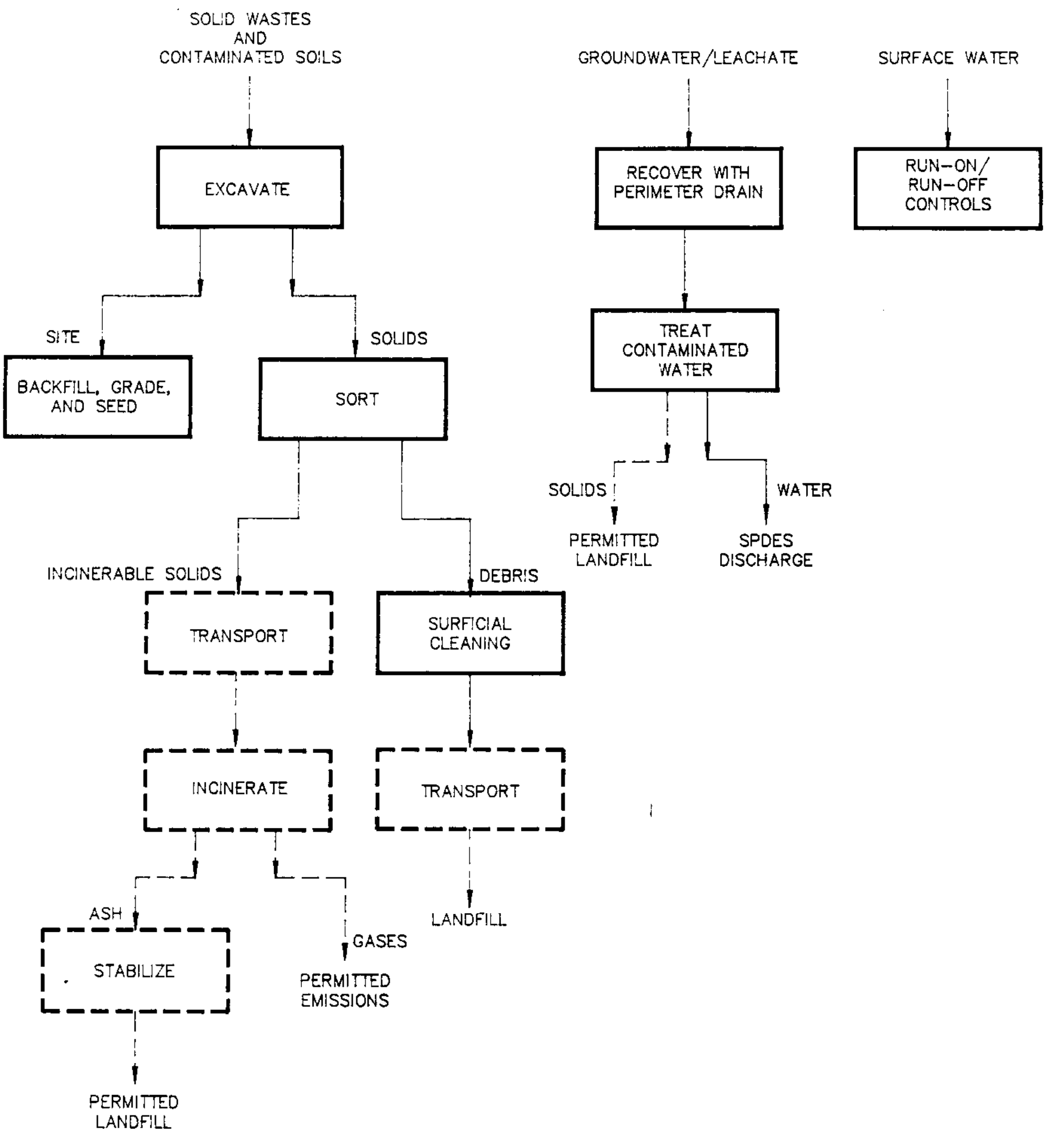
11:18

Rev. No.	Date	Type of Revision	Checked by:

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

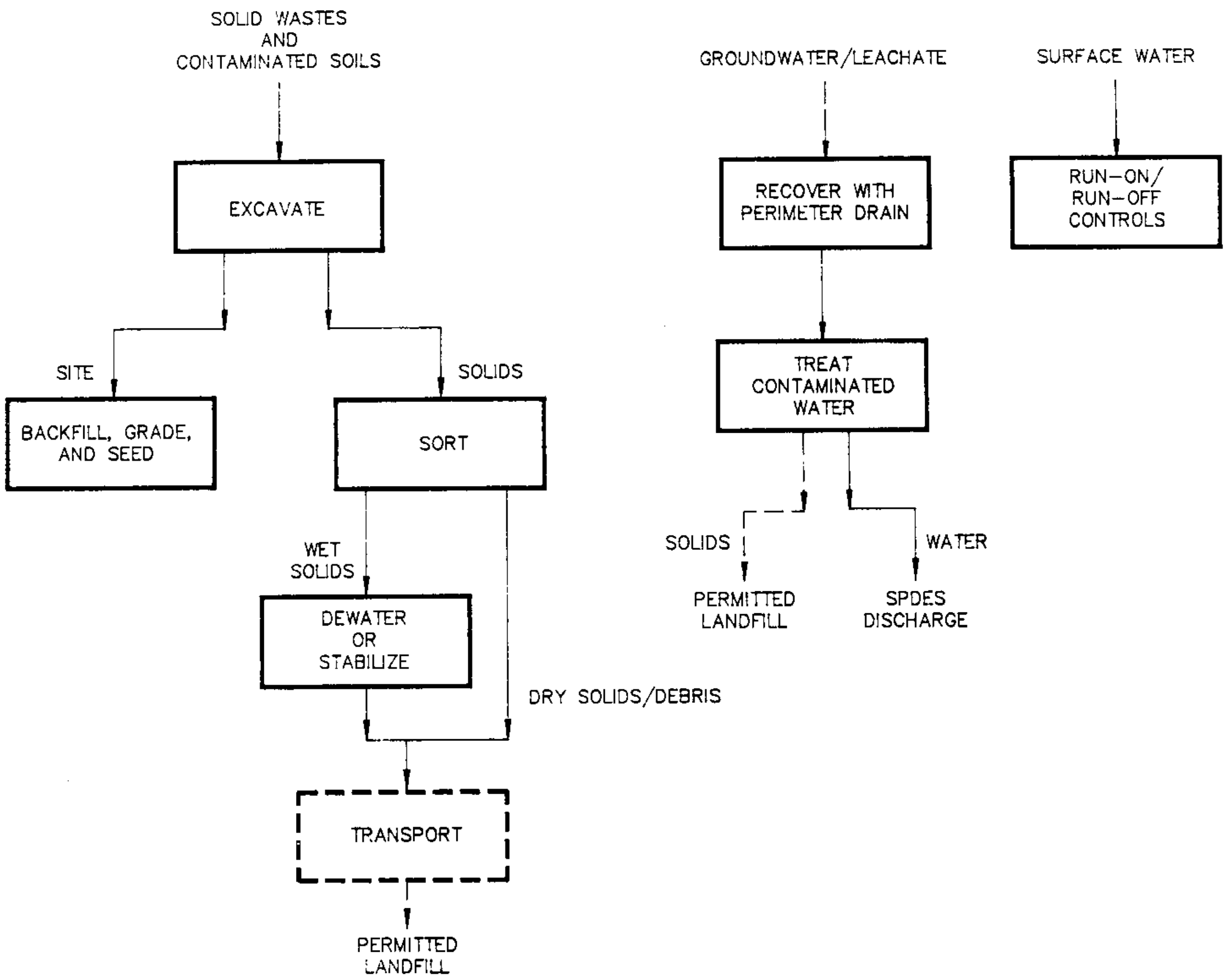
Job No.: 89C2515A4	Drawing No. 95152150	Date: 11/26/90
Drawn by: T.P.	Checked by: D.M.H.	
Scale: 0 — 200 FT.		FIGURE IV-2

FIGURE IV-3
LANDFILL AND FORMER POTLINER STORAGE AREA
PROCESS FLOW DIAGRAM
ALTERNATIVE 2A



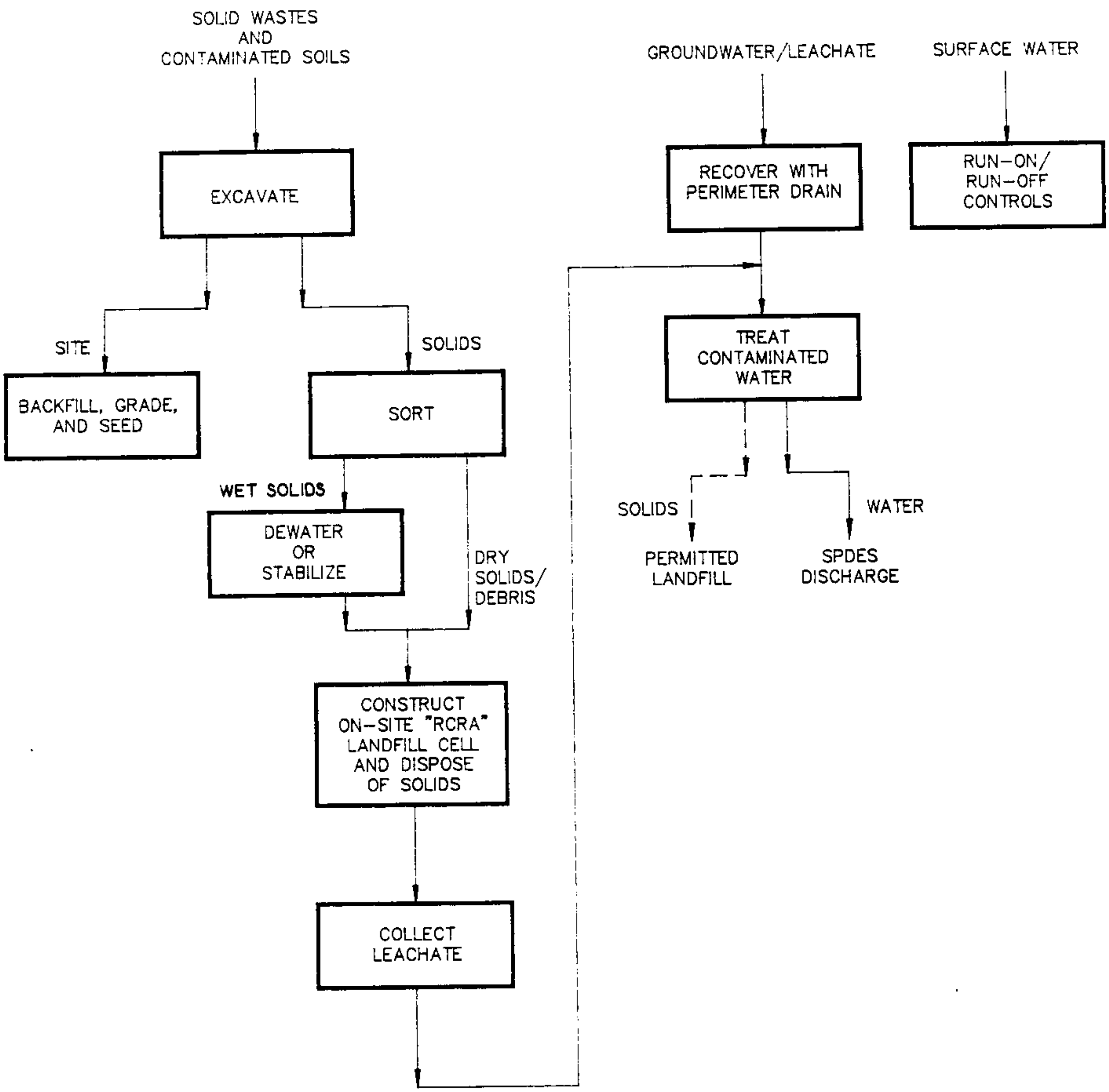
NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

FIGURE IV-4
LANDFILL AND FORMER POTLINER STORAGE AREA
PROCESS FLOW DIAGRAM
ALTERNATIVE 3A



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

FIGURE IV-5
LANDFILL AND FORMER POTLINER STORAGE AREA PROCESS FLOW DIAGRAM
ALTERNATIVE 3B



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE

PART V: WETLANDS

13.0 ANALYSIS OF ALTERNATIVES

The Preliminary Feasibility Study indicated a total of three remedial alternatives for the Wetlands. This section of the FS provides definitions of these three alternatives (Sections 13.1.1, 13.2.1, and 13.3.1), each of which is followed by seven subsections describing the detailed evaluation according to the following seven criteria specified by the NYSDEC TAGM:

- Short-Term Impacts and Effectiveness
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Implementability
- Compliance with ARARs
- Overall Protection of Human Health and the Environment
- Cost

The Wetlands represent a unique Area of Concern at the Reynolds plant because of the Remedial Action Objective to provide for a wetlands habitat. The remedial alternatives for the Wetlands meet this objective; however, to remediate the Wetlands, they must first be destroyed, either by 1) burying and capping in place, or 2) by total removal of the water and substrate (sediments). In either event, a new Wetlands habitat would be created in an adjacent area so that there would be no net loss of wetlands habitat.

Remediation of the Wetlands would begin upon completion of a portion of the remediation of the Landfill and Former Potliner Storage Area (Part IV). Since the Landfill and Former Potliner Storage Area is the main upgradient source of contaminants to the Wetlands, it will be necessary to eliminate this main source of contamination before performing remediation in the Wetlands.

A separate source of PCB contamination to the Wetlands is the Rectifier Yard and associated drainage pathways leading to the Wetlands. The Rectifier Yard and drainageways will also be addressed as part of remedial measures conducted prior to initiation of remediation of the Wetlands. Remedial measures associated with the Rectifier Yard and drainageways are discussed in Part VIII.

13.1 ALTERNATIVE 1A - IN PLACE MANAGEMENT/CAPPING

13.1.1 Alternative Definition

Remedial alternative 1A requires capping of contaminated sediment, effectively burying the existing Wetlands in place, with nearby replacement of the Wetlands acreage for no net loss of wetlands habitat. The main components of alternative 1A follow:

- Install surface water controls to isolate the impacted portion of the Wetlands from the remainder of Wetlands RR-6
- Dewater the approximately 10-acre impacted area
- Remove or chip stumps and other large vegetation
- Excavate contaminated sediments from the east and west Wetlands drainageways and contain them in the open water portion of the Wetlands
- Backfill and grade as necessary to provide a subbase with adequate strength for the cap, with the appropriate slopes
- Dewater and/or consolidate the sediments to provide an adequate subbase for cap construction
- Install a permanent leachate collection system (Figure V-1)
- Cap the area

- Construct approximately 10 acres of new wetlands in a nearby location
- Monitor surface water

A process flow diagram for this alternative is given in Figure V-2.

The affected area of the Wetlands would be isolated from the remaining portions of RR-6 before initiating remedial efforts. Temporary berms would be constructed to limit the migration of contaminated surface water into uncontaminated areas.

Because the Wetlands is a groundwater discharge area, with much of the water originating from the Landfill Area, installation of the Landfill Area groundwater/leachate collection system may effectively dewater the contaminated area of the Wetlands. As mentioned above, it is assumed that the Landfill Area remediation would be completed before starting remediation in the Wetlands. If standing water and/or saturated conditions still exist after remediation of the Landfill and Former Potliner Storage Area, then berms and sumps would be used to control water and entrained sediment during Wetlands remediation. This system would also serve as the permanent leachate collection system. The water collected during remediation and the leachate generated after capping would be treated in the same system as groundwater/leachate collected from the Landfill Area.

Excavation of the contaminated sediments in the Wetlands drainageways would occur prior to capping the affected area of the Wetlands. The excavated drainageways would be backfilled with clean sand or crushed stone to promote good drainage and minimize erosion.

Vegetation would be cleared from the area to be capped. Dead trees and stumps would be chipped and left in the affected area. To provide adequate strength for cap construction, the open water area would be covered with a geotextile, then backfilled with approximately two feet of material prior to cap installation.

The multi-layer cap would be placed over the affected area to minimize rainwater infiltration and to isolate contaminated soil and sediment from the surrounding environment. The constructed cap would have main components as indicated on Figure II-1, but would likely require design modifications to accommodate the soft and potentially saturated base of the Wetlands. For example, it is expected that implementability constraints would preclude the use of compacted clay layer. This would likely be replaced by an impermeable geomembrane. Further discussion of cap installation is presented in Section 3.1.5. Surface water controls would be emplaced during cap installation. After capping, surface water run-on would be minimized by redirecting it toward uncontaminated/unaffected areas with new drainageways. A groundwater and surface water monitoring program would be initiated upon completion of the remedial alternatives.

This alternative requires that a new Wetlands be created, probably by adding additional equivalent acreage to another part of Wetlands RR-6, to replace the capped Wetlands. The result would be no net loss of wetlands to the entire Reynolds area. Extension of the RR-6 Wetlands would be done by excavating in an adjacent area, providing appropriate hydraulic control structures in the newly created Wetlands, and planting propagules to initiate wetlands vegetation. A small surface water impoundment would probably be used to maintain the appropriate wetlands environment for the new area. The amount of excavation required, and the design of hydraulic structures to be used would be determined based on site-specific information.

13.1.2 Short-Term Impacts and Effectiveness

The implementation of alternative 1A would not require the handling and transporting of contaminated sediments. Implementation of alternative 1A would have little or no impact on the local community during construction. All remedial work would be completed on the Reynolds site. Installation of the cap and leachate collection system would involve potential contact with the contaminated sediments. Any contact with the contaminated leachate or surface water would be minimized by measures to control seepage during operations. Health and safety practices would be developed and implemented to minimize worker exposure to contaminated water and sediment during remediation.

13.1.3 Long-Term Effectiveness and Permanence

Cap maintenance would ensure that it has the long-term ability to restrict contact with the contaminated materials in the Wetlands. This maintenance would include monthly inspections of cap integrity and settlements, and repair, as necessary. The cap would need to be carefully designed, and constructed in phases to ensure that it would effectively maintain its integrity in the long-term, and thus provide an effective barrier to groundwater and surface water contamination and rain water infiltration. The cap would also provide an effective barrier to human and animal contact with the contaminated material.

Surface water would no longer come into contact with the contaminated material; therefore, cap installation is expected to isolate the contaminated soil/sediment from the surrounding environment and greatly enhance the surface water quality in the area. Reduced rainwater infiltration into the capped Wetlands Area and the leachate collection system should, over time result in reduced quantities of contaminated leachate.

13.1.4 Reduction of Toxicity, Mobility or Volume

Although the contaminated sediments are not treated in this alternative, collection and treatment of groundwater/leachate would reduce contaminant toxicity. Cap installation would isolate the contaminated soils/sediments in the affected portion of the Wetlands, drastically reducing any potential contaminant impacts in the area. Dewatering and consolidation of contaminated sediments would result in a reduction in volume.

13.1.5 Implementability

This alternative is technically feasible, however, geotechnical data on the strength of the subsurface soils is required to evaluate the implementability with regard to time and cost considerations. Depending on the degree to which the sediments and subsurface soils consolidate during drainageway excavations and cap subbase preparation, significant changes may be needed in the approach to cap construction and other work in the Wetlands. For example, finger dikes or other working platforms may be required for much of the work in the

Wetlands Area. With regard to cap installation, the work would need to be performed in phases to allow for consolidation and settlement of subsurface soils, to thus ensure cap stability in the long-term. This could result in cap installation requiring 2 to 4 years for completion.

The leachate collection system and construction of new surface water drainageways would be implemented using standard practices. Water treatment would be done by the North Yard GAC system, and integrated with the Landfill and Former Potliner Storage Area remedial actions, if possible.

Off-site TSD services would not be required for this alternative. It is assumed that construction materials would be commercially available from several vendors. Currently, technologies required to implement this alternative are available. The work tasks required for completion can be provided by more than one vendor to provide for competitive bids.

The administrative feasibility of this alternative would depend on regulatory approval of water treatment and discharge, construction work in a regulated Wetlands, and construction of a new wetlands area.

13.1.6 Compliance With ARARs

Because the cap and hydraulic controls would no longer allow surface water to contact the contaminated sediments in the Wetlands, surface water quality would be expected to improve significantly and reach ARARs. Water collected by the underdrains would be treated to reduce contaminant levels in the leachate to the applicable New York State SCGs. After capping, the sediments will be equivalent to subsurface soils, in terms of the remedial criteria for PCBs.

In summary, this alternative will meet all applicable ARARs and TBCs.

13.1.7 Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment. Installation of the cap required by alternative 1A would adequately protect human health by eliminating contact with the contaminated soils/sediments in the Wetlands. Although this alternative would effectively destroy whatever residual environmental benefits exist in the affected area of the Wetlands, these benefits would be restored by creation of new Wetlands elsewhere on the Reynolds property. The integrity of the cap would be ensured by regular maintenance procedures. The hydraulic controls for leachate and surface water would significantly reduce or eliminate contaminant mobility from the area, and the treatment of contaminated water would help to mitigate any long-term risks which could be associated with the leachate from the Wetlands. The protection associated with this alternative would benefit on-site personnel only, since there is presently no public use of the site.

13.1.8 Cost

The direct and indirect capital costs for all alternatives for the Wetlands are itemized in Table V-1. The estimated capital cost for alternative 1A is $7,000,000. Annual O&M costs are summarized on Table V-2, and for this alternative are estimated to be $180,000, which would allow for regular cap maintenance, as well as leachate collection and treatment. The present worth cost for this alternative is estimated to be $10,000,000, based on a 4 percent interest rate over a 30-year period. Table V-3 summarizes all of the above costs. Appendix A summarizes the assumptions and sources used to estimate these costs.

13.2 ALTERNATIVE 2A - ON-SITE MANAGEMENT

13.2.1 Alternative Definition

In the Preliminary FS, this alternative called for removal and treatment of contaminated soils/sediments. Alternative 2A now calls for removal and on-site management of the contaminated sediments from the Wetlands. Remedial alternative 2A proposes a Wetlands Area remediation with the following main components:

- Dewater/excavate sediments and vegetation from the impacted area of the Wetlands

- Dewater and manage excavated materials on-site in the Former Potliner Storage Area (assumes that area will be capped)
- Backfill, grade, and seed excavated areas to provide adequate drainage of the area
- Redirect drainage towards the south with new drainageways
- Monitor surface water
- Construct approximately 10 acres of new wetlands in a nearby location

A process flow diagram for this alternative is given in Figure V-3. Alternative 2A as written can only be considered if an in-place closure alternative is selected for the Landfill and Former Potliner Storage Area, but would also be applicable in concept if a new landfill cell were constructed elsewhere on-site (as described in Appendix E). As described in Section 6.4.1, disposal of low level contaminated soils in the Former Potliner Storage Area is considered environmentally equivalent to disposal in a new landfill cell.

Prior to removal of the contaminated soils/sediments, vegetation in the effected portion of the Wetlands would be cleared, chipped and placed in the Former Potliner Storage Area. The affected portion of the Wetlands would be dewatered, as necessary, with the water being collected and treated in the on-site GAC system in the North Yard. On-site management of these materials with low levels of contamination (maximum detected PCB concentration of approximately 15 ppm) would involve moving the material to the area that is now the Former Potliner Storage Area and consolidating it with other soils and sediments from around the plant site with low levels of contamination. The excavated area would then be backfilled, graded, and seeded as necessary to provide adequate surface water control in the area. Glacial till excavated from other parts of the site could be used as fill material; this could include off-specification material from cap installation in the Landfill Area, material from excavation of the new Wetlands Area, or material from construction of an on-site landfill. Creation of a new wetlands area would be done as described in Section 13.1.1. A surface water monitoring program is part of this alternative. In addition, new drainageways would be constructed to the east and west of the Wetlands to redirect flow away from the remediated open water area, and more directly southward.

13.2.2 Short-Term Impacts and Effectiveness

Implementation of alternative 2A would have little or no impact on the local community during construction. All work would be conducted within a limited, inactive area of Reynolds' property. Workers performing the remedial activities could come in contact with contaminated sediment, soil, surface water or groundwater. Personal protective equipment will minimize or eliminate this potential contact. Water control measures would be instituted to minimize spillage and leakage during remediation. Dust control measures would also be implemented, as necessary, to ensure minimal environmental impact from construction and implementation of these remedial measures. The short-term effectiveness of alternative 2A is similar to that of alternative 1A. Installation of berms to isolate contaminated Wetlands Areas would restrict further migration of contaminants during remedial activities.

13.2.3 Long-Term Effectiveness and Permanence

The long-term effectiveness of alternative 2A would be similar to that of alternative 1A (i.e., a high level of effectiveness for all media). The long-term effectiveness of the on-site management of the excavated materials would be dependent on appropriate maintenance of the Former Potliner Storage Area, which is discussed in Part IV. Conditions in the newly-created wetlands would be monitored and maintained, as necessary initially, to ensure its long-term success.

13.2.4 Reduction of Toxicity, Mobility or Volume

Although source material treatment is not performed in this alternative, dewatering and collection and treatment of surface water during remediation would reduce the toxicity and volume of contamination in alternative 2A. Excavation and on-site management of sediments will reduce the potential for impacts from contaminants.

13.2.5 Implementability

The excavation and on-site management of contaminated sediment, placement of clean fill and collection/treatment of surface water associated with this alternative are technically feasible. Special construction techniques may be required for working on soft ground areas.

The excavation of contaminated sediments from the Wetlands would likely require the use of low-contact pressure earthworks equipment or other approaches. It would be important to avoid practices where vehicle wheels or tracks drag contaminated sediments into the underlying soils, thereby increasing the volume of contaminated materials.

The administrative feasibility of this alternative would depend on regulatory approval considering the Wetlands restoration plan.

Off-site TSD services would not be required for this alternative. Construction services would be commercially available from several sources at the time of remediation to provide competitive bids.

13.2.6 Compliance with ARARs

The excavation and on-site materials management would meet the remedial action objective of preventing migration of contamination. Implementation of this alternative would reduce the volume associated with the contaminated sediments by dewatering. In addition, this alternative meets the remedial action objective of restoring the original wetlands habitat.

Water collection and treatment during remediation activities would result in compliance with ARARs. Excavation and on-site management of the contaminated sediments would ensure long-term water quality improvement.

In summary, all applicable ARARs and TBCs would be met for this alternative.

13.2.7 Overall Protection of Human Health and the Environment

Alternative 2A would provide overall protection of human health and the environment through isolation of contaminated soil and sediments in a contained area with surface water and groundwater collection. Removal of contaminated soil/sediment from the existing Wetlands and creation of a new wetlands area would improve the existing surface water quality, and result in no net loss of wetlands habitat.

13.2.8 Cost

Estimated capital costs for alternative 2A is included on Table V-1. The table itemizes the components of the direct and indirect capital costs for all alternatives under consideration for the Wetlands. The total estimated capital cost for alternative 2A is $2,700,000. Estimated operation and maintenance (O&M) costs for the alternative is included on Table V-2, and are estimated at $60,000 per year. The present worth cost for this alternative, as summarized on Table V-3, is estimated at $3,700,000 based on a 4 percent interest rate over a 30-year period. Appendix A summarizes the assumptions and sources used to estimate these costs.

13.3 ALTERNATIVE 4A - OFF-SITE INCINERATION

13.3.1 Alternative Definition

Remedial alternative 4A considers excavation and off-site incineration for contaminated soil and sediment with institutional controls for surface water and groundwater. The main components for alternative 4A follow:

- Dewater the Wetlands by installation of temporary sumps
- Excavate contaminated soil/sediment and vegetation from the affected Wetlands
- Transport and off-site incinerate contaminated soil and sediment

- Backfill, grade, and seed excavated areas to provide adequate drainage of the area
- Redirect drainage towards the south with new drainageways
- Monitor surface water
- Construct approximately 10 acres of new wetlands in a nearby location

A process flow diagram for this alternative is given by Figure V-4. These components would be implemented as described in Sections 13.1.1 and 13.2.1.

13.3.2 Short-Term Impacts and Effectiveness

The short-term impacts associated with alternative 4A are primarily those which are a result of materials handling and transportation. Contaminated soil and sediment would be transported off-site for alternative 4A, which would represent a potential short-term impact. Workers performing remedial activities could come in contact with contaminated soil/sediment as well as contaminated surface water and groundwater. Personal protective equipment will minimize or eliminate this potential exposure pathway.

13.3.3 Long-Term Effectiveness and Permanence

Implementation of the remedial measures required by alternative 4A would be effective in the long-term for the Wetlands. Removal and treatment of the contaminated materials would minimize the threat to the environment from the organic contaminants in the area.

13.3.4 Reduction of Toxicity, Mobility or Volume

Removal and transport of the Wetlands soils/sediments to a commercial incinerator for treatment would mitigate any potential for contaminant mobility from the area via surface water or leachate. Incineration of these contaminated materials would destroy the organic contaminants in the waste, thereby reducing the toxicity of the treated residuals. In addition, the treated residuals would be smaller in volume than the original materials. If stabilization of the treated residuals were required prior to its ultimate disposal, there would be minimal net volume reduction. In addition, long-term management of the incinerator ash may be required.

13.3.5 Implementability

The remedial measures required by alternative 4A would be conducted using standard construction practices. Special earthworks practices may be required to work in soft ground areas, as discussed in Section 13.1.5. For the transport of the wastes to an incinerator, waste manifests and tracking procedures would be prepared and followed throughout the implementation of the remedial measure. In addition, special scheduling arrangements may be required with the facility to treat this volume of waste.

The administrative feasibility of this alternative is uncertain. Off-site TSD services would be required. Based on the characteristics of the contaminated sediments, i.e., presence of cyanides, fluorides, sulfides, and metals, it may not be possible to obtain disposal approval from commercial incinerators.

13.3.6 Compliance with ARARs

Surface water run-off would no longer be in contact with the contaminated materials of the Wetlands; therefore, it is anticipated that surface water quality in the area would improve sufficiently to comply with ARARs. This alternative would also meet the remedial action objectives of mitigating off-site contaminant transport and providing for a wetlands habitat, by creating a new wetlands area.

13.3.7 Overall Protection of Human Health and the Environment

Alternative 4A would provide overall protection of human health and the environment. Exposure from direct contact with contaminated sediments would be eliminated by excavation and transport of contaminated soil/sediment to a commercial incinerator. Surface water and groundwater would be collected and treated during the remedial action. There is presently no public access to the site; hence, there would not be a significant improvement in human health protection resulting from this alternative.

13.3.8 Cost

The estimated capital costs for alternative 4A are itemized in Table V-1, and total $40,000,000. The capital costs associated with off-site incineration are much higher than costs for the other alternatives. The only significant O&M costs for this alternative after implementation of the remedial measure would be surface water monitoring, estimated at $60,000 per year (Table V-2). The total present worth cost for alternative 4A is estimated at $41,000,000 (Table V-3), based on a 4 percent interest rate and a 30 year duration. Appendix A summarizes the assumptions and sources used to estimate these costs.

14.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, the three alternatives under consideration for the Wetlands are compared against each other. The comparison is based on the seven evaluation criteria established by NYSDEC. The alternatives are evaluated against the seven criteria discussed in Section 13.0. The comparison of alternatives for the Wetlands will facilitate the presentation of conclusions and recommendations in Section 15.0.

A direct comparison between alternatives for the Wetlands is summarized in Table V-4, to allow for easy comparisons of the alternatives on each criterion. A compilation of scores for each alternative, scored according to NYSDEC TAGM Tables 5-2 through 5-7, is presented in Table V-5. A brief discussion for each criteria is presented below. Two elements not addressed here are state and community acceptance, which the NYSDEC will evaluate prior to selecting the final remedy.

14.1 SHORT-TERM IMPACTS AND EFFECTIVENESS

Potential short-term impacts for alternatives 1A and 2A are minimal. There are significant short-term impacts associated with alternative 4A as a result of materials handling and transport operations for a large volume of contaminated materials. Additionally, air emissions and treated residuals resulting from the incineration process of alternative 4A could pose a threat to the local environment at the incineration site. All three alternatives would be effective in eliminating contact with and migration of contaminants, and would be implemented with the necessary control measures to minimize adverse impacts to the environment during the remediation.

14.2 LONG-TERM EFFECTIVENESS AND PERMANENCE

All three alternatives would be effective in eliminating contact with and migration of contaminants over the long-term. Alternatives 1A and 2A would not permanently destroy the contaminants but would permanently isolate them with a management system that includes collection, treatment and monitoring of groundwater and surface water. Alternative 4A would destroy the organic contaminants but would provide minimal treatment/destruction of inorganic contaminants, therefore long-term management of the treated residuals would probably be required. For all three alternatives, creation of a new wetlands area would result in no net loss of wetlands habitat.

14.3 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

Only alternative 4A would reduce the mobility, toxicity, and, possibly, the volume of contaminated sediment through source treatment. However, the collection and treatment of water associated with all three alternatives during implementation of the remedial measures will reduce the potential impacts of contamination. Implementation of alternative 1A would require leachate collection and treatment for the long-term. Alternatives 1A and 2A would mitigate contaminate transport pathways through containment.

14.4 IMPLEMENTABILITY

All three alternatives are considered technically implementable, given the limitations described earlier pertaining to performing construction work in soft ground areas. Removal of sediments associated with alternatives 2A and 4A and the placement and stability of the cap over the in-place sediments in alternative 1A, may be difficult to accomplish because of the physical properties of the underlying glaciolacustrine clays. Approval of a disposal application for off-site incineration (alternative 4A) may be difficult to obtain due to the cyanides, fluorides, sulfides, and metals contained in the contaminated sediment.

14.5 COMPLIANCE WITH ARARs

Implementation of alternatives 1A, 2A or 4A would satisfy site-specific remedial objectives of treating or isolating the contaminants from the Wetlands Area and restoring the Wetlands habitat. Alternative 1A would minimize contaminant mobility by capping, while water would be collected and treated to meet the applicable New York State SCGs. The removal alternatives 2A and 4A would also result in isolating the contaminants for the long-term. All three alternatives would involve creation of a new wetlands habitat. As a result of source removal and remediation of upgradient areas, water quality would be anticipated to improve significantly, and the water quality monitoring program would assess the progress in attaining the ARARs.

In summary, all three alternatives are expected to be equally effective in meeting ARARs.

14.6 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The three alternatives would be equally protective of human health and the environment; upon completion of remediation, all three will eliminate contact with, and migration of contaminants. Protection of human health and the environment during removal, transport and incineration of contaminants associated with alternative 4A is less certain.

14.7 COST

The total present worth cost associated with alternatives 1A, 2A and 4A are $10,000,000, $3,700,000, and $41,000,000, respectively. The costs associated with alternative 4A are significantly higher than those associated with alternatives 1A and 2A, reflecting the high unit costs of off-site incineration. Appendix A summarizes the assumptions and sources used for the cost estimates.

15.0
CONCLUSIONS AND RECOMMENDATIONS CONCERNING THE WETLANDS

Section 14.0 provides a comparative analysis of the alternatives available for the Wetlands. This section uses that analysis to recommend a particular alternative for the Wetlands. The recommended alternative is intended to satisfy the remedial action objectives presented in Section 3.1. Aspects of the recommended remedial alternative may change or be modified based on NYSDEC input and/or during review of the recommended alternatives on a site-wide basis.

For the Wetlands, alternative 2A is recommended. Alternative 2A includes the following main components:

- Dewater/excavate sediments and vegetation from the impacted area of the Wetlands
- Dewater and manage excavated materials on-site in the Former Potliner Storage Area (assumes that area will be capped)
- Backfill, grade, and seed excavated areas to provide adequate drainage of the area
- Redirect drainage towards the south with new drainageways
- Monitor surface water
- Construct approximately 10 acres of new wetlands in a nearby location

A review of alternative 2A, in regards to the seven NYSDEC TAGM evaluation criteria, indicate that it has minimal potential short-term impacts and, for the short- and long-term, is effective in eliminating contact with, and migration of contaminants, thereby providing overall protection of human health and the environment. Consolidation and capping of contaminated sediments in the Former Potliner Storage Area would reduce contaminant mobility and reduce the size of the affected area. Alternative 2A is technically and administratively feasible, although working in the Wetlands may be difficult, more difficult than in other areas due to the physical properties of the underlying clays. Water treatment would reduce contaminant levels to comply with ARARs. The alternative, relative to the other Wetlands remedial alternatives, is cost-effective with an estimated total present worth cost of $3,700,000.

Alternative 1A, when scored according to NYSDEC TAGM tables, scores approximately the same as alternative 2A (71 versus 74) and higher than alternative 4A (67) (Table V-5).

Alternative 2A meets the remedial action objectives (Section 3.1) by:

1) Considering means (water treatment and consolidation with on-site management) to permanently treat, reduce or immobilize contaminants

2) Preventing the migration of contaminants in groundwater and surface water on or beyond the Reynolds Plant boundaries

3) Minimizing contaminant transport, and preventing groundwater, surface water and air contamination

4) Providing a Wetland habitat, by creating a new area which is equivalent to the impacted portion of the Wetlands RR-6 ecosystem

The selection of alternative 2A will require the construction of new Wetlands in a nearby area to replace the Wetlands acreage lost by excavating and backfilling. Siting studies have not been performed to locate the replacement Wetlands, but it would likely be constructed adjacent to another portion of Wetlands RR-6.

TABLE V-1
CAPITAL COST ESTIMATE SUMMARY
WETLANDS

REMEDIAL ACTION	UNITS	UNIT COST	ALTERNATIVE 1A QUANTITY	ALTERNATIVE 1A COST	ALTERNATIVE 2A QUANTITY	ALTERNATIVE 2A COST	ALTERNATIVE 4A QUANTITY	ALTERNATIVE 4A COST
***************	*****	****	********	****	********	****	********	****
A. SITE PREPARATION								
1. Prepare Access Roads	lf	$35	3,800	$133,000	3,800	$133,000	3,800	$133,000
2. Clear and Grub	acre	$6,000	6.9	$41,400	6.9	$41,400	6.9	$41,400
3. Water/Sediment Control for Drainageways	LS	$45,000		$45,000		$45,000		$45,000
4. Water Control/Berms for Open Water Area	LS	$110,000				$110,000		$110,000
B. EXCAVATION/HANDLING OF CONTAMINATED SEDIMENT								
1. Excavate Sediments	ton	$10	7,745	$77,450	24,442	$244,420	24,442	$244,420
C. TRANSPORT AND TREATMENT OF CONTAMINATED SEDIMENT								
1. Transport/Treat at Commercial Incinerator	ton	$1,500					24,442	$36,663,000
2. On-Site Hauling	ton	$2	7,745	$15,490	24,442	$48,884		
D. COLLECTION/TREATMENT OF WATER								
1. Install Lateral Drains	lf	$5	1,100	$5,500				
2. Construct Drainageways for Surface Water	lf	$40	2000	$80,000	2000	$80,000	2000	$80,000
3. Piping to NY GAC	LS	$100,000		$100,000		$50,000 b		$50,000 b
E. SITE RESTORATION								
1. Backfill and Grade	ton	$5			24,442	$122,210	24,442	$122,210
2. Backfill Drainageways with Crushed Stone	cu yd	$20	5,163	103,260	5,163	$103,260	5,163	$103,260
3. Install RCRA Cap	sq ft	$10	300,564	$3,005,640				
4. Hydraulic Control for New Wetlands	LS	$40,000		$40,000		$40,000		$40,000
5. Excavate New Wetlands	ton	$5	97,768	$488,840	97,768	$488,840	97,768	$488,840
6. Vegetate the Wetlands	acre	$10,000	10.1	$101,000	10.1	$101,000	10.1	$101,000
DIRECT CAPITAL COSTS				$4,236,580		$1,608,014		$38,222,130
INDIRECT CAPITAL COSTS	(% of Direct Capital Costs)							
A. Implementation	(25%)			$1,059,145		$402,004		$500,000 a
B. Administration	(15%)			$635,487		$241,202		$750,000 a
C. Contingency	(25%)			$1,059,145		$402,004		$1,000,000 a
TOTAL ESTIMATED CAPITAL COSTS				$7,000,000		$2,700,000		$40,000,000

Notes: a. Estimated costs not based on a percentage of the capital costs.
b. Temporary water storage, transport, and treatment.

TABLE V-2
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS
WETLANDS

REMEDIAL ACTION	ALT. 1A	ALT. 2A	ALT. 4A
A. Groundwater Monitoring	$10,000		
B. Surface Water Monitoring	$50,000	$50,000	$50,000
C. Conveyance to NY GAC	$10,000		
D. Leachate Collection	$10,000		
E. Water Treatment (NY GAC)	$20,000		
F. RCRA Cap Maintenance	$50,000		
DIRECT O&M COSTS	$150,000	$50,000	$50,000
INDIRECT O&M COSTS			
A. Administration (10% of O&M Costs)	$15,000	$5,000	$5,000
B. Contingency (10% of O&M Costs)	$15,000	$5,000	$5,000
TOTAL ESTIMATED O&M COSTS	$180,000	$60,000	$60,000

TABLE V-3
SUMMARY OF REMEDIATION ALTERNATIVES
WETLANDS

ALTERNATIVE	KEY COMPONENTS	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH (a)
1A	A. Monitor Groundwater B. Monitor Surface Water C. Excavate Drainageways D. Install RCRA Cap E. Create a New Wetlands Area F. Groundwater Recovery/Treatment G. Construct New Surface Water Drainageways H. Backfill and Grade Drainageways	$7,000,000	$180,000	$10,000,000
2A	A. Monitor Surface Water B. Excavate Wetlands Sediments C. Dispose in Former Potliner Storage Area D. Backfill and Grade Excavated Area E. Create a New Wetlands Area F. Construct New Surface Water Drainageways	$2,700,000	$60,000	$3,700,000
4A	A. Monitor Surface Water B. Excavate Wetlands Sediments C. Transport/Treat at Commercial Incinerator D. Backfill and Grade Excavated Area E. Create a New Wetlands Area F. Construct New Surface Water Drainageways	$40,000,000	$60,000	$41,000,000

Notes: a. 30-year post-closure period, 4% interest.

TABLE V-4

COMPARISON OF WETLANDS REMEDIAL ALTERNATIVES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Criteria	Alternative 1A (Cap In-Place)	Alternative 2A (Consolidate Sediments)	Alternative 4A (Incinerate Sediments)
Short-Term Impacts and and Effectiveness	Minimal potential short-term impacts.	Minimal potential short-term impacts.	Potential short-term impacts during removal, transport, and incineration.
Long-Term Effectiveness and Permenence	Effective in eliminating contact with, and migration of, contaminants.	Effective in eliminating contact with, and migration, of, contaminants.	Effective in eliminating contact with, and migration of, contaminants; will destory organic contaminants.
Reduction of Toxicity,	The cap will reduce contaminant mibility. Dewatering will reduce sediment volume.	Consolidation of contaminated sediments in the Former Potliner Storage Area will reduce contaminant mobility and reduce the size of the affected area.	Incineration will reduce the toxcity of the organic constituents.
Implementability	Cap installation and stability issues may prolong implementation time.	Implementable. Removal of sediments from the Wetlands may be difficult due to the physical properties of the underlying clays.	Implementable. Removal of sediments from the Wetlands may be difficult due to the plysical properties of the underlying clays. Administrative feasibility is uncertain.
Compliance with ARARs	All ARARs will be met.	All ARARs will be met.	All ARARs will be met.
Overall Protection of Human Health and the Environment	Protective by eliminating contact with, and migration of, contaminants.	Protective by eliminating contact with, and migration of, contaminants.	Protective by removing contaminated sediments from the site.
Cost	Total alternative present worth is approximately $10,000,000.	Total alternative present worth is approximately $3,700,000.	Total alternative present worth is approximately $41,000,000.

TABLE V-5

SCORING OF WETLANDS REMEDIAL ALTERNATIVES
ACCORDING TO NYSDEC TAGM
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

	Alternatives		
	1A	2A	4A
Short-Term Impacts and Effectiveness (10)	10	10	7
Long-Term Effectiveness and Permanence (15)	7	7	13
Reduction of Toxicity, Mobility, or Volume (15)	0	0	10
Implementability (15)	13	12	7
Compliance with ARARs (10)	10	10	10
Overall Protection of Human Health and the Environment (20)	20	20	20
Cost (15)	11	15	0
TOTAL	71	74	67

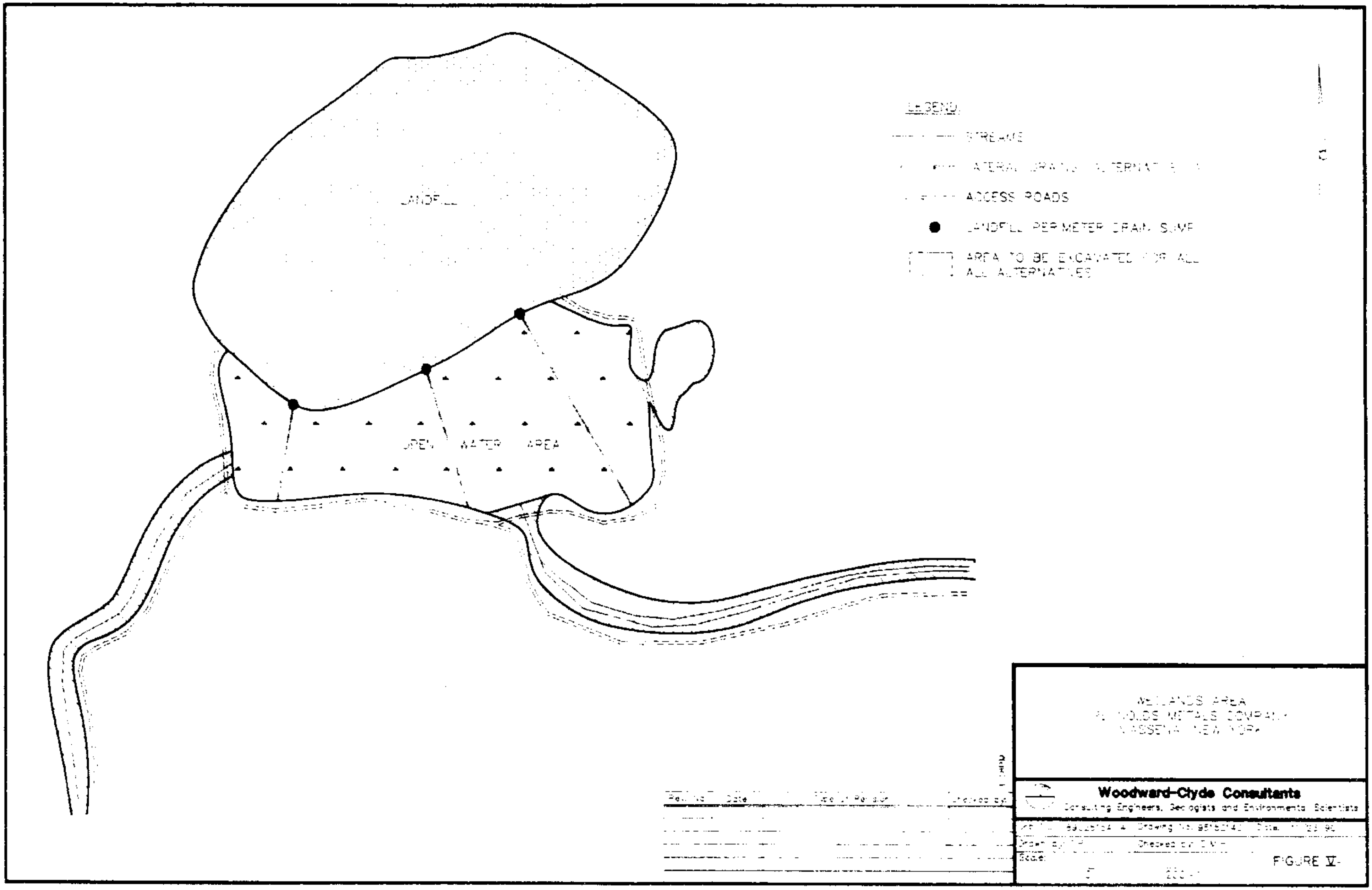
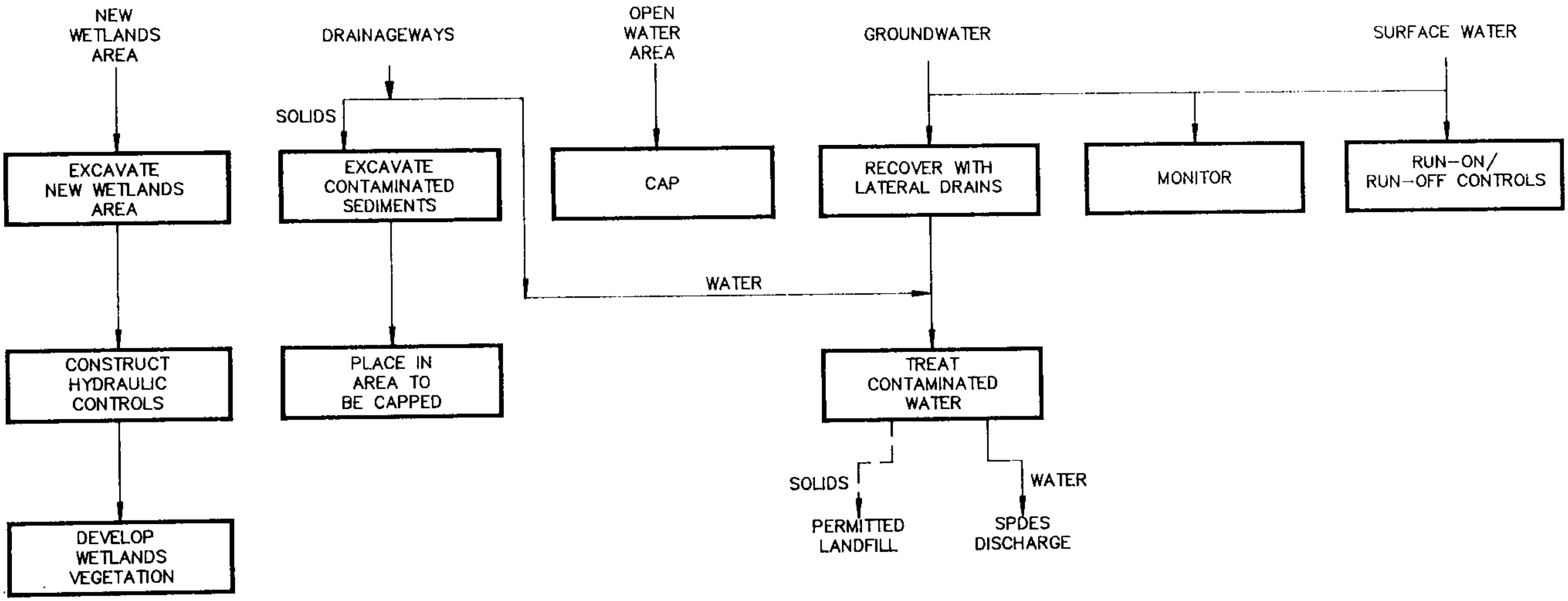
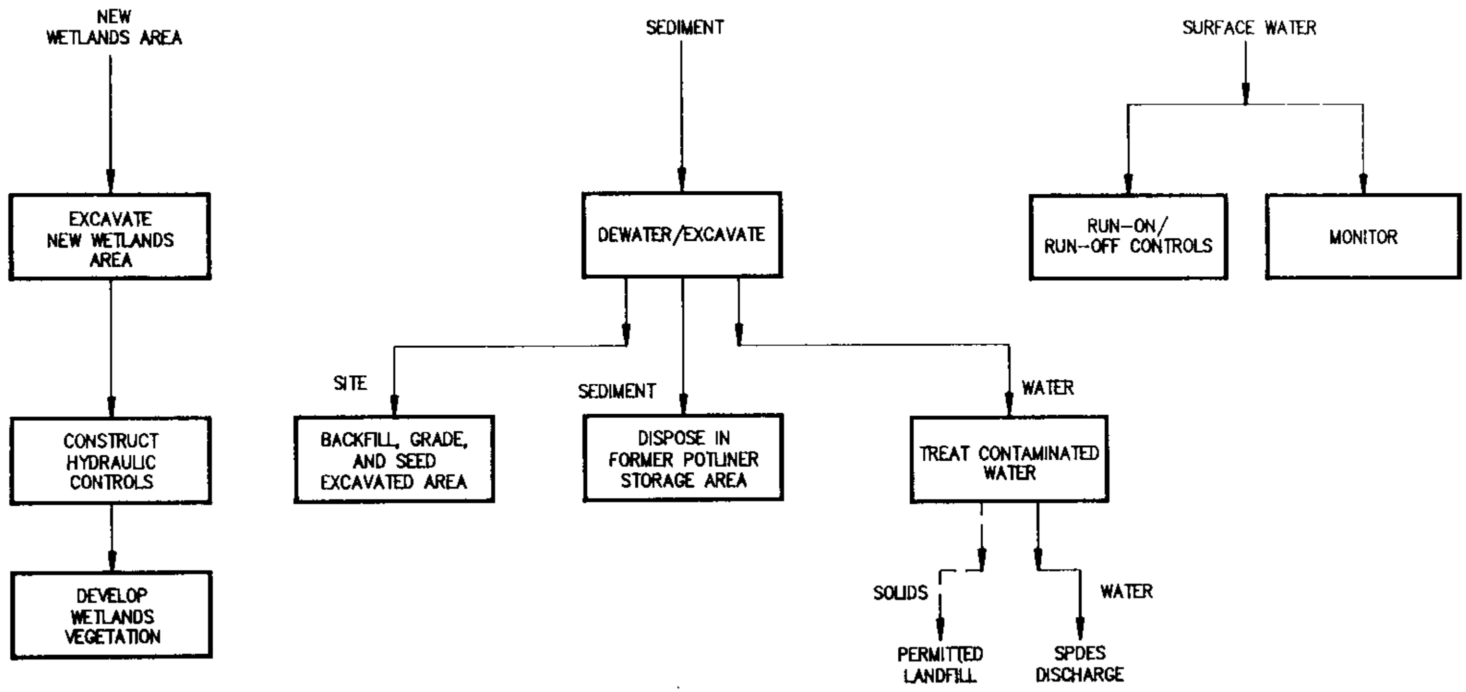

LEGEND
STREAMS
ACCESS ROADS
LANDFILL PERIMETER DRAIN SUMP
AREA TO BE EXCAVATED FOR ALL
ALL ALTERNATIVES
LANDFILL
WATER AREA
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
FIGURE V-

FIGURE V-2
WETLANDS
PROCESS FLOW DIAGRAM
ALTERNATIVE 1A



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

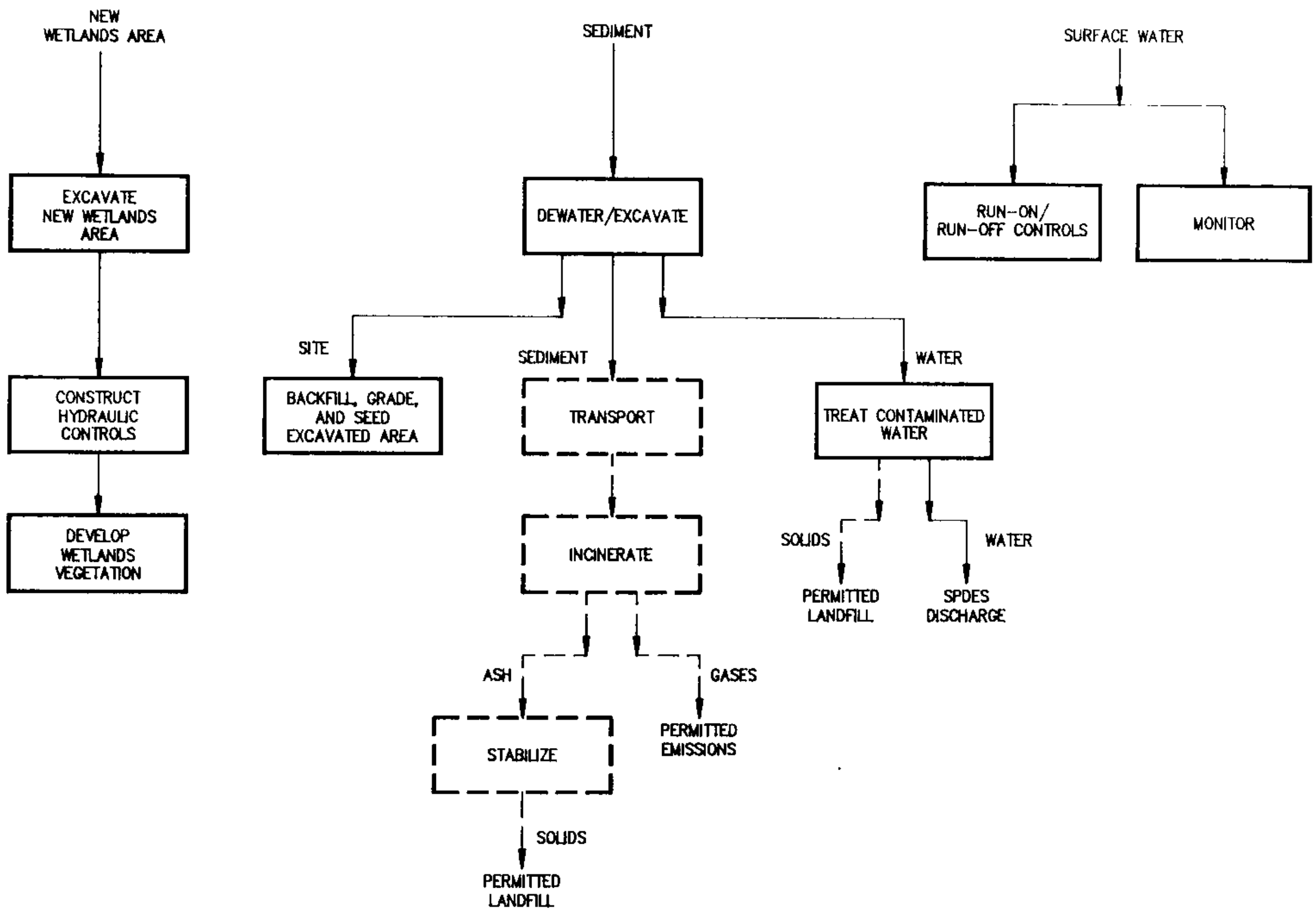
FIGURE V-3
WETLANDS
PROCESS FLOW DIAGRAM
ALTERNATIVE 2A



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE

Drawing No. 95150755

FIGURE V-4
WETLANDS
PROCESS FLOW DIAGRAM
ALTERNATIVE 4A



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE

Drawing No. 95150755

PART VI: POTLINER PAD AREA

16.0
ANALYSIS OF ALTERNATIVES

The Potliner Pad and the Crusher Building are in an active and relatively small on-site area (about 1 acre), much of which is paved. A drainage ditch traverses the area, the West Ditch, and continues to the St. Lawrence River. Part of the West Ditch was remediated as an IRM; this work is discussed in Parts I and VIII. The Potliner Pad is the concrete surface adjacent to the Crusher Building (shown in Figure VI-1). It was formerly used by Reynolds as an area for handling spent potliner, and has provisions for drainage of the Pad. The drainage pipeline leads to the existing wastewater treatment facility on-site. Various remedial measures were proposed in the Preliminary FS for the media associated with the Potliner Pad Area. Considering different combinations of remedial measures which could apply here, nine remedial alternatives were selected for further evaluation by this FS.

All but one of the alternatives considered below require rehabilitation of the Potliner Pad. This rehabilitation would include the following activities:

- Redirect drainage from the Pad to the North Yard GAC water treatment system (described in Section 6.5.1)
- Inspect the Pad for cracks and resurface with asphalt if necessary
- Regularly maintain an open drainage pathway (i.e., clean out accumulated sediments regularly to avoid plugging of the drain)

Some of the alternatives in the Preliminary FS proposed treatment of contaminated soils or sediments. These alternatives have been modified for the Final FS to consider on-site management of the excavated materials. The modification was made because of the low levels of contaminants detected in the sediments; presently there is not a reliable chemical treatment method for low-level PCBs in soils and sediments. Treatment by incineration is considered in Section 16.4. On-site management would involve moving the material to the Former Potliner

Storage Area and consolidating it with other soils and sediments from the site which contain relatively low levels of contamination. The alternatives which require on-site management of soils/sediments are therefore only viable if an in-place closure alternative is selected for the Landfill Area or a landfill is developed on-site. On-site landfilling of the soils/sediments from the Potliner Pad Area is considered in Part IX and Appendix E.

The nine alternatives are grouped by the type of control applied to the soil around the Potliner Pad (e.g., capping, excavating), with members of each group varying the controls on other media. The alternatives are discussed below in Sections 16.1, 16.2, 16.3, and 16.4 for alternatives 1 (A, B and C), alternatives 2 (B, C and D), alternatives 3 (A and B) and alternative 4A, respectively. Alternatives 1A, 1B and 1C propose institutional controls for soils; alternatives 2B, 2C and 2D propose capping the soils with an asphalt-composite cap, and alternatives 3A and 3B propose excavating the soils for disposal in the Former Potliner Storage Area. Alternative 4A has been eliminated from detailed consideration by this FS, as discussed in Section 16.4.

Section 16.0 provides a brief description of key components for each remedial alternative. Each alternative has in turn been assessed against the following seven evaluation criteria:

- Short-Term Impacts and Effectiveness
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Implementability
- Compliance with ARARs
- Overall protection of Human Health and the Environment and
- Cost

16.1 ALTERNATIVES 1A, 1B AND 1C

16.1.1 Alternative Definitions

Alternative 1A consists of institutional controls for all media, i.e., soil, sediment, groundwater and surface water. These controls would limit access to the Potliner Pad Area by deed and access restrictions, and groundwater and surface water would be monitored regularly.

The key components of alternative 1B include the following:

- Institutional controls for soils
- Monitor groundwater with existing wells
- Monitor surface water
- Pave ditch
- Install ditch culvert
- Potliner Pad rehabilitation
- Groundwater recovery and treatment
- Surface water collection and treatment

Alternative 1C is similar to alternative 1B above, but requires excavation of contaminated ditch sediments, disposal of the sediments in the Former Potliner Storage Area, and backfilling of the excavated area with crushed stone. A process flow diagram for alternatives 1A, 1B and 1C is given in Figure VI-2.

The ditch paving required by alternative 1B could be done using a crushed stone base followed by asphalt paving, or could be done using an impermeable geomembrane and paving blocks. For the purposes of this FS, it is assumed that a geomembrane and paving blocks would be used.

The excavation of ditch sediments required by alternative 1C would likely proceed after delineation of "hot-spot" areas along the ditch. The excavated area in upstream portions of the ditch would be backfilled with crushed stone to minimize erosion and promote good drainage.

For alternatives 1B and 1C, culvert installation for the downstream reach of the ditch would be completed (see Figure VI-1). This culvert would serve to isolate clean surface water run-off from any contaminated sediment in the ditch. Sediments in the existing culverts along the length of the ditch would be cleaned out, if necessary, to ensure a clean drainage pathway for surface water flow.

In order to collect surface water run-off (alternative 1B and alternative 1C), the areas adjacent to the Potliner Pad would be graded as necessary to induce drainage towards a collection sump. Berms or swales would also be constructed as needed. The water collected from the potentially contaminated soils in the Potliner Pad Area would be piped to the North Yard GAC treatment system.

For alternatives 1B and 1C, a groundwater recovery well would be installed in the Potliner Pad Area to recover groundwater contaminated with cyanides, fluorides, PCBs, and other site contaminants. The well would be placed within the relatively permeable fill soils of the former drainage ditch which runs north-south, adjacent to the Pad. The recovered groundwater, expected to be on the order of a few gallons per minute, would be directed to the North Yard GAC system.

16.1.2 Short-Term Impacts and Effectiveness

Alternative 1A is essentially a "no action" alternative. There would not be any short-term impacts beyond the existing conditions. Institutional controls would be effective in limiting exposure to contaminants by limiting access to the area and the contaminated media.

Implementation of alternative 1B or 1C would have no impact on the local community during remediation. All work would be conducted within a limited area of the plant site. Workers performing the remediation could contact contaminated soils, sediment, surface water or groundwater. Personal protective equipment would be used to minimize any exposure to these media. In addition, measures would be instituted to minimize spillage and leakage of contaminated water during remediation. Surface water and sediment control measures would be used to prevent adverse impacts on the local environment during remediation.

16.1.3 Long-Term Effectiveness and Permanence

The effectiveness of the institutional controls proposed by alternative 1A is associated with limiting exposure to the area. With respect to groundwater, there are no on-site or off-site drinking water wells in the vicinity of the plant, and groundwater flow rates are extremely low.

The long-term effectiveness of alternatives 1B and 1C are associated with the ditch remediation, groundwater recovery and treatment, and surface water collection and treatment. Remediation of the ditch, and collection and treatment of groundwater and surface water would act to significantly reduce contaminant transport from the area in the long-term. The excavation of contaminated sediments required by alternative 1C provides a more permanent solution than alternative 1B, as the removal of contaminated sediments could make the area available for future use.

16.1.4 Reduction of Toxicity, Mobility, or Volume

The remedial measures required by alternative 1A would not reduce the toxicity, mobility or volume of contaminated material.

For alternatives 1B and 1C, remediation of the ditch from the Potliner Pad Area, in conjunction with the collection and treatment of both groundwater and surface water from the area would effectively eliminate these contaminant transport pathways. The water treatment required by alternatives 1B and 1C would reduce contaminant toxicity and volume over the long-term.

16.1.5 Implementability

There would be no anticipated implementability constraints associated with alternatives 1A, 1B and 1C. Installation and operation of the groundwater recovery well would be done using standard practices, as would the grading and/or construction of berms to collect surface water. It is anticipated that water treatment would be implemented without the need for any area-specific treatment process design; the North Yard GAC system would be able to accept contaminated water from the area.

Implementation of the ditch remedial measures would involve standard earthworks and construction operations. For the most downstream reach of the ditch, clearing and grubbing of an adjacent area would be necessary to provide access for equipment. All work would be performed in Personal Protection Level D. Sediment and water control would be required during remediation. This control would likely entail the use of temporary berms, sediment traps, and pumps to collect any contaminated sediment or water mobilized as a result of remedial operations in the area.

16.1.6 Compliance With ARARs

Alternative 1A may not meet the site ARARs or TBCs. Therefore this area would pose a continuing risk, no greater than currently exists.

Capping of the sediments (alternative 1B) or excavation and management of the sediments (alternative 1C) would meet the remedial action objectives of preventing migration of contamination and minimizing the mobility of contaminants, as would collection and treatment of surface water and groundwater. The collection and treatment of surface water and groundwater would be designed to attain compliance with the applicable New York State SCGs. Monitoring of water quality in the area would enable an assessment of the effectiveness of the remedial measures.

16.1.7 Overall Protection of Human Health and the Environment

Alternative 1A calls for institutional controls, therefore exposure to the general public would be minimal. There is no current use of groundwater for drinking water, and future use would be prevented through land use restrictions. The groundwater monitoring system would evaluate potential future exposures. The effect of groundwater contamination on surface water quality is probably small due to attenuation, dilution and the low permeability of the subsurface.

Implementation of alternatives 1B or 1C would provide long-term protection of human health and the environment. Both options for the ditch remediation would effectively isolate the contaminated sediments from contact with humans, and surface water run-off. Exposure to the potentially contaminated soils in the Potliner Pad Area would be reduced or eliminated by institutional controls. The collection and treatment of surface water and groundwater would effectively mitigate the contaminant transport pathways, and thus protect the local environment.

16.1.8 Cost

Estimated capital costs for alternatives 1A, 1B and 1C are included on Table VI-1. The table itemizes the components of the direct and indirect capital costs for all alternatives under consideration for the Potliner Pad. The total estimated capital cost for alternatives 1A, 1B and 1C are $0, $260,000, and $210,000, respectively. Estimated O&M costs for alternatives 1A, 1B and 1C are included on Table VI-2. O&M costs are estimated at $60,000, $82,000, and $82,000, per year for alternatives 1A, 1B and 1C, respectively, and are largely attributed to monitoring costs. Capital and O&M costs are summarized on Table VI-3. Present worth costs for the alternatives have been computed for a 30-year period using a 4 percent interest rate, and are estimated for these alternatives at $1,000,000 for 1A, and $1,700,000 for alternative 1B and $1,600,000 1C (Table VI-3). Appendix A discusses the assumptions made and sources used to estimate the capital and O&M costs.

16.2 ALTERNATIVES 2B, 2C AND 2D

16.2.1 Alternative Definitions

The key components of alternative 2B follow:

- Cap all unpaved soils in the Potliner Pad Area
- Monitor groundwater with existing wells
- Monitor surface water
- Pave ditch
- Install stream culvert
- Potliner Pad rehabilitation
- Groundwater recovery and treatment

Alternative 2C requires the same remedial measures as alternative 2B, but instead of ditch paving, requires excavation of contaminated ditch sediments, disposal of the sediments in the Former Potliner Storage Area, and backfilling of the upstream excavated area with crushed stone. Alternative 2D is similar to alternative 2B above, but requires institutional controls for groundwater instead of recovery and treatment. A process flow diagram for alternatives 2B, 2C and 2D is given in Figure VI-3. Surface water collection for these three alternatives would be done by rehabilitation of the Potliner Pad. The adjacent areas would be capped with an asphalt-composite cap, thus providing a barrier to prevent potential surface water contamination. All other components of these alternatives are the same as those described in Section 16.1.1.

16.2.2 Short-Term Impacts and Effectiveness

Implementation of alternatives 2B, 2C and 2D would have little, if any, impact on the local community during construction. All of the work would be completed on the plant site. Workers performing the remediation could come in contact with contaminated soils, sediment, surface water or groundwater, but personal protective equipment would be used to minimize or eliminate this exposure. Preventative measures would be undertaken during ditch remediation to minimize any short-term impacts, as described in Section 16.1.5.

16.2.3 Long-Term Effectiveness and Permanence

The long-term effectiveness of alternatives 2B, 2C and 2D is primarily associated with the isolation or removal of contaminated materials, as discussed in Section 16.2.1. Surface water quality from the area would improve as a result of capping, Potliner Pad rehabilitation, and ditch remediation. Surface water monitoring would be used to assess the performance of these remedial measures.

In addition, for alternatives 2B and 2C, groundwater recovery and treatment would mitigate the groundwater pathway for contaminant transport.

16.2.4 Reduction of Toxicity, Mobility, or Volume

Contaminant transport via surface water and suspended sediment would be restricted by implementation of the ditch remediation required by all three alternatives. Surface water in contact with the Potliner Pad would be collected and treated in the on-site system. The capping of the potentially contaminated soils required by these three alternatives would limit rainwater infiltration and surface water run-off contamination. Transport of the contaminants via groundwater would be mitigated by installation and operation of the groundwater recovery well required by alternatives 2B and 2C. The water treatment required by these alternatives would reduce the toxicity of the contaminants, as well as the volume of contaminants in the long-term.

16.2.5 Implementability

The implementability of the components of alternatives 2B, 2C and 2D were discussed in Section 16.1.5. The installation of an asphalt-composite cap on the Potliner Pad Area soils would be easily implementable, without any anticipated delays due to technical, administrative or regulatory considerations.

No off-site TSD services would be required as part of these alternatives. It is assumed that construction materials would be available at the time of construction. These construction materials should be commercially available from several vendors. Currently, technologies required to implement these alternatives are available. The work tasks required for completion can be provided by more than one vendor to provide competitive bids.

16.2.6 Compliance With ARARs

The capping of soils and sediments, or the excavation and on-site management of sediments, would meet the remedial action objectives of minimizing contaminant mobility and would significantly improve surface water quality. The groundwater and surface water treatment required by alternatives 2B and 2C would be designed to attain ARARs. Monitoring of water quality in the area would enable an assessment of the effectiveness of the remedial measures in this regard.

16.2.7 Overall Protection of Human Health and the Environment

Installation of the caps and/or on-site management required by these alternatives would be expected to adequately protect human health and the environment. Contact with, and transport of, the contaminants of the soils/sediments of the Potliner Pad Area would be restricted. The integrity of the asphalt-composite cap would be ensured by regular maintenance procedures. The treatment of contaminated water required by alternatives 2B and 2C would help to mitigate any long-term risks which could be associated with the surface water and groundwater from the area. The protection associated with this alternative would primarily benefit on-site personnel and the receiving waters of the Potliner Pad Area drainageway.

16.2.8 Cost

The direct and indirect capital costs for all alternatives for the Potliner Pad are itemized in Table VI-1. The estimated capital cost for alternatives 2B, 2C and 2D are $520,000, $470,000, and $490,000, respectively. O&M costs are summarized on Table VI-2, and for these alternatives are estimated to be $84,000, $84,000, and $77,000, respectively, which would allow for regular cap maintenance, as well as groundwater collection and treatment (alternatives 2B and 2C). The present worth costs for these alternatives are estimated to be $2,000,000, $1,900,000, and $1,800,000, respectively, based on a 4 percent interest rate over a 30-year period. Table VI-3 summarizes all of the above costs. Appendix A discusses the assumptions made and sources used to estimate the capital and O&M costs.

16.3 ALTERNATIVES 3A AND 3B

16.3.1 Alternative Definition

The key components of alternative 3A follow:

- Excavate soils and manage on-site in Former Potliner Storage Area
- Backfill, grade and pave excavated area
- Monitor groundwater with existing wells

- Monitor surface water
- Pave ditch
- Install ditch culvert
- Potliner Pad rehabilitation
- Groundwater recovery and treatment

Alternative 3B requires the same remedial measures, but instead of ditch paving, requires excavation of contaminated sediments, disposal of the sediments in the Former Potliner Storage Area, and backfilling of the upstream excavated area with crushed stone. A process flow diagram for alternatives 3A and 3B is given by Figure VI-4. For the purposes of this FS, it was assumed that only unpaved, open areas would be excavated, and that the depth of contamination in the soils would coincide with the depth of fill material (typically 2 feet).

The components required by these alternatives have been described above in Sections 16.1.1 and 16.2.1. It is important to note, however, that these alternatives are viable only if an in-place management option is selected for the Landfill Area, but would also be applicable in concept if a new landfill cell is constructed elsewhere on-site (as described in Appendix E). As discussed in Section 6.4.1., disposal of low level contaminated soils in the Former Potliner Storage Area is considered environmentally equivalent to disposal in a new landfill cell.

16.3.2 Short-Term Impacts and Effectiveness

The short-term impacts associated with the implementation of the remedial measures required for these alternatives are primarily associated with the handling of the excavated soils and sediments. Because the Potliner Pad is in an active plant area, the potential for exposure of the plant workers would be increased during excavation and on-site transport of the material. Precautionary measures such as access restrictions and personal protective equipment would be used as necessary to minimize any potential risks. Water and sediment control measures would also be implemented as described in Section 16.1.5.

16.3.3 Long-Term Effectiveness and Permanence

The long-term effectiveness of alternatives 3A and 3B are essentially the same as that discussed in Section 16.2.3 for alternatives 2B and 2C, respectively. Because alternatives 3A and 3B require removal of contaminated soils prior to backfilling and paving, no restrictions would be necessary for future subsurface activities in the area.

16.3.4 Reduction of Toxicity, Mobility, or Volume

As discussed in Section 16.2.4 above for alternatives 2B and 2C, the primary contaminant transport pathways would be mitigated by implementation of these alternatives. In addition, the water treatment processes required would decrease the toxicity of the contaminants, in addition to decreasing contaminant volume over time.

16.3.5 Implementability

As Sections 16.1.5 and 16.2.5 indicate, no unusual implementability constraints are anticipated for implementation of the various remedial measures proposed. Excavation of Potliner Pad Area soils, however, would require consideration of building foundation stability. Excavation of potentially contaminated soils in an active plant area could require planning to limit access to the area, which would adversely impact daily plant operations.

No off-site TSD services would be required as part of this alternative. It is assumed that construction materials would be available at the time of construction.

16.3.6 Compliance With ARARs

Excavation and on-site management of soils and sediments, or capping of sediments, would comply with remedial action objectives by preventing migration of contamination and minimizing the mobility of contaminants, as would collection and treatment of surface water and groundwater. It is anticipated that the collection and treatment of surface water and groundwater would result in compliance with the applicable New York State SCGs. Monitoring of water quality in the area would enable an assessment of the effectiveness of the remedial measures.

16.3.7 Overall Protection of Human Health and the Environment

As discussed in detail in Section 16.2.7 for alternatives 2B and 2C, implementation of either alternative 3A or 3B would provide adequate protection of human health and the environment. The removal of contaminated soils from the area would help to ensure the long-term effectiveness of the measure.

16.3.8 Cost

Estimated capital costs for alternatives 3A and 3B are included on Table VI-1. The table itemizes the components of the direct and indirect capital costs for all alternatives under consideration for the Potliner Pad. The total estimated capital cost for alternative 3A is $620,000, and for alternative 3B is $570,000. Estimated O&M costs for the alternatives are itemized on Table VI-2. O&M costs include those annual costs necessary to administer alternatives 3A and 3B and ensure continued effectiveness of the remedial action. They are estimated at $84,000 per year for each of these two alternatives. Capital and O&M costs are summarized on Table VI-3. Present worth costs for the alternatives have been computed for a 30-year period using a 4 percent interest rate, and is estimated for these alternatives at $2,100,000 for alternative 3A and 2,000,000 for 3B. Appendix A summarizes the assumptions made and sources used to estimate the capital and O&M costs.

16.4 ALTERNATIVE 4A

Remedial alternative 4A, as defined in the Preliminary FS, calls for excavation and off-site incineration of sediments, capping soils and collection and treatment of surface water and groundwater. As previously indicated, the contaminant characterization of the sediments indicates minimal contamination. The levels of PCBs present are significantly below levels warranting incineration. Therefore, excavation and incineration, for the purposes of this alternative, has been changed to excavation and on-site management of these sediments. This change makes alternative 4A identical to alternative 2C. The reader is referred to Section 16.2 for the alternative evaluation.

17.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, the eight alternatives available for the Potliner Pad Area are compared against each other. The comparison is based on the seven evaluation criteria established by NYSDEC. The alternatives are individually evaluated against the seven criteria in Section 16.0. The comparison of alternatives for the Potliner Pad facilitates the presentation of conclusions and recommendations in Section 18.0.

A direct comparison between alternatives for the Potliner Pad Area is summarized in Table VI-4. A compilation of scores for each alternative, scored according to NYSDEC TAGM Tables 5-2 through 5-7, is presented in Table VI-5. The table format allows for easy comparisons of the alternatives on each criterion. A brief discussion for each criteria is presented below. Two elements not addressed here are the criteria of state and community acceptance, which the NYSDEC will evaluate prior to selecting the final remedy.

17.1 SHORT-TERM IMPACTS AND EFFECTIVENESS

The potential short-term impacts for all the Potliner Pad alternatives, with the exception of alternative 1A, are considered minimal. There are no short-term impacts related to alternative 1A (institutional controls). Similarly, all the alternatives, with the exception of alternative 1A, are effective in eliminating or limiting contact with, and migration of the contaminants.

17.2 LONG-TERM EFFECTIVENESS AND PERMANENCE

All the alternatives for the Potliner Pad would be effective in eliminating, or limiting, contact with contaminants over the long-term. Alternatives 1B, 1C, 2B, 2C, 3A and 3B require groundwater treatment and Potliner Pad rehabilitation. Rehabilitation of the Potliner Pad would allow drainage from the Pad to be collected and treated in the North Yard GAC treatment system. Alternatives 1B and 1C also require surface water treatment for drainage from adjacent areas. Alternative 1A does not require water treatment, and alternative 2D requires Potliner Pad rehabilitation. None of the alternatives would require treatment of contaminants associated with sediments and/or soils, but all alternatives except alternative 1A would include long-term management of contaminated sediments and soils.

17.3 REDUCTION OF TOXICITY, MOBILITY OR VOLUME

The collection and treatment of water associated with all alternatives, with the exception of alternatives 1A and 2D which call for institutional controls for waters, would reduce the toxicity and volume of contamination. With the exception of alternative 1A, all the alternatives involve some sort of containment for sediments and/or soils. Containment and water collection and treatment would mitigate contaminant transport pathways.

17.4 IMPLEMENTABILITY

All eight alternatives considered for the Potliner Pad Area are considered implementable. All are considered technically feasible with the administrative feasibility being less clear. Alternatives 2C, 3A and 3B are implementable only if an in-place closure alternative is selected for the Former Potliner Storage Area, otherwise, the alternatives would have to be redefined.

17.5 COMPLIANCE WITH ARARs

Implementation of the remedial measures required by the Potliner Pad alternatives would satisfy the remedial action objectives of minimizing contaminant mobility. Capping measures would limit contaminant transport by surface water, and by foot and vehicular traffic. Removal measures would eliminate the contaminant source form the area and isolate the contaminants in the Former Potliner Storage Area, which would be carefully maintained and monitored. These options would both result in improving water quality in the area. The groundwater recovery system required by many of the alternatives would accelerate this process. For all alternatives, the groundwater and surface water quality monitoring program would allow an on-going assessment of progress in attaining the applicable New York State SCGs.

17.6 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternatives 1B, 1C, 2B, 2C, 3A and 3B would provide equal overall protection of human health and the environment by eliminating or limiting contact with, and migration of, contaminants. Alternatives 1A and 2D would be protective to human health by limiting access, but would not necessarily be protective to the environment.

17.7 COST

The total cost associated with the eight alternatives for the Potliner Pad range from $1,000,000 for alternative 1A to $2,100,000 for alternative 3A. The remaining alternatives are within a relatively narrow range, from $1,600,000 to $2,000,000.

18.0
CONCLUSIONS AND RECOMMENDATIONS CONCERNING THE POTLINER PAD AREA

Section 17.0 provides a comparative analysis of alternatives available for the Potliner Pad Area. This section uses that analysis to recommend a particular alternative for the Potliner Pad Area. The recommended alternative is intended to satisfy the remedial action objectives presented in Section 3.1. Aspects of the recommended remedial alternative may change, or be modified, based on NYSDEC input and/or during review of the recommended remedial alternatives with a site-wide perspective.

For the Potliner Pad Area, alternative 2B is recommended. Alternative 2B includes the following main components:

- Cap sediments and soils
- Rehabilitate Potliner Pad
- Collect and treat groundwater
- Monitor groundwater and surface water

A review of alternative 2B in regards to the seven evaluation criteria indicate that it has minimal potential short-term impacts and, for the short- and long-term, is effective in eliminating contact with, and migration of contaminants. Collection and treatment of water will reduce the toxicity and volume of contamination. Alternative 2B is technically and administratively feasible. Water treatment would reduce contaminant levels to meet ARARs. The alternative would provide overall protection by eliminating contact with, and migration of contaminants. The alternative, relative to other alternatives for the Potliner Pad is considered to be cost-effective. The total cost for the alternative is $2,000,000.

Alternative 2B, when scored according to NYSDEC TAGM tables, scores within a narrow range of scores for the alternatives (52 to 65) (Table VI-5). The score for alternative 2B is 60. The only other alternatives which score slightly higher are alternatives 1A, 1C, and 2C with scores of 65 and 61 respectively.

Alternative 2B meets the remedial action objectives (Section 3.1) by:

1) Considering means (water treatment and capping) to permanently treat, reduce or immobilize contaminants

2) Preventing the migration of contaminants in groundwater and surface water on or beyond the Reynolds' plant boundaries

3) Minimizing the mobility of contaminants in soils and sediments and preventing groundwater, surface water and air contamination

In addition, alternative 2B minimizes the disruption of plant operations during remediation activities.

TABLE VI-1
CAPITAL COST ESTIMATE SUMMARY
POTLINER PAD

REMEDIAL ACTION	UNITS	UNIT COST	ALTERNATIVE 1A QUANTITY	ALTERNATIVE 1A COST	ALTERNATIVE 1B QUANTITY	ALTERNATIVE 1B COST	ALTERNATIVE 1C QUANTITY	ALTERNATIVE 1C COST	ALTERNATIVE 2B QUANTITY	ALTERNATIVE 2B COST	ALTERNATIVE 2C QUANTITY	ALTERNATIVE 2C COST
***************	*****	****	********	****	********	****	********	****	********	****	********	****
A. SITE PREPARATION												
1. Water/Sediment Control During Remediation	LS	$3,000				$3,000		$3,000		$3,000		$3,000
B. EXCAVATION/HANDLING OF CONTAMINATED MATERIALS												
A. Excavate Soil	ton	$5										
B. Excavate Sediment	ton	$10					443	$4,430			443	$4,430
C. TRANSPORT AND DISPOSAL OF CONTAMINATED MATERIALS												
1. On-Site Hauling	ton	$2					443	$886			443	$886
D. COLLECTION/TREATMENT OF WATER												
1. Potliner Pad Rehabilitation	LS	$10,000				$10,000		$10,000		$10,000		$10,000
2. Install Groundwater Recovery Well and Pump	LS	$20,000				$20,000		$20,000		$20,000		$20,000
3. Install Stream Culvert	lf	$75			210	$15,750	210	$15,750	210	$15,750	210	$15,750
4. Surface Water Collection	LS	$50,000				$50,000		$50,000				
5. Piping to NY GAC	LS	$20,000				$20,000		$20,000		$20,000		$20,000
E. SITE RESTORATION												
1. Install Asphalt-Composite Cap	sq ft	$5							42,400	$212,000	42,400	$212,000
2. Backfill Ditch with Crushed Stone	cu yd	$20					278	$5,560			278	$5,560
3. Pave Ditch (Geomembrane/Blocks)	sq ft	$5			8,600	$43,000			8,600	$43,000		
DIRECT CAPITAL COSTS						$161,750		$129,626		$323,750		$291,626
INDIRECT CAPITAL COSTS	(% of Direct Capital Costs)											
A. Implementation	(25%)					$40,438		$32,407		$80,938		$72,907
B. Administration	(15%)					$24,263		$19,444		$48,563		$43,744
C. Contingency	(20%)					$32,350		$25,925		$64,750		$58,325
TOTAL ESTIMATED CAPITAL COSTS				$0		$260,000		$210,000		$520,000		$470,000

TABLE VI-1
(continued)

REMEDIAL ACTION	UNITS	UNIT COST	ALTERNATIVE 2D QUANTITY	ALTERNATIVE 2D COST	ALTERNATIVE 3A QUANTITY	ALTERNATIVE 3A COST	ALTERNATIVE 3B QUANTITY	ALTERNATIVE 3B COST
***************	*****	****	********	****	********	****	********	****
A. SITE PREPARATION								
1. Water/Sediment Control During Remediation	LS	$3,000		$3,000		$3,000		$3,000
B. EXCAVATION/HANDLING OF CONTAMINATED MATERIALS								
1. Excavate Soil	ton	$5			5,496	$27,480	5,496	$27,480
2. Excavate Sediment	ton	$10					443	$4,430
C. TRANSPORT AND DISPOSAL OF CONTAMINATED MATERIALS								
1. On-Site Hauling	ton	$2			5,496	$10,992	5,939	$11,878
D. COLLECTION/TREATMENT OF WATER								
1. Potliner Pad Rehabilitation	LS	$10,000		$10,000		$10,000		$10,000
2. Install Groundwater Recovery Well and Pump	LS	$20,000				$20,000		$20,000
3. Install Stream Culvert	lf	$75	210	$15,750	210	$15,750	210	$15,750
4. Surface Water Collection	LS	$50,000						
5. Piping to NY GAC	LS	$20,000		$20,000		$20,000		$20,000
E. SITE RESTORATION								
1. Backfill and Compact	ton	$5			5,496	$27,480	5,496	$27,480
2. Install Asphalt-Composite Cap	sq ft	$5	42,400	$212,000	42,400	$212,000	42,400	$212,000
3. Backfill Ditch with Crushed Stone	cu yd	$20					278	$5,560
4. Pave Ditch (Geomembrane/Blocks)	sq ft	$5	8,600	$43,000	8,600	$43,000		
DIRECT CAPITAL COSTS				$303,750		$389,702		$357,578
INDIRECT CAPITAL COSTS	(% of Direct Capital Costs)							
A. Implementation	(25%)			$75,938		$97,426		$89,395
B. Administration	(15%)			$45,563		$58,455		$53,637
C. Contingency	(20%)			$60,750		$77,940		$71,516
TOTAL ESTIMATED CAPITAL COSTS				$490,000		$620,000		$570,000

TABLE VI-2
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS
POTLINER PAD

REMEDIAL ACTION	ALT. 1A	ALT. 1B	ALT. 1C	ALT. 2B	ALT. 2C	ALT. 2D	ALT. 3A	ALT. 3B
A. Groundwater Monitoring	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000
B. Surface Water Monitoring	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000
C. Maintain Ditch, Soils and/or Potliner Pad Remediation		$5,000	$5,000	$12,000	$12,000	$12,000	$12,000	$12,000
D. Conveyance to NY GAC		$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
E. Groundwater Recovery		$6,000	$6,000	$6,000	$6,000		$6,000	$6,000
G. Surface Water Collection		$5,000	$5,000					
H. Water Treatment (NY GAC)		$20,000	$20,000	$10,000	$10,000		$10,000	$10,000
DIRECT O&M COSTS	$50,000	$68,000	$68,000	$70,000	$70,000	$64,000	$70,000	$70,000
INDIRECT O&M COSTS								
A. Administration (10% of O&M Costs)	$5,000	$6,800	$6,800	$7,000	$7,000	$6,400	$7,000	$7,000
B. Contingency (10% of O&M Costs)	$5,000	$6,800	$6,800	$7,000	$7,000	$6,400	$7,000	$7,000
TOTAL ESTIMATED O&M COSTS	$60,000	$82,000	$82,000	$84,000	$84,000	$77,000	$84,000	$84,000

TABLE VI-3
SUMMARY OF REMEDIAL COSTS
POTLINER PAD

ALTERNATIVE	KEY COMPONENTS	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH (a)
1A	A. Monitor Existing Wells B. Monitor Surface Water C. Institutional Controls for All Media	$0	$60,000	$1,000,000
1B	A. Monitor Existing Wells B. Monitor Surface Water C. Institutional Controls for Soils D. Pave Ditch (Geomembrane/Blocks) E. Potliner Pad Rehabilitation F. Groundwater Recovery/Treatment G. Surface Water Collection/Treatment	$260,000	$82,000	$1,700,000
1C	A. Monitor Existing Wells B. Monitor Surface Water C. Institutional Controls for Soils D. Excavate Ditch Sediments E. Dispose of Ditch Sediments in Former Potliner Storage Area F. Potliner Pad Rehabilitation G. Groundwater Recovery/Treatment H. Surface Water Collection/Treatment I. Backfill Ditch with Crushed Stone	$210,000	$82,000	$1,600,000
2B	A. Monitor Existing Wells B. Monitor Surface Water C. Cap All Unpaved Areas D. Pave Ditch (Geomembrane/Blocks) E. Potliner Pad Rehabilitation F. Groundwater Recovery/Treatment	$520,000	$84,000	$2,000,000
2C	A. Monitor Existing Wells B. Monitor Surface Water C. Cap All Unpaved Areas D. Excavate Ditch Sediments E. Dispose of Ditch Sediments in Former Potliner Storage Area F. Potliner Pad Rehabilitation G. Groundwater Recovery/Treatment H. Backfill Ditch with Crushed Stone	$470,000	$84,000	$1,900,000

... interest rate

TABLE VI-3
(continued)

ALTERNATIVE	KEY COMPONENTS	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH (a)
2D	A. Monitor Existing Wells B. Monitor Surface Water C. Pave Ditch (Geomembrane/Blocks) D. Cap All Unpaved Areas E. Potliner Pad Rehabilitation	$490,000	$77,000	$1,800,000
3A	A. Monitor Existing Wells B. Monitor Surface Water C. Excavate Contaminated Soils D. Dispose of Soils in Former Potliner Storage Area E. Pave Ditch (Geomembrane/Blocks) F. Potliner Pad Rehabilitation G. Groundwater Recovery/Treatment H. Backfill and Pave Excavated Area	$620,000	$84,000	$2,100,000
3B	A. Monitor Existing Wells B. Monitor Surface Water C. Excavate Contaminated Soils and Sediments D. Dispose of Soils/Sediments in Former Potliner Storage Area E. Potliner Pad Rehabilitation F. Groundwater Recovery/Treatment G. Backfill Ditch with Crushed Stone H. Backfill and Pave Excavated Area	$570,000	$84,000	$2,000,000

Notes: a. 30-year post-closure period, 4% interest rate.

TABLE VI-4

COMPARISON OF ALTERNATIVES
POTLINER PAD
REYNOLDS METALS, MASSENA, NEW YORK

Criteria	Alternative 1A (Institutional Controls)	Alternative 1B (Pave Ditch)	Alternative 1C (Excavate Ditch)
Short-Term Impacts and Effectiveness	No short-term impact or effectiveness.	Minimal short-term impacts.	Minimal short-term impacts.
Long-Term Effectiveness and Permanence	Would limit exposure to area; would not be permanent.	Effective in eliminating contact with, and migration of, contaminants; will permanently treat water.	Effective in eliminating contact with, and migration of, contaminants; will permanently treat waters.
Reduction of Toxicity, Mobility or Volume	No reduction of toxicity, mobility or volume.	Capping will reduce contaminant migration potential.	Excavation and management will reduce contaminant migration potential.
Implementability	Easily implemented. Technically feasible.	Easily implemented. Technically feasible.	Easily implemented. Technically feasible.
Compliance with ARARs	Would meet ARARs.	Would meet ARARs.	Would meet ARARs.
Overall Protection of Human Health and the Environment	Protective to human health by limiting access.	Would provide overall protection to human health and the environment.	Would provide overall protection to human health and the environment.
Cost	Total present worth cost is approximately $1,000,000.	Total present worth cost is approximately $1,700,000.	Total present worth cost is approximately $1,600,000.

TABLE VI-4
(continued)

Criteria	Alternative 2B (Cap Soils, Pave Ditch, Collect Water)	Alternative 2C (Cap Soils, Excavate Ditch)	Alternative 2D (Cap Soils, Pave Ditch)
Short-Term Impacts and Effectiveness	Minimal short-term impacts.	Minimal short-term impacts.	Minimal short-term impacts.
Long-Term Effectiveness and Permanence	Effective in eliminating contact with, and migration of, contaminants; will permanently treat waters.	Effective in eliminating contact with, and migration of, contaminants; will permanently treat waters.	Effective in eliminating contact with contaminants.
Reduction of Toxicity, Mobility or Volume	Capping will reduce contaminant migration potential.	Capping and excavation will reduce contaminant migration potential.	Capping will reduce contaminant migration potential.
Implementability	Easily implemented. Technically feasible.	Easily implemented. Technically feasible. Dependent upon selection of in-place closure for the Former Potliner Storage Area.	Easily implemented. Technically feasible.
Compliance with ARARs	Would meet ARARs.	Would meet ARARs.	Would meet ARARs.
Overall Protection of Human Health and the Environment	Would provide overall protection to human health and the environment.	Would provide overall protection to human health and the environment.	Protective to human health and the environment.
Cost	Total present worth cost is approximately $2,000,000.	Total present worth cost is approximately $1,900,000.	Total present worth cost is approximately $1,800,000.

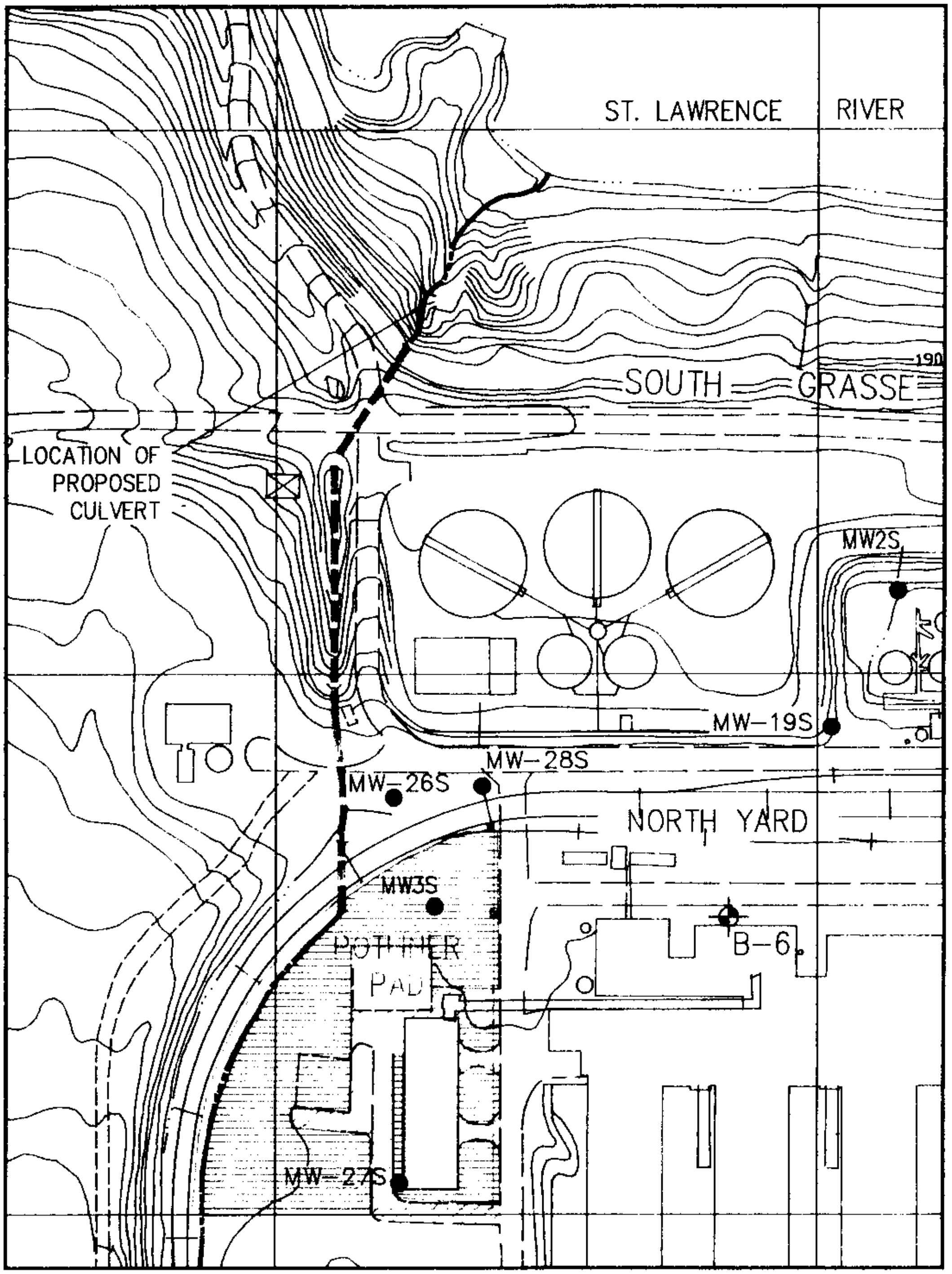
TABLE VI-4
(continued)

Criteria	Alternative 3A (Excavate Soils, Pave Ditch)	Alternative 3B (Excavate Soils, Excavate Ditch)
Short-Term Impacts and Effectiveness	Minimal short-term impacts.	Minimal short-term impacts.
Long-Term Effectiveness and Permanence	Effective in eliminating contact with, and migration of, contaminants; will permanently treat waters.	Effective in eliminating contact with, and migration of, contaminants; will permanently treat waters.
Reduction of Toxicity, Mobility or Volume	Capping and excavation will reduce contaminant migration potential.	Excavation will reduce contaminant migration potential.
Implementability	Easily implemented. Technically feasible. Dependent upon selection of in-place closure for Former Potliner Storage Area.	Easily implemented. Technically feasible. Dependent upon selection of in-place closure for Former Potliner Storage Area.
Compliance with ARARs	Would meet ARARs.	Would meet ARARs.
Overall Protection of Human Health and the Environment	Would provide overall protection to human health and the environment.	Would provide overall protection to human health and the environment.
Cost	Total present worth cost is approximately $2,100,000.	Total present worth cost is approximately $2,000,000.

TABLE VI-5

**SCORING OF POTLINER PAD REMEDIAL ALTERNATIVES
ACCORDING TO NYSDEC TAGM
REYNOLDS METALS COMPANY
MASSENA, NEW YORK**

	Alternatives							
	1A	1B	1C	2B	2C	2D	3A	3B
Short-Term Impacts and Effectiveness (10)	10	10	10	10	10	10	10	10
Long-Term Effectiveness and Permanence (15)	6	7	7	7	7	4	7	7
Reduction of Toxicity, Mobility or Volume (15)	0	0	0	0	0	0	0	0
Implementability (15)	13	12	12	12	12	12	12	12
Compliance with ARARs (10)	10	10	10	10	10	10	10	10
Overall Protection of Human Health and the Environment (20)	11	17	18	20	20	14	20	20
Cost (15)	15	3	4	1	1	2	0	1
TOTAL	65	59	61	60	60	52	59	60



LEGEND:

POTLINER PAD AREA

EXISTING PAVEMENT

EXISTING CULVERTS

PROPOSED ASPHALT-COMPOSITE CAPS FOR ALTS. 2B, 2C, AND 2D

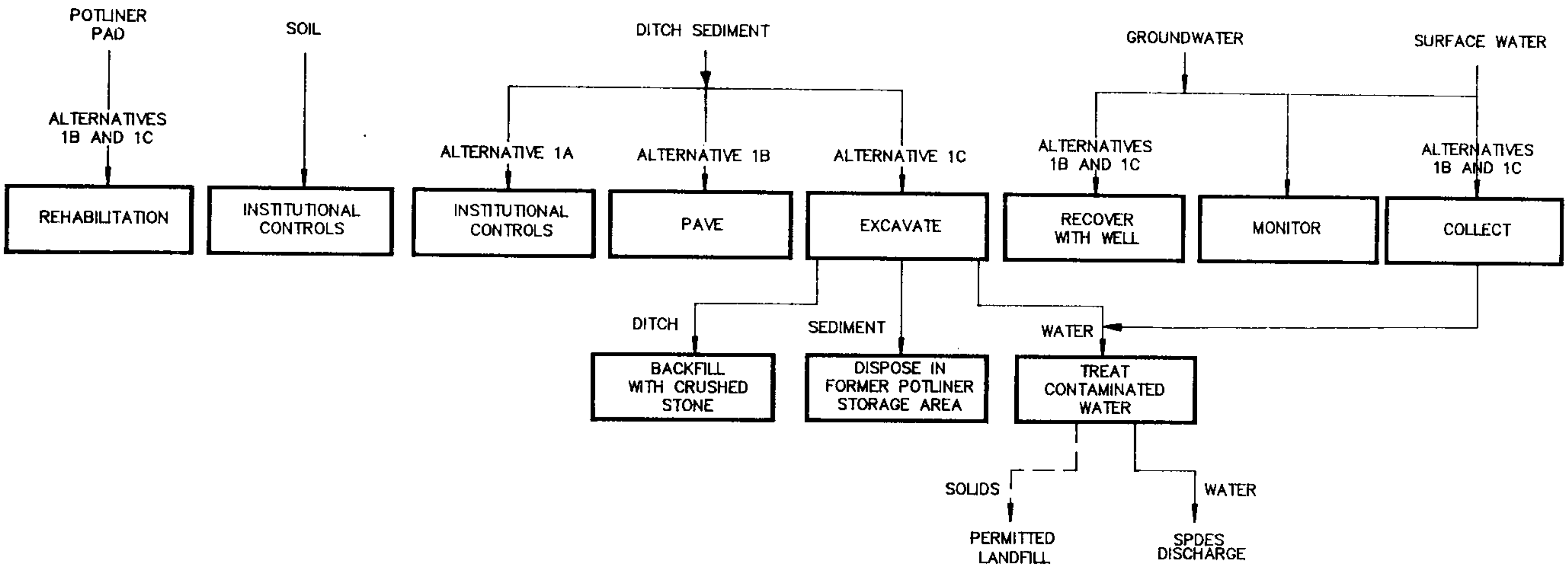
POTLINER PAD DRAINAGEWAYS (PROPOSED GEOMEMBRANE AND PAVING BLOCKS FOR ALTS. 1B, 2B, 2D AND 3A)

POTLINER PAD AREA
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

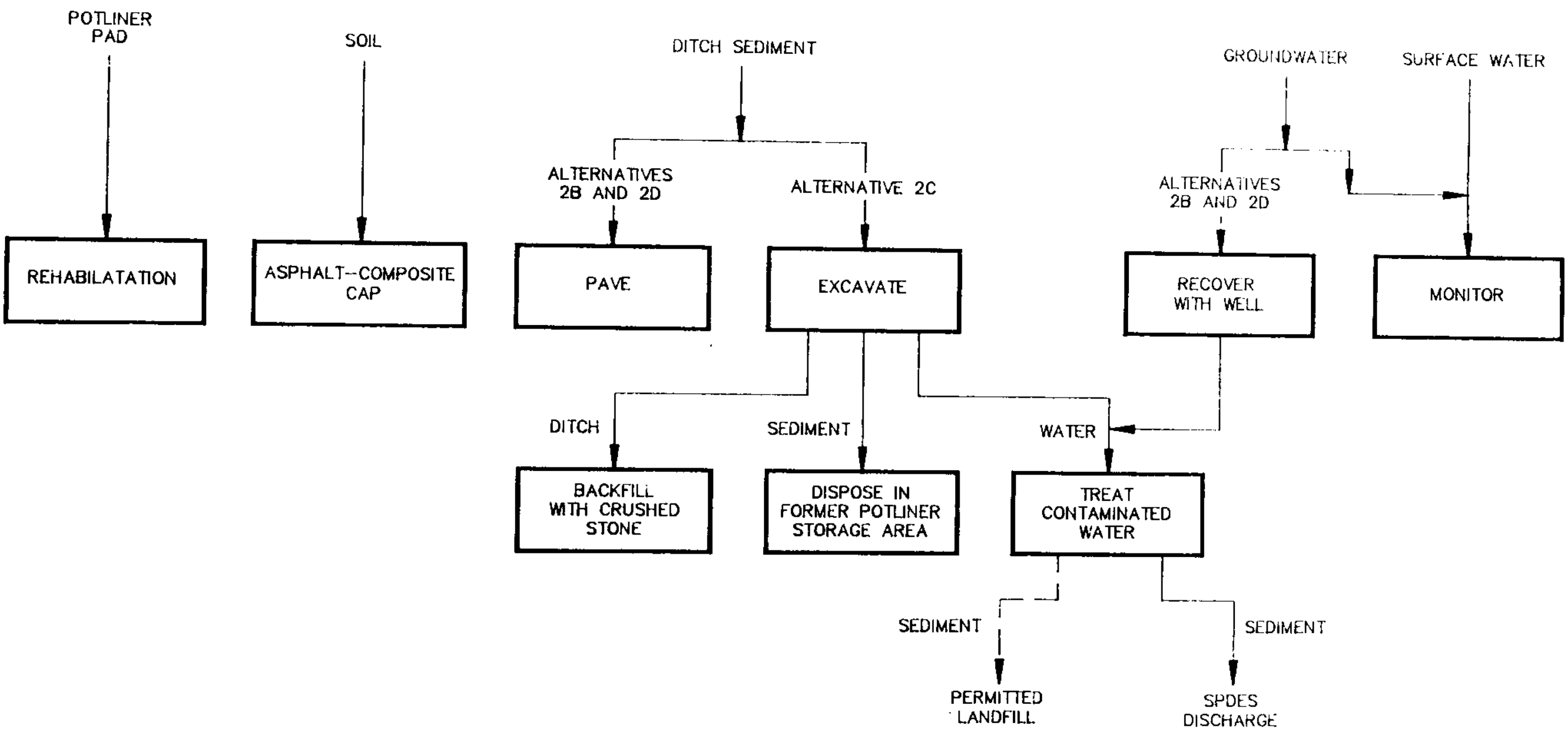
Job No.: 89C2515-4	Drawing No. 95150725	Date: 05/23/91
Drawn by: D.E.G	Checked by: P.R.J.	FIGURE VI-1
Scale: 0 — 200 FEET		

FIGURE VI–2
POTLINER PAD
PROCESS FLOW DIAGRAM
ALTERNATIVES 1A,1B AND 1C



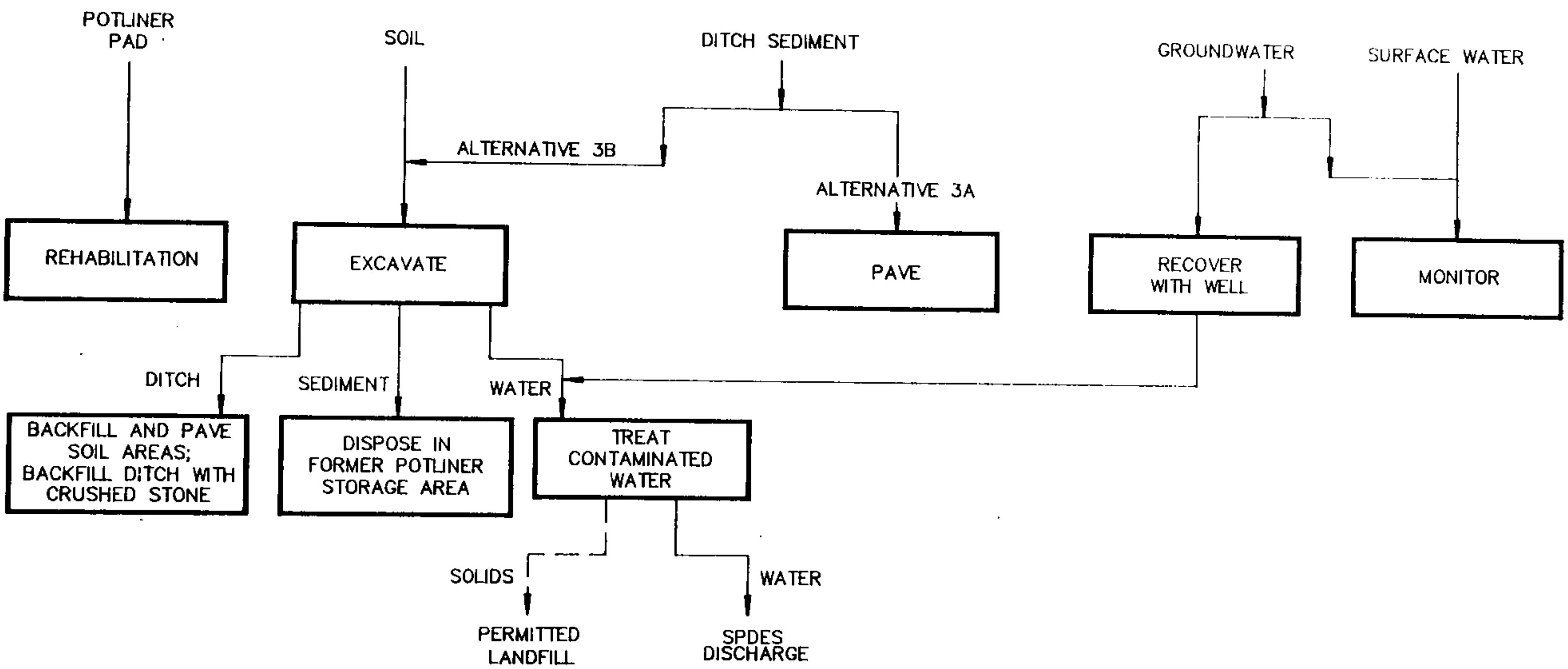
NOTE: SOLID LINES INDICATE ON–SITE ACTIVITIES; DASHED LINES OFF–SITE.

FIGURE VI-3
POTLINER PAD
PROCESS FLOW DIAGRAM
ALTERNATIVES 2B, 2C, AND 2D



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

FIGURE VI-4
POTLINER PAD
PROCESS FLOW DIAGRAM
ALTERNATIVES 3A AND 3B



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF-SITE.

PART VII: NORTH YARD

19.0
NORTH YARD

19.1 NORTH YARD CONSTRAINTS

The North Yard is a unique area of the plant with respect to the potential for remedial alternatives to have repercussions on plant operations, plant vitality, employment, and local socio-economics. Essential parts of the plant's operations occur in the North Yard; i.e., off-loading and storage of the main raw materials (alumina, coke, pitch), movement of materials from storage to points of use in the plant, and other key utilities. Furthermore, the North Yard is a transportation hub, in that virtually all rail cars entering and leaving the plant pass through this area.

Appendix G provides a detailed discussion of the day-to-day operations and logistical constraints in the North Yard.

The importance of maintaining operational continuity of the North Yard cannot be understated. The plant only has storage capacity of several days for alumina, coke, and pitch. Because large quantities of these materials are required for operations, use of temporary storage capacity would not be a feasible solution to this constraint. Significant disruptions in the supply of these materials to the potrooms would cause a total plant shutdown. Beside the significant economic impact associated with the restart of the potlines, it could be expected that up to 50 percent of the pots would experience cathode failure. Relining these pots would result in the generation of several thousand tons of an EPA-listed hazardous waste (K088).

Recognizing that any remedial alternative for the North Yard will have some impact on plant operations, the primary remedial challenge for this area is to balance the environmental goals with the operational considerations discussed above. In some scenarios, this may mean postponing the completion of parts of the remediation until such time that the plant closes. Appendix G provides a plan for remediation of the North Yard that accomplishes the environmental objectives without requiring a plant shutdown.

19.2 TREATABILITY STUDY RESULTS

Treatability studies on the North Yard soils were conducted in accordance with WCC's Work Plan of September 1990 and were later completed by Galson Remediation Corporation (GRC) in November 1990 and by OH Materials Corporation (OHM) in December 1990. The studies were conducted to evaluate the APEG dechlorination and the infrared thermal treatment technologies, respectively. The GRC and OHM final reports are included as Appendices B and C, respectively. The reports detail the procedures followed for the treatability studies on each composite soil sample and the corresponding results. In addition, during the course of the treatability studies, the full-scale implementability of each technology was considered. The vendors' unit rate estimates of full-scale treatment costs were also submitted. Sections 19.1 and 19.2 summarize and discuss the findings of the APEG dechlorination and the infrared thermal treatment treatability studies, respectively.

In addition to the two treatability studies mentioned above, more recent information has resulted in the undertaking of a treatability test program for treatment using a lime baghouse dust, fly ash, and one other reagent. This test program began in February 1991 and is underway at the time of submittal of this report. Section 19.5 describes the current status of the program.

19.3 APEG DECHLORINATION

The results of the bench-scale treatability study for APEG dechlorination suggest that treatment by this method might be feasible for low-level soils, but that additional laboratory scale work would be required to insure its success. In addition, many full-scale implementability concerns remain, as GRC's mobile treatment unit is still in the development and testing stage. Full-scale cost estimates for the process were given by GRC as $300 to $600 per ton, with a 50 percent margin of error. Because there are many uncertainties which would require significantly more study, this technology will be rejected from further consideration by this FS. More detailed discussion of the issues raised above follow.

GRC conducted treatability tests on two composite soil samples. Due to permitting constraints, the treatability test for the high PCB concentration soil was conducted on a sample which was mixed with the lower concentration soil to attain a resultant PCB concentration of less than 5000 ppm, as required by GRC's TSCA permit. This sample is referred to as the blended sample. Based on GRC's final analytical results, the APEG process may be technically feasible for the low level composite soil sample (44 ppm PCBs), but would not be successful in reducing the high concentration soil sample to the 2 ppm clean level (see Appendix B). The results of additional analytical work which was done by an outside laboratory for confirmatory purposes, as well as for information about parameters other than PCBs, is presented in Table VII-1. Discrepancies in the analytical results for PCB concentrations (between GRC and the outside laboratory) may be due to sample variability, soil matrix interferences, or the use of different analytical methods by the laboratories.

Apart from issues of technical feasibility based on laboratory testing, the full-scale implementability of GRC's mobile treatment unit is unproven. To-date GRC has not performed a full-scale remediation on soil volumes and concentrations comparable to those in the North Yard. It is anticipated, therefore, that major modifications may be necessary for process equipment such as centrifuges, the reagent recovery system, and soils handling equipment. These modifications would need to be based on further operational experience. For application of APEG to the North Yard soil, GRC recommends extensive additional laboratory and pilot-scale testing to better define the process reagent and materials handling requirements. The wide range in estimated unit cost reflects the uncertainties in the applicability of the APEG dechlorination technology to the North Yard soils. Therefore, as stated above, the APEG dechlorination treatment option is being rejected from further consideration by this FS.

19.4 INFRARED THERMAL DESTRUCTION

OHM's treatability study for infrared thermal destruction of PCBs in the North Yard soil indicated that the technology would be effective. In addition, OHM's mobile infrared thermal destruction unit has been successfully used for full-scale operations comparable to the North Yard application. OHM's treatability study report is given in Appendix C, and results are summarized below. Also in Appendix C is a description of the full-scale mobile unit, and past thermal destruction projects. Environmental emission control equipment is described therein, and trial burn emission results from previous projects are given. The estimated full-scale unit cost given by OHM is $325 per ton, with a mobilization/ demobilization cost of approximately $1,200,000, and a margin of error of 30 percent. Use of the mobile infrared thermal destruction unit appears to be a viable treatment alternative, and will therefore be retained for further consideration in this FS.

For both the high and low concentration composite samples, PCB concentrations were reduced to well below the 2 ppm clean level. In addition, TCLP analyses suggest that the treated residual would meet TCLP regulatory limits for metals, volatiles and semi-volatiles (see Table VII-1). Results from the outside confirmatory laboratory (ENSECO) for PCBs, dioxins and furans are presented in Table VII-1. Both short (15-minute) and long (25-minute) retention time trials resulted in acceptable reductions in PCB concentrations in the treated residual. Thus, given the results of these tests, a short retention time appears to be adequate for treatment of the North Yard soils.

For the evaluation of North Yard remedial alternatives which follows, infrared thermal treatment is used, as costs are available and the technology has been shown to be viable.

19.5 LIME/FLY ASH TREATMENT

Recent studies conducted for the USEPA Risk Reduction Engineering Laboratory (RREL) have indicated that the application of lime-related compounds may be a viable treatment method for PCB-contaminated materials. A work plan for treatability studies to examine the effectiveness of North Yard soil treatment with lime, fly ash, and another reagent was prepared and submitted to the USEPA on January 29, 1991. The primary goal of the test program is to determine whether lime/fly ash application can effectively detoxify the PCBs in the North Yard soils.

At the time of preparation of the Final FS, three phases of this treatability program were complete. The results from the first three trials show an apparent consistent reduction in PCB content of the treated samples. However, the study has been unable to achieve greater than

40 percent reduction in any of the 8-day individual reactions. WCC has initiated trial four as a long-term test with ten reactions which will be allowed to proceed for three months.

19.6 GROUNDWATER IN THE NORTH YARD

Groundwater is present in the North Yard as shallow groundwater confined to the thin layer of fill, or as deeper groundwater found either in the utility trenches or the native till soils. Shallow groundwater in the fill zone has been shown to be contaminated by PCBs, as indicated by samples from the French drain system. This French drain system, originally installed during construction of the plant, was designed to collect the shallow groundwater to prevent flooding and freezing of North Yard facilities and utilities. The French drain system is effective in collecting this shallow groundwater, and as such, has mitigated the potential for migration of PCBs to deeper groundwater.

The lack of PCB migration to deeper zones is also demonstrated by soil sampling in the fill and till zones and by groundwater sampling throughout the North Yard. The soil samples exhibit a significant (orders of magnitude) decrease in concentration below the fill/till interface, reflecting the barrier presented by the low permeability of the native till.

Groundwater sampling in the North Yard has been from wells screened in the fill located in utility trenches and in the till. With one possible exception, PCBs have not been detected at any of these locations, further substantiating the lack of PCB migration out of the shallow zone (thus supporting the effectiveness of the French drain system). The one possible exception is with MW-16S. Samples from this well have had detectable PCBs; however, the well had been damaged by a vehicle, destroying the integrity of the surface casing and seal. This may have allowed surface materials to contaminate the well, placing all subsequent data under suspicion of being non-representative. Reynolds has decommissioned and replaced this well.

20.0
ANALYSIS OF ALTERNATIVES

The results of the Preliminary FS indicated eleven remedial alternatives for the North Yard. These eleven remedial alternatives have been revised from those presented in the Preliminary FS to reflect more current understanding of appropriate remedial measures for the area. A total of five remedial alternatives were developed and evaluated for this FS. Each of the alternatives is described below, and evaluated with respect to the following seven criteria specified in the NYSDEC TAGM:

- Short-Term Impacts and Effectiveness
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Implementability
- Compliance with ARARs
- Overall Protection of Human Health and the Environment
- Cost

Remedial strategies for soils include in-situ capping, excavation and treatment, and on-site disposal of contaminated soils and treated residuals in a secure RCRA type cell.

Surface water and shallow groundwater collection and treatment has been included for all of the alternatives in light of the work which Reynolds has completed to implement the collection and treatment of surface water and shallow groundwater. Discussion and evaluation of this work is included in Part VIII; therefore, descriptions or discussions regarding water collection and treatment in the North Yard will be limited. Surface water and groundwater monitoring are also included as part of all alternatives under consideration.

The difference between the five North Yard alternatives is the remedial method for the contaminated soils, although they all require removal as a permanent remedy. Alternative 1 requires in-situ capping of the soils as a temporary measure, with full scale remediation performed at the time that the plant closes; alternatives 2A and 2B require excavation of contaminated soils with PCB concentrations above 10 ppm, followed by treatment or on-site landfilling, respectively; and alternatives 3A and 3B require excavation of the most highly contaminated soils (PCB concentrations above 500 ppm) followed by treatment or on-site landfilling, respectively. All five alternatives include excavation and/or capping of all soils with PCB concentrations greater than 10 ppm.

Figures VII-1 and VII-2 summarize the approximate distribution of PCBs and PCDDs, respectively within soils in the North Yard. Alternatives 2A and 2B include excavation of soils with PCB levels greater than 10 ppm and will also result in removal of soils contaminated with detectable levels of PCDDs. Alternatives 3A and 3B include excavation of soils with PCB levels greater than 500 ppm and will also result in removal of virtually all soils contaminated with detectable levels of PCDDs and most soils with PCDFs greater than 500 ppb.

In addition to the remedial measures required by the five alternatives, current operating units in the North Yard should be examined. Because the North Yard is used as an unloading and storage area for raw materials and fuels used at the plant, there is potential for continued non-PCB contamination of soils and water in the area. Therefore the operating units in the area, e.g., pipe bridge, pitch pump house, fuel storage tanks, pitch storage tanks, unloading shed, etc., should be inspected, and on-going processes and procedures should be critically reviewed. Where necessary, materials handling operations should be streamlined to minimize contamination resulting from spillage and fugitive dust. The retrofilled HTM oil should be monitored to evaluate the potential for continued contamination as a result of leakage.

20.1 ALTERNATIVE 1 - INTERIM CAPPING

20.1.1 Alternative Definition

Remedial alternative 1 consists of the following key components:

- Monitor groundwater and surface water
- In-place capping of contaminated soils with PCB levels greater than 10 ppm

- Collect and treat surface water and shallow groundwater
- Maintain the cap's integrity during the operational life of the plant
- Excavate pavement and contaminated soils from the North Yard after plant closure and demolition of buildings and structures
- Treat excavated materials using infrared incineration
- Dispose of treated residuals in an on-site secure landfill cell

This alternative has been developed and structured to account for the fact that alternatives requiring excavation of contaminated soils are not practical in the North Yard while the plant is operating. Upon closure of the entire facility, excavation will be more feasible and would be implemented.

As Figure VII-1 shows, much of the North Yard Area is occupied by structures required as part of active plant operations. An asphalt-composite cap would be installed in all unpaved areas other than the rail lines, and restrictions on subsurface activities would be implemented. Diked areas would be dewatered, as necessary, prior to installation of the cap. The soils comprising the dikes, and all other exposed soils would be capped to mitigate the potential for contamination of run-off, physical contact with the soils, and infiltration of rainwater. A process flow diagram for alternative 1 is given by Figure VII-3.

The asphalt-composite cap described in Part II (Figure II-2) would be installed over relatively flat, unpaved areas except where the railroad tracks exist (Figure VII-4). The contaminated subsoils would be graded to provide good surface water drainage for the North Yard. This would require negligible removal of contaminated soils. After grading, a 6-inch layer of coarse stone would be laid to provide an adequate subbase for the cap. This would be followed by application of a spray sealant and an asphalt-impregnated, non-woven, polypropylene geotextile. The asphalt layer would consist of a 2-inch base coat and a 2-inch top coat. The combination of these layers would provide significantly lower permeability than a conventional asphalt cap, and the grading would induce surface flow. This asphalt-composite cap could be replaced by a concrete-composite cap, although design details have not yet been developed.

For the steeply sloped areas north of the dikes, a uniform grouted mat would be used to minimize erosion and rainwater infiltration. The cap would be tied into the tank and building foundations to provide a continuous, low permeability barrier.

Surface water and shallow groundwater would continue to be collected and treated in the newly installed North Yard GAC system. Long-term monitoring of surface water and groundwater would also be required.

Upon closure of the St. Lawrence plant, full scale permanent remediation of the North Yard would be implemented. This would entail excavation of surface soils greater than 10 ppm of PCBs and subsurface soils greater than 50 ppm. This excavation would not begin until plant structures, such as the pipe bridge and unloading shed, were demolished. Excavated soils and pavement would be treated by infrared incineration, with the residuals disposed of in a secure on-site landfill cell, such as described in Appendix E. For the purposes of this FS only, WCC assumed that the cap would be designed and maintained for a 30-year life span, with final remediation beginning at year 30.

20.1.2 Short-Term Impacts and Effectiveness

Implementation of the remedial measures required by this alternative would have minimal short-term impacts. Implementation of alternative 1 would not require handling or transport of large volumes of contaminated soils or waste. Cap installation would involve potential contact with contaminated soils only at the beginning of installation. Measures would be implemented to minimize generation of dust and associated migration of contaminants past work areas. Standard health and safety practices would be implemented to minimize exposure to workers.

20.1.3 Long-Term Effectiveness and Permanence

Over the first 30 years, the long-term effectiveness of this remedial alternative is associated with both capping and water collection and treatment. The capping of contaminated soils acts to mitigate the potential for human contact with contaminated materials. In addition, capping would significantly reduce rainwater infiltration, thus minimizing the potential for groundwater contamination. Surface water contamination resulting from contact with contaminated surface soils would be mitigated by capping. Collection and treatment of surface treatment water and shallow groundwater should improve water quality. The permanence of the remedial measures would be substantially improved by maintenance of the cap, and would be monitored by both surface water and groundwater quality monitoring. The long-term permanence of this alternative would be further established by the excavation and treatment of contaminated soils after plant closure.

20.1.4 Reduction of Toxicity, Mobility, or Volume

Capping of contaminated soils in the North Yard would restrict contaminant transport by minimizing rainwater infiltration. The collection and treatment of surface water and shallow groundwater and the eventual disposal of soils would mitigate potential impacts from the contaminants on the surrounding environment. Transport of contaminated soils via foot or vehicular traffic, or via airborne particulates would be eliminated by the cap. After final remediation, the potential exposure routes would be further reduced by incineration of the contaminated soils and disposal of the residuals in a secure landfill.

20.1.5 Implementability

The remedial measures proposed for alternative 1 could all be implemented using standard construction, water monitoring, and treatment practices. The cap design would need to be altered in some areas to provide a continuous barrier, while minimizing interference of the cap with essential on-site equipment and operations.

Future intrusive (subsurface) maintenance work would be done in accordance with all applicable regulatory requirements. Maintenance workers would be health and safety-trained in accordance with OSHA requirements for hazardous waste workers. Any excavated soil would be tested to determine whether backfilling the soil would be appropriate. If contaminant levels were such that backfilling would be inappropriate, the soils would be disposed of at an off-site, commercial landfill, and clean fill would be used to backfill the excavated volume.

Administrative coordination with regulators during subsurface maintenance activities would be required to assure compliance with all appropriate procedures. Any future excavation work in the area would be completed by restoring the asphalt-concrete cap to its original condition.

Off-site TSD services would not be required for this alternative. It is assumed that construction materials would be commercially available from several vendors. Currently, technologies required to implement this alternative are available. The work tasks required for completion can be provided by more than one vendor to provide for competitive bids, and no schedule delays would be anticipated.

20.1.6 Compliance With ARARs

This remedial alternative would meet ARARs. Surface water run-off would no longer be in contact with contaminated soils. Therefore, it is anticipated that surface water quality would improve. Surface water treatment would ensure compliance with New York State SCGs. In addition, installation of the cap would help to mitigate further groundwater contamination. Shallow groundwater treatment would ensure compliance with New York State SCGs.

20.1.7 Overall Protection of Human Health and the Environment

Installation of the asphalt-composite cap to isolate the North Yard soils is expected to protect human health and the environment for its design life. The cap would be maintained regularly to ensure continued long-term performance as a physical barrier between contaminated soils and the surrounding environment. Surface water and shallow groundwater collection and treatment would reduce contaminant migration via surface water and groundwater pathways. The long-term disposal of contaminants in a secure landfill cell, following incineration, with appropriate monitoring, would be protective of human health and the environment.

20.1.8 Cost

The estimated direct and indirect capital costs for alternative 1 are presented in Table VII-2. Estimated unit costs for some operations are estimated to be higher than for other areas of the plant due to implementability constraints (see Appendix G). The total estimated capital cost is $6,000,000. This capital cost was obtained by using present worth values for those activities performed at the time of plant closure, assumed to be in 30 years. O&M costs are itemized in Table VII-3, and are estimated at $246,000 from years 0 to 30 and $217,000 for years 30 to 60. Present worth costs were calculated on the basis of a 4 percent discounted rate of return for a 30 year period of cap maintenance with excavation and disposal occurring in year 30, with an additional 30 years of landfill O&M. Present worth costs for this alternative are estimated at $11,000,000.

20.2 ALTERNATIVES 2A AND 2B - TREATMENT/CONTAINMENT

20.2.1 Alternative Definition

Alternative 2A consists of the following key components:

- Monitor surface water and groundwater
- Modify plant facilities and operations to allow for excavation of contaminated soils with PCB levels above 10 ppm
- Treat contaminated soils on-site
- Dispose of treated soils in a secure on-site landfill cell
- Backfill, grade, and pave excavated area
- Collect and treat surface water and shallow groundwater

Alternative 2B requires many of the same remedial measures, but instead of on-site treatment, it requires on-site landfilling of the contaminated soils without treatment. A process flow diagram for these alternatives is given by Figure VII-5.

For both alternatives 2A and 2B, excavation of contaminated soils would require modifications to the facilities and operations in the North Yard, if the remediation is to occur while the plant is operating. Furthermore, the remediation would have to be staged over several construction seasons. Details of the plan for excavation of the North Yard under these alternatives are provided in Appendix G.

Alternative 2A provides treatment of contaminated soils on-site using a mobile thermal destruction unit. Contaminated soil and fill materials would be excavated, with oversize material being separated from the material to be treated. Depending on the treatment effectiveness, it is possible that soil and fill materials treated in this manner would still be considered a regulated waste and would therefore require landfill disposal rather than use as common fill. Therefore, for the purposes of this FS, it is assumed that treated soils and untreated oversize materials would be placed in an on-site secure landfill cell.

Alternative 2B provides for on-site disposal of contaminated material in a dedicated, secure landfill cell. Both alternatives 2A and 2B provide for on-site management of contaminated material by Reynolds.

20.2.2 Short-Term Impacts and Effectiveness

The potential short-term impacts associated with both alternatives 2A and 2B are primarily those which result from materials handling operations for a relatively large volume of contaminated soils. Exposure of the remediation workers to the soils would be minimized by the use of personal protective equipment.

For alternative 2A, the potential short-term impacts during treatment would be associated with equipment failures during the process which could result in accidental untreated air emissions, and spillage or leakage of contaminated process waters. Depending on the treatment effectiveness, transport and handling of the treated residuals might pose a risk to the environment in the event of an accidental spill. During the remediation, precautionary measures would be taken to minimize the potential for adverse environmental impacts, e.g., bermed areas for treatment equipment, emergency spill procedures.

For alternative 2B, post-excavation materials handling operations would be limited to on-site hauling of the soils for storage. Thus, any potential short-term impacts would be limited to a relatively restricted on-site area.

20.2.3 Long-Term Effectiveness and Permanence

Implementation of either alternative 2A or 2B would remove contaminated materials from an active plant area, thereby minimizing the potential for exposure to, or transport of the contaminants, and eliminating contamination of the local groundwater. Surface water and shallow groundwater collection and treatment would ensure that any water leaving the North Yard Area would be in compliance with water quality standards.

For alternative 2A, treatment of the soils would permanently destroy the organic contaminants in the soil. For alternative 2B, long-term monitoring and controls for the on-site storage facility would ensure the effectiveness of the remedial measure.

20.2.4 Reduction of Toxicity, Mobility, or Volume

Implementation of either alternative 2A or 2B would minimize contaminant transport by removing contaminated soil and fill materials from the North Yard Area. Alternative 2A would provide reduction in contaminant toxicity and volume through thermal destruction of organic contaminants. On-site containment of contaminated materials (alternative 2B) and treated residues (alternative 2A) would virtually eliminate long-term contaminant transport pathways. Surface water and shallow groundwater collection and treatment would reduce contaminants in the area and potentially leaving the site.

20.2.5 Implementability

Excavation of the contaminated soils from the North Yard is technically feasible, although difficult, due to the necessity of moving, modifying, or replacing many facilities and unit operations in the area. Because the excavation would be performed adjacent to buildings and other structures, however, their structural stability would need to be evaluated prior to excavation. For the purposes of this FS, it was assumed that contaminated soil underneath foundations and other structures would not be removed.

As detailed in Appendix G, considerable administrative and logistical arrangements would be required to allow the remediation to proceed without disruption of on-going plant activities. Remediation of the area, and in particular, excavation under the railroad tracks, could result in a complete shutdown of the facility if appropriate technical, logistical, and administrative arrangements are not made. It is estimated that excavation of the North Yard soils would require 2-3 construction seasons.

For alternative 2A, involving on-site treatment, the administrative feasibility of incineration could require substantial planning, negotiation and permitting. Public meetings and good community relations would be required to obtain community acceptance of the thermal destruction process prior to initiation of the soil treatment. The technical feasibility of the treatment process was demonstrated by the results of the treatability study, discussed above in Section 19.0. Disposal of the treated residual may require additional administrative and technical considerations, such as approvals and/or permits for disposal in a landfill cell.

Construction of an on-site landfill cell, as required by alternatives 2A and 2B would be technically feasible, but would require regulatory approval and permitting. Community resistance would also need to be overcome before disposal of contaminated materials could be implemented on-site.

20.2.6 Compliance With ARARs

For alternatives 2A and 2B, removal of the contaminated soils in the North Yard would satisfy site-specific ARARs and remedial action objectives. In addition, surface water and groundwater quality are expected to improve, as a result of source removal and water treatment, to New York State SCGs. Water quality monitoring would assess the progress in attaining ARARs.

For the treatment alternative 2A, there would be a potential for non-compliance with air quality ARARs in the event of emission control system problems with the mobile thermal destruction unit under consideration for this alternative. For instance, "...since the nominal operating range of incinerators precludes measurable POHC [principal organic hazardous constituents] or PIC [products of incomplete combustion] emissions, we are left with the conclusion that temporal or spatial excursions from the measured conditions are responsible for the observed emissions. These "failure modes" may be due to excursions in temperature (thermal), residence time (temporal), or oxygen concentration (mixing)" (Minimization and Control of Hazardous Combustion Byproducts; Dellinger et al; USEPA Risk Reduction Engineering Laboratory, May 1991). However, oversight of operations and maintenance would help to mitigate these potentials Dust generated during handling of the treated residuals could also result in short-term non-compliance with ARARs, unless dust suppression methods are 100 percent effective.

For the on-site landfilling alternative, on-site hauling of the contaminated soil would increase the potential for accidents to occur as a result of the increased on-site traffic (approximately 2500 truckloads would be required). In the event of a spill, clean-up procedures would be implemented.

20.2.7 Overall Protection of Human Health and the Environment

The removal of contaminated North Yard soil would ensure that there would no longer be the potential for physical contact with the contaminants from the area. Thus, further surface water and groundwater contamination in the area would also be mitigated. For alternative 2A, air emissions, water treatment, and disposal of the treated residuals would need to be carefully controlled parts of the remediation. The on-site landfill cell required by alternatives 2A and 2B would be a secure controlled facility, and would be designed to ensure adequate protection of human health and the environment. Collection and treatment of surface water and shallow groundwater would remove residual contaminants prior to discharge to adjacent receiving waters. Long-term monitoring of groundwater would provide a measure of effectiveness of the remedial strategy.

20.2.8 Cost

The majority of the capital costs associated with alternative 2A are associated with the treatment of contaminated soils. Estimated unit costs for many other activities are higher than for other areas of the plant due to implementability constraints (Appendix G). In addition, these alternatives include the costs of moving or modifying plant processes to the extent necessary to accomplish the remediation. The total estimated capital cost for alternatives 2A and 2B is $28,000,000 and $8,000,000, respectively (Table VII-2). Estimated O&M costs for the treatment alternatives 2A and 2B are $230,000 annually, and are associated primarily with monitoring costs (Table VII-3). For alternative 2A, if on-site landfilling of treated residuals were not required, capital costs would decrease by about $1,200,000. Overall capital and O&M costs are summarized by Table VII-4, and present worth costs are approximately $32,000,000 and $12,000,000 for alternatives 2A and 2B, respectively. Additional assumptions used in developing the cost estimates are provided in Appendix A.

20.3 ALTERNATIVES 3A AND 3B - SELECTIVE REMOVAL

20.3.1 Alternative Definitions

Alternative 3A consists of the following key components:

- Monitor surface water and groundwater
- Modify plant facilities to allow for excavation of contaminated soils with PCB levels greater than 500 ppm
- Incinerate contaminated soils on-site
- Dispose of treated soils in a secure on-site landfill cell
- Backfill, grade, and pave (cap) excavated area
- Pave (cap) adjacent areas with PCB levels between 10 and 500 ppm
- Collect and treat surface water and shallow groundwater

Alternative 3B requires similar remedial measures as alternative 3A, but requires direct on-site land disposal of the excavated materials with no on-site treatment. A process flow diagram for these alternatives is given by Figure VII-6.

For the purposes of this FS, it is assumed that high-level contaminated soils would include those soils with PCB concentrations greater than 500 ppm. The excavated area on-site would be backfilled and compacted, then graded to promote good surface water drainage and to provide a suitable subbase for installation of a macadam cap. Paving would be done in conjunction with the paving of the adjacent low-level contaminated areas, thus providing a barrier to isolate the contaminated soils from physical contact and rainwater infiltration. Paving would not be required in the rail lines. Collection and treatment of surface water and shallow groundwater would be implemented as described in Section 20.1.1.

As with alternatives 2A and 2B, plant processes and facilities in the North Yard would have to be moved or modified to accomplish the excavation of soils without large-scale plant disruptions. With alternatives 3A and 3B, however, the amount of excavation is significantly less than for alternatives 2A and 2B (approximately 8,700 tons versus 35,000 tons), although the areas that would be excavated for high level soil removal are largely coincident with most of the process areas (e.g., pitch pump house, pipe bridge, etc.).

20.3.2 Short-Term Impacts and Effectiveness

The short-term impacts of either alternative 3A or 3B would be similar to but slightly less than those associated with alternatives 2A and 2B.

20.3.3 Long-Term Effectiveness and Permanence

By removing the most highly contaminated soils from the North Yard Area, and by capping the entire area of concern, long-term risks in the area would be significantly reduced. In addition, the long-term collection and treatment of surface water and shallow groundwater would mitigate potential contaminant transport to off-site areas. Maintenance of the macadam cap, in addition to the collection and treatment of surface water and shallow groundwater would be effective in reducing risks in the North Yard in the long-term. In areas where contaminated materials would be replaced with clean fill, no restrictions on future subsurface activities would be required.

For alternative 3A, treatment to destroy the organic contaminants in the soil followed by management of the treated residuals in an on-site cell would ensure the long-term effectiveness of the remedial measure. For the purposes of this FS, it was assumed that the treated residuals would still be hazardous and thus require landfilling. If possible, however, the materials would be delisted and used as backfill. Management of untreated soil and fill materials in a monitored, on-site landfill cell, as required by alternative 3B, would also provide an effective long-term solution to minimize the risks associated with the contaminated North Yard soils.

20.3.4 Reduction of Toxicity, Mobility, or Volume

Excavation of highly contaminated soils as provided by alternatives 3A and 3B would remove those soils with PCB levels above 500 ppm from the North Yard Area. On-site containment of contaminated materials (alternative 3B) or treated residuals (alternative 3A) and capping of contaminated areas required by both alternatives 3A and 3B would act to significantly reduce transport of low level contaminated soils left in place. Treatment of the soil required by alternative 3A would destroy the organic contaminants, thereby reducing the toxicity and volume of the treated residuals. The surface water and shallow groundwater treatment required for both alternatives 3A and 3B would reduce the potential impacts of the contaminants present within the surface water and shallow groundwater.

20.3.5 Implementability

Implementability constraints associated with alternatives 3A and 3B are similar to those described in Section 20.2.5 for alternatives 2A and 2B; however the reduced volume of excavation would significantly facilitate materials handling operations. As described previously, the primary implementability issues are associated with coordination of plant and remedial activities, and with excavations near tank and building foundations (Appendix G).

20.3.6 Compliance With ARARs

As with alternatives 2A and 2B, alternatives 3A and 3B would require source removal, but over a more limited area. Other lower-level contaminated soils would be capped. Thus, site-specific ARARs and remedial action objectives would be satisfied by treating or isolating the contaminated soils. In addition, surface water and groundwater quality are expected to improve, as a result of source removal and water treatment, to New York State SCGs. Water quality monitoring would assess the progress in attaining ARARs.

As discussed in Section 20.2.6, there are several required activities in the short-term which could result in non-compliance with ARARs. Because less source removal is required for these alternatives, however, the associated risks would be lower.

20.3.7 Overall Protection of Human Health and the Environment

Removal of the most contaminated soils from the North Yard, and capping of the adjacent lower-level contaminated soils would be protective of human health. In particular, the potential for exposure of the plant workers to high levels of PCBs would be minimized. Adequate protection of the environment would be provided by reducing contaminant mobility, toxicity and volume. Specifically, the collection and treatment of surface water and shallow groundwater would protect the downgradient waterways, i.e., the St. Lawrence River. Treatment of the soils required by alternative 3A would destroy the organic contaminants in the soil. Disposal of the treated residuals in a secure landfill cell would provide a high-level of protection of human health and the environment. Direct on-site land disposal of the contaminated soils in a monitored and maintained facility, as required by alternative 3B, would also provide a high degree of protection of human health and the environment in the long-term, while minimizing any adverse short-term impacts.

20.3.8 Cost

The significant components of the capital costs required for the implementation of alternative 3A or 3B are itemized in Table VII-2. Estimated units costs for many activities in the North Yard are higher than for other areas of the plant due to implementability constraints (see Appendix G). The total estimated capital cost for alternative 3A and 3B is $11,800,000 and $5,400,000, respectively. Annual O&M costs for the alternatives are estimated at $230,000 for both alternatives 3A and 3B (Table VII-3). For alternative 3A, if on-site landfilling of treated residuals were not required, capital costs would decrease by about $300,000, and O&M costs would decrease by about $3,000 annually. Table VII-4 summarizes costs for all alternatives and estimates present worth costs for alternatives 3A and 3B at $16,000,000 and $9,400,000, respectively. Additional assumptions used in developing cost estimates are provided in Appendix A.

21.0
COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, the five alternatives available for remediation of the North Yard are compared. Each alternative is compared with respect to the seven evaluation criteria in Section 20.0. This comparison of alternatives for the North Yard will facilitate the presentation of conclusions and recommendations in Section 22.0.

A direct comparison between alternatives for the North Yard is summarized in Table VII-5. A tabulation of scores for each alternative, scored according to the NYSDEC TAGM Tables 5-2 through 5-7, is presented in Table VII-6. The table format allows for easy comparisons of the alternatives on each criterion. A brief discussion for each criteria is presented below. Two elements not addressed here are the criteria of state and community acceptance, which the NYSDEC will evaluate prior to selecting the final remedy.

21.1 SHORT-TERM IMPACTS AND EFFECTIVENESS

Potential short-term impacts for alternative 1 are minimal. There are significant potential short-term impacts associated with alternatives 2A, 2B, 3A, and 3B involving worker and environmental exposures. These impacts are primarily a result of activities during removal of contaminated materials. Additional short-term impacts are associated with materials handling for a relatively large volume of contaminated materials and with air emissions and treated residuals resulting from the incineration process for alternatives 2A and 3A. Personal protective equipment, and dust, water and emission controls would be used to minimize any adverse impacts during remediation.

21.2 LONG-TERM EFFECTIVENESS AND PERMANENCE

All five alternatives would be effective in minimizing contact with and migration of contaminants over the long-term. Alternatives 2A, 2B, 3A and 3B would provide a more restrictive environment for controlling contaminant migration through the use of a secure landfill cell, and alternative 1 would reduce contaminant transport by capping. Alternatives 2A and 3A would provide for destruction of organic contaminants by incineration and would therefore provide less potential for further contamination over the long-term. However, the incinerator ash would likely require long-term management.

21.3 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

Collection and treatment of surface water and shallow groundwater associated with all five alternatives would reduce the potential impacts of contaminants present in the surface water and shallow groundwater. Alternatives 1, 2B, and 3B would mitigate the contaminant transport pathways by the use of containment technologies. Alternatives 2A and 3A would provide for reduction in contaminant toxicity, mobility, and volume by the use of incineration.

21.4 IMPLEMENTABILITY

All five alternatives could be implemented using standard construction practices. Alternatives 2A, 2B, 3A, and 3B could cause disruptions of plant activities during removal of contaminated material and would require extensive coordination with plant personnel (Appendix G). Alternative 1 (cap in place) would cause less disruption of plant activities than alternatives 2A, 2B, 3A, and 3B since contaminated materials would be capped in-place with little or no disruption of railroad tracks, tanks, buildings, utility lines, etc.

21.5 COMPLIANCE WITH ARARs

Implementation of removal alternatives 1, 2A, 2B, 3A and 3B would satisfy site-specific ARARs and remedial action objectives by treating or isolating the contaminated soils from the North Yard Area, although implementation of the capping alternative 1 would not meet these ARARs until removal is performed when the plant closes (assumed at year 30). Water quality is expected to improve upon implementation of any of the alternatives, as they all minimize contaminant mobility and require surface water and shallow groundwater treatment to New York State SCGs. The water quality monitoring program required by all alternatives would assess progress in attaining ARARs.

During implementation of removal alternatives, there is potential for non-compliance with both ARARs and the remedial action objectives. This is discussed in detail in Section 20.2.6. Implementation of alternative 1, however would be protective of human health and the environment in the short-term, for as long as the plant is operational. Alternative 1 satisfies remedial action objectives, and ensures compliance with ARARs in the long-term by acknowledging that upon closure of the St. Lawrence Reduction Plant further remedial work would be required.

21.6 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All five alternatives would provide protection of human health and the environment by eliminating contact with and migration of contaminants. Alternatives 2A and 3A would provide a greater degree of long-term protection than alternatives 2B and 3B through destruction (elimination) of organic contaminants by incineration.

21.7 COST

The total present worth cost associated with alternatives 1, 2A, 2B, 3A, and 3B are $11,000,000, $32,000,000, $12,000,000, $16,000,000, and $9,400,000, respectively.

22.0 CONCLUSIONS AND RECOMMENDATIONS CONCERNING THE NORTH YARD

Section 21.0 provides a comparative analysis of alternatives available for the North Yard. This section utilizes that analysis to recommend a particular alternative for the North Yard. The recommended alternative is intended to satisfy the remedial objectives presented in Section 3.1.

For the North Yard, alternative 1 is recommended and includes the following main components:

- Cap all soils (exclusive of the rail lines) in the North Yard with PCB concentrations greater than 10 ppm, using the asphalt-composite cap
- Collect and treat surface water and shallow groundwater
- Monitor surface water and groundwater
- Excavate and incinerate contaminated materials when the plant closes, and dispose of the residuals in a secure landfill

A review of alternative 1 with regard to the seven evaluation criteria indicates that short-term environmental impacts are far less significant than for the other alternatives. In addition, placement of a asphalt-composite cap over contaminated soils in the North Yard would be much less disruptive of plant operations than would alternatives involving excavation. The asphalt-composite cap would provide an effective long-term barrier to minimize rainwater infiltration and would prevent human contact with contaminated soils. The cap would restrict contaminant mobility by restricting rainwater infiltration and by eliminating contaminant transport by dust migration and by foot and vehicular traffic.

Alternative 1 could be implemented using standard construction practices. For the reasons discussed in Section 20.0, remedial activities must be coordinated with plant activities to avoid interruptions in plant operations. Installation of the cap would be feasible with minimal disruption of plant operations, whereas the implementation of other alternatives could result in the shut-down of the plant. Alternative 1 was selected to avoid the adverse socio-economic effects that a plant shut-down would have on the local community, with the intent that removal, treatment, and disposal would occur upon plant closure in the future.

As part of the on-going activities associated with the implementation of alternative 1, surface water and shallow groundwater would continue to be collected and treated in the recently installed intercept drains and North Yard GAC system. It is anticipated that the surface water quality would improve after cap installation, as surface water would be isolated from the underlying contaminated soils. In addition, because residual contaminants would temporarily remain in the North Yard Area, appropriate health and safety procedures would be required for intrusive (subsurface) maintenance activities in the area.

Alternative 1 is the most cost-effective alternative when compared with other alternatives, and it meets the remedial action objectives (Section 3.1) by:

1) Considering means (water treatment and capping) to permanently treat, reduce or immobilize contaminants

2) Preventing the migration of contaminants in groundwater and surface water on or beyond the Reynolds' plant boundaries

3) Minimizing the mobility of contaminants in soils

Alternative 1 would cause minimal disruption of plant operations during remediation activities, since the full-scale removal of soils is postponed until after closure of the plant.

TABLE VII-1

TREATABILITY STUDY RESULTS
CONFIRMATORY LABORATORY (ENSECO) VALUES

APEG DECHLORINATION

Parameter	Untreated Soil			Treated Residual APEG Dechlorination**	
	Composite 1	Composite 2	Blended	Composite 1	Blended
Total PCBs (mg/kg)	44	10,000	1900	< 0.160	< 0.160
Total dioxins (ug/kg)	< 0.001	0.992	0.153	< 0.001	< 0.001
Total furans (ug/kg)	0.278	67	15	< 0.001	0.0063
Total PAHs (mg/kg)	556	2638	1362	1183	1424
Chloride (mg/kg)	<18.1	25.2	< 17.3	41.5	< 23.2
RCRA Total Metals (mg/kg):					
Arsenic	<10.0*	<10.0*	--	--	--
Barium	19.9*	43.6*	--	--	--
Cadmium	< 1.25*	< 1.25*	--	--	--
Chromium	11.9*	11.4*	--	--	--
Lead	23.3*	25.6*	--	--	--
Mercury	< 0.1*	< 0.1*	--	--	--
Selenium	< 5.0*	< 5.0*	--	--	--
Silver	< 2.0*	< 2.0*	--	--	--
TCLP Metals (mg/L):					
Arsenic	--	--	--	<0.50	<0.50
Barium	--	--	--	0.38	0.35
Cadmium	--	--	--	<0.050	<0.050
Chromium	--	--	--	0.21	<0.10
Lead	--	--	--	<0.50	<0.50
Mercury	--	--	--	<0.0010	<0.0010
Selenium	--	--	--	<0.050	<0.050
Silver	--	--	--	<0.050	<0.050
TCLP Semi-volatiles (ug/L)	--	--	--	18	25
TCLP Volatiles (ug/L)	--	--	--	61	56.3

* Analytical values given by OHM's analytical laboratory.
** Results for Composite 1 and Blended are from GRC's Reactions 5 and 6, respectively.
-- Not analyzed.

TABLE VII-1
(continued)

TREATABILITY STUDY RESULTS
CONFIRMATORY LABORATORY (ENSECO) VALUES

INFRARED THERMAL

Parameter	Untreated Soil			Treated Residual Infrared Thermal**	
	Composite 1	Composite 2	Blended	Composite 1	Composite 2
Total PCBs (mg/kg)	44	10,000	1900	<0.160	0.200
Total dioxins (ug/kg)	< 0.001	0.992	0.153	<0.68	<0.44
Total furans (ug/kg)	0.278	67	15	<0.67	<0.55
Total PAHs (mg/kg)	556	2638	1362	<0.200	<0.200
Chloride (mg/kg)	<18.1	25.2	< 17.3	--	--
RCRA Total Metals (mg/kg):					
Arsenic	<10.0*	<10.0*	--	--	--
Barium	19.9*	43.6*	--	--	--
Cadmium	< 1.25*	< 1.25*	--	--	--
Chromium	11.9*	11.4*	--	--	--
Lead	23.3*	25.6*	--	--	--
Mercury	< 0.1*	< 0.1*	--	--	--
Selenium	< 5.0*	< 5.0*	--	--	--
Silver	< 2.0*	< 2.0*	--	--	--
TCLP Metals (mg/L):					
Arsenic	--	--	--	<0.100*	<0.100*
Barium	--	--	--	0.448*	0.339*
Cadmium	--	--	--	<0.005*	<0.005*
Chromium	--	--	--	0.0270*	<0.020*
Lead	--	--	--	<0.100*	<0.100*
Mercury	--	--	--	<0.001*	<0.001*
Selenium	--	--	--	<0.100*	<0.100*
Silver	--	--	--	<0.020*	<0.020*
TCLP Semi-volatiles (ug/L)	--	--	--	<0.100*	<0.100*
TCLP Volatiles (ug/L)	--	--	--	<0.013*	<0.013*

* Analytical values given by OHM's analytical laboratory.
** Results for both Composite 1 and 2 are from OHM's short retention-time trials.
-- Not analyzed.

TABLE VII-2
CAPITAL COST ESTIMATE SUMMARY
NORTH YARD

EDIAL ACTION	UNITS	UNIT COST	ALTERNATIVE 1 QUANTITY	ALTERNATIVE 1 COST	ALTERNATIVE 2A QUANTITY	ALTERNATIVE 2A COST	ALTERNATIVE 2B QUANTITY	ALTERNATIVE 2B COST	ALTERNATIVE 3A QUANTITY	ALTERNATIVE 3A COST	ALTERNATIVE 3B QUANTITY	ALTERNATIVE 3B COST
************	*****	****	********	****	********	****	********	****	********	****	********	****
SITE PREPARATION												
Mobilization/Demolition	LS			$925 a		$563,000		$563,000		$563,000		$563,000
Loading Dock Reloc.	LS					$60,000		$60,000				
On-Site Laboratory	LS					$100,000		$100,000		$100,000		$100,000
EXCAVATION/HANDLING OF CONTAMINATED MATERIALS												
Excavate Contam. Soil:												
Carbon Plant Area	ton	$6	6,300	$11,654 a	6,300	$37,800	6,300	$37,800				
North Yard Area	ton	$4	29,000	$35,763 a	29,000	$116,000	29,000	$116,000				
Excavate Hot Spots	ton	$6							8,700	$52,200	8,700	$52,200
RR Track Removal	lf	$25	3,000	$23,123 a	3,000	$75,000	3,000	$75,000	700	$17,500	700	$17,500
TRANSPORT AND TREATMENT/ DISPOSAL OF CONTAMINATED MATERIALS												
Dispose in On-Site												
Landfill	ton	$30	23,828	$220,381 a	54,475	$1,634,250	68,595	$2,057,850	34,525	$1,035,750	36,700	$1,101,000
On-Site Hauling	ton	$2	27,402	$16,896 a	62,646	$125,292	78,884	$157,768	39,704	$79,408	42,205	$84,410
Incinerate On-Site	ton	$325	26,475	$2,652,729 a	40,595	$13,193,375			10,005	$3,251,625		
Incinerator Mob/Demob	LS	$1,200,000		$369,960 a		$1,200,000				$1,200,000		
WATER COLLECTION/TREATMENT				Installed		Installed		Installed		Installed		Installed
SITE RESTORATION												
Install Asphalt-												
Composite Cap	sq ft	$5	120,000	$600,000								
Install Uniform												
Grouted Mat	sq ft	$3	80,000	$240,000								
Backfill and Grade	ton	$10			35,300	$353,000	35,300	$353,000	8,700	$87,000	8,700	$87,000
Install Macadam Cap	sq ft	$2			130,000	$260,000	130,000	$260,000	130,000	$260,000	130,000	$260,000
RR Track Replacement	lf	$100			3,300	$330,000	3,300	$330,000	700	$70,000	700	$70,000
Replace PPH, HTM System	LS					$1,400,000		$1,400,000		$1,400,000		$1,400,000
CT CAPITAL COSTS				$4,171,429 a		$19,447,718		$5,510,419		$8,116,483		$3,735,110
RECT CAPITAL COSTS	(% of Direct Capital Costs)											
mplementation	(10%)			$417,143 a		$1,944,772		$551,042		$811,648		$373,511
dministration	(15%)			$625,714 a		$2,917,158		$826,563		$1,217,472		$560,267
ontingency	(20%)			$834,286 a		$3,889,544		$1,102,084		$1,623,297		$747,022
L ESTIMATED CAPITAL COSTS				$6,000,000 a		$28,000,000		$8,000,000		$11,800,000		$5,400,000

s: a. Costs adjusted to present worth cost for closure at year 30 (4% discounted rate of return assumed).

TABLE VII-3
ESTIMATED ANNUAL OPERATION AND MAINTENANCE COSTS
NORTH YARD

REMEDIAL ACTION	ALT. 1	ALT. 2A	ALT. 2B	ALT. [illegible]	ALT. 3B
A. Groundwater Monitoring	$65,000 a	$65,000	$65,000	$60,000	$60,000
B. Surface Water Monitoring	$25,000 a	$25,000	$25,000	$25,000	$25,000
C. Cap or Paving Maintenance	$35,000 b	$20,000	$20,000	$20,000	$20,000
D. Surface Water and Shallow Groundwater Collection/Treatment	$80,000 a	$80,000	$80,000	$80,000	$80,000
E. On-Site Landfill Cell	$5,000 c	$5,000	$5,000	$3,000	$3,000
F. RCRA Cap Maintenance	$6,000 c	$6,000	$6,000	$4,000	$4,000
DIRECT O&M COSTS	$170,000 a $35,000 b $11,000 c	$195,000	$195,000	$188,000	$188,000
INDIRECT O&M COSTS					
A. Administration (10% of O&M Costs)	$17,000 a $3,500 b $1,100 c	$19,500	$19,500	$18,800	$18,800
B. Contingency (10% of O&M Costs)	$17,000 a $3,500 b $1,100 c	$19,500	$19,500	$18,800	$18,800
TOTAL ESTIMATED O&M COSTS	$204,000 a $42,000 b $13,200 c	$230,000	$230,000	$230,000	$230,000

Note: a. Costs incurred from years 1 to 60.
b. Costs incurred from years 1 to 30.
c. Costs incurred from years 30 to 60.

TABLE VII-4
SUMMARY OF REMEDIAL ALTERNATIVES
NORTH YARD

ERNATIVE	KEY COMPONENTS	CAPITAL COSTS	ANNUAL O&M COSTS	PRESENT WORTH (a)
1	A. Monitor Existing Wells B. Monitor Surface Water C. Cap Contaminated Soils D. Surface Water and Shallow Groundwater Collection and Treatment E. Excavate and Incinerate Contaminated Materials Upon Plant Closure	$6,000,000	$204,000 b $42,000 c $13,200 d	$11,000,000
2A	A. Monitor Existing Wells B. Monitor Surface Water C. Excavate Contaminated Soils D. Treat Excavated Material On-Site E. Dispose Treated Residuals in On-Site Landfill F. Backfill, Grade, and Pave Excavated Areas G. Surface Water and Shallow Groundwater Collection and Treatment	$28,000,000	$230,000	$32,000,000
2B	A. Monitor Existing Wells B. Monitor Surface Water C. Excavate Contaminated Soils D. Dispose Treated Residuals in On-Site Landfill E. Backfill, Grade, and Pave Excavated Area F. Surface Water and Shallow Groundwater Collection and Treatment	$8,000,000	$230,000	$12,000,000
3A	A. Monitor Existing Wells B. Monitor Surface Water C. Excavate "Hot Spot" Soils D. Treat Excavated Material On-Site E. Dispose Treated Residuals in On-Site Landfill F. Backfill, Grade, and Pave Excavated Area G. Cap Low-Level Contaminated Soils H. Surface Water and Shallow Groundwater Collection and Treatment	$11,800,000	$230,000	$16,000,000

s: a. 30-year post-closure period, 4% interest rate.
b. Costs incurred from years 1 to 60.
c. Costs incurred from years 1 to 30.

TABLE VII-5

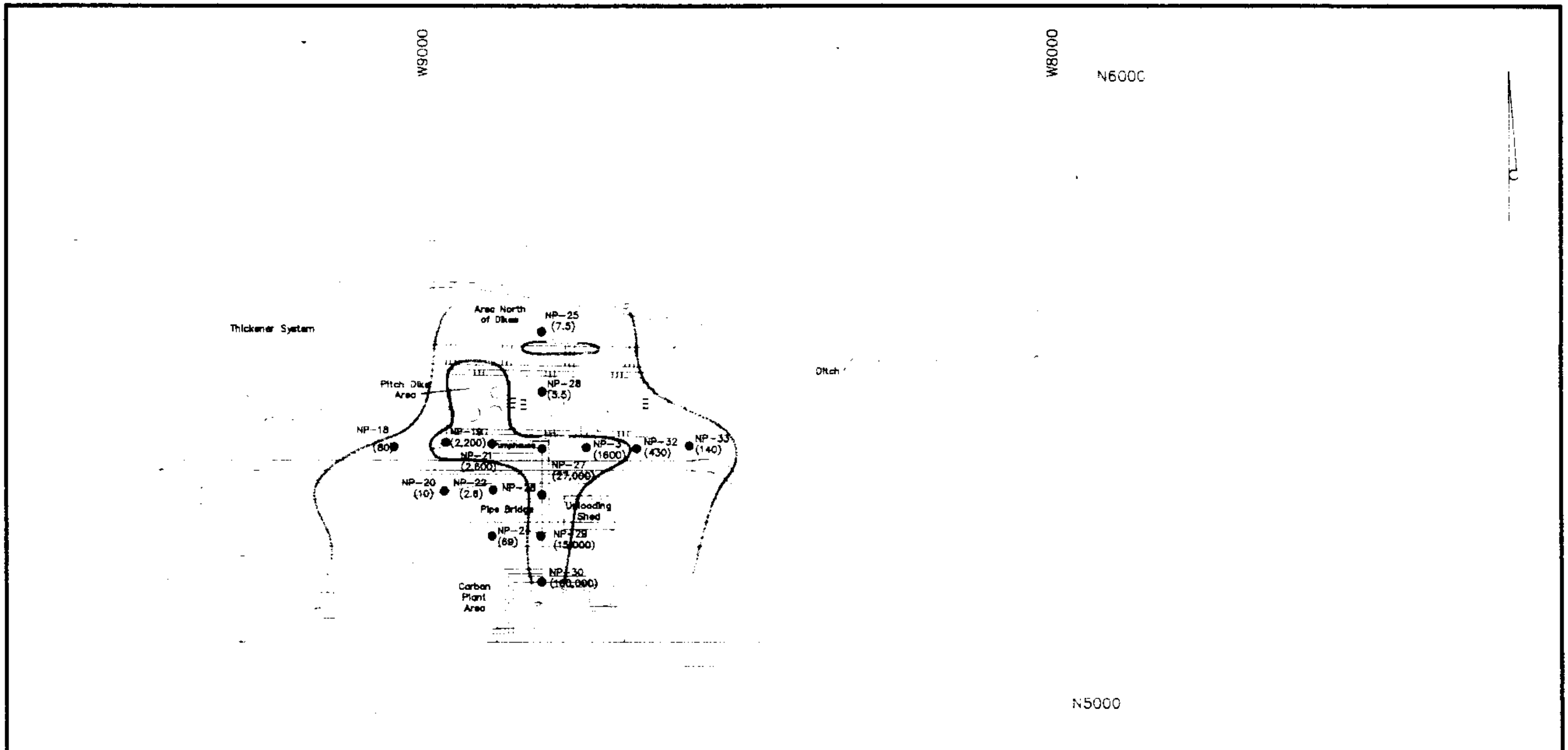
COMPARISON OF NORTH YARD REMEDIAL ALTERNATIVES
REYNOLDS METALS
MASSENA, NEW YORK

Criteria	Alternative 1 (Cap In-Place)	Alternative 2A (Excavate/Treat All Soils On-Site, Contain)	Alternative 2B (Excavate/Contain All Soils On-Site)	Alternative 3A (Excavate/Treat "Hot Spot" Soils, Contain)	Alternative 3B (Excavate/Contain "Hot Spot" Soils)
Short-Term Impacts and Effectiveness	Minimal impacts. Effective in eliminating contact with and migration of contaminants.	Impacts due to materials handling and treatment operations for large volumes.	Impacts due to materials handling of large volumes.	Impacts due to materials handling and treatment of contaminated soil.	Impacts due to materials handling of contaminated soil.
Long-Term Effectiveness and Permanence	Effective in eliminating contact with, and migration of contaminants.	Effective in eliminating contact with, and migration of contaminants. Will destroy organic contaminants only.	Effective in eliminating contact with, and migration of contaminants.	Effective in eliminating contact with, and migration of contaminants. Will destroy organic contaminants only.	Effective in eliminating contact with, and migration of contaminants.
Reduction of Toxicity, Mobility, and Volume	The cap and eventual landfilling will reduce contaminant transport potential.	Treatment will reduce the toxicity of the organic contaminants.	Containment will reduce contaminant migration potential.	Treatment will reduce the toxicity of the organic contaminants.	Containment and capping will reduce contaminant transport potential.
Implementability	Implementation would require schedule coordination with plant activities.	Difficult to implement. Would involve significant modifications to plant activities.	Difficult to implement. Would involve significant modifications to plant activities.	Difficult to implement. Would involve significant modifications to plant activities.	Difficult to implement. Would involve significant modifications to plant activities.
Compliance with ARARs	Will comply with ARARs.	Will comply with ARARs.	Will comply with ARARs.	Will comply with ARARs.	Will comply with ARARs.
Overall Protection of Human Health and the Environment	Protective by eliminating contact with, and migration of contaminants.	Protective by destroying organic contaminants, and by eliminating contact with, and migration of contaminants.	Protective by eliminating contact with, and migration of contaminants.	Protective by destroying organic contaminants, and by eliminating contact with, and migration of, contaminants.	Protective by eliminating contact with, and migration of contaminants.
Cost	Total present worth cost is approximately $11,000,000.	Total present worth cost is approximately $32,000,000.	Total present worth cost is approximately $12,000,000.	Total present worth cost is approximately $16,000,000.	Total present worth cost is approximately $9,400,000.

TABLE VII-6

SCORING OF NORTH YARD REMEDIAL ALTERNATIVES
ACCORDING TO NYSDEC TAGM
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

	ALTERNATIVES				
	1 (Capping with Water Treatment)	2A (Incineration with Water Treatment)	2B (On-site Landfill with Water Treatment)	3A (Hot Spot Incineration with Water Treatment)	3B (Hot Spot On-Site Landfill with Water Treatment)
ort-Term pacts and fectiveness (10)	10	0	0	0	4
ng-Term fectiveness and rmanence (15)	10	8	7	8	7
duction of xicity, Mobility, Volume (15)	0	11	0	7	0
plementability 5)	14	7	7	7	7
mpliance with ARs (10)	10	10	10	10	10
erall Protection Human Health d the vironment (20)	20	20	20	20	20
st (15)	10	0	9	8	15
TOTAL	74	56	53	60	63



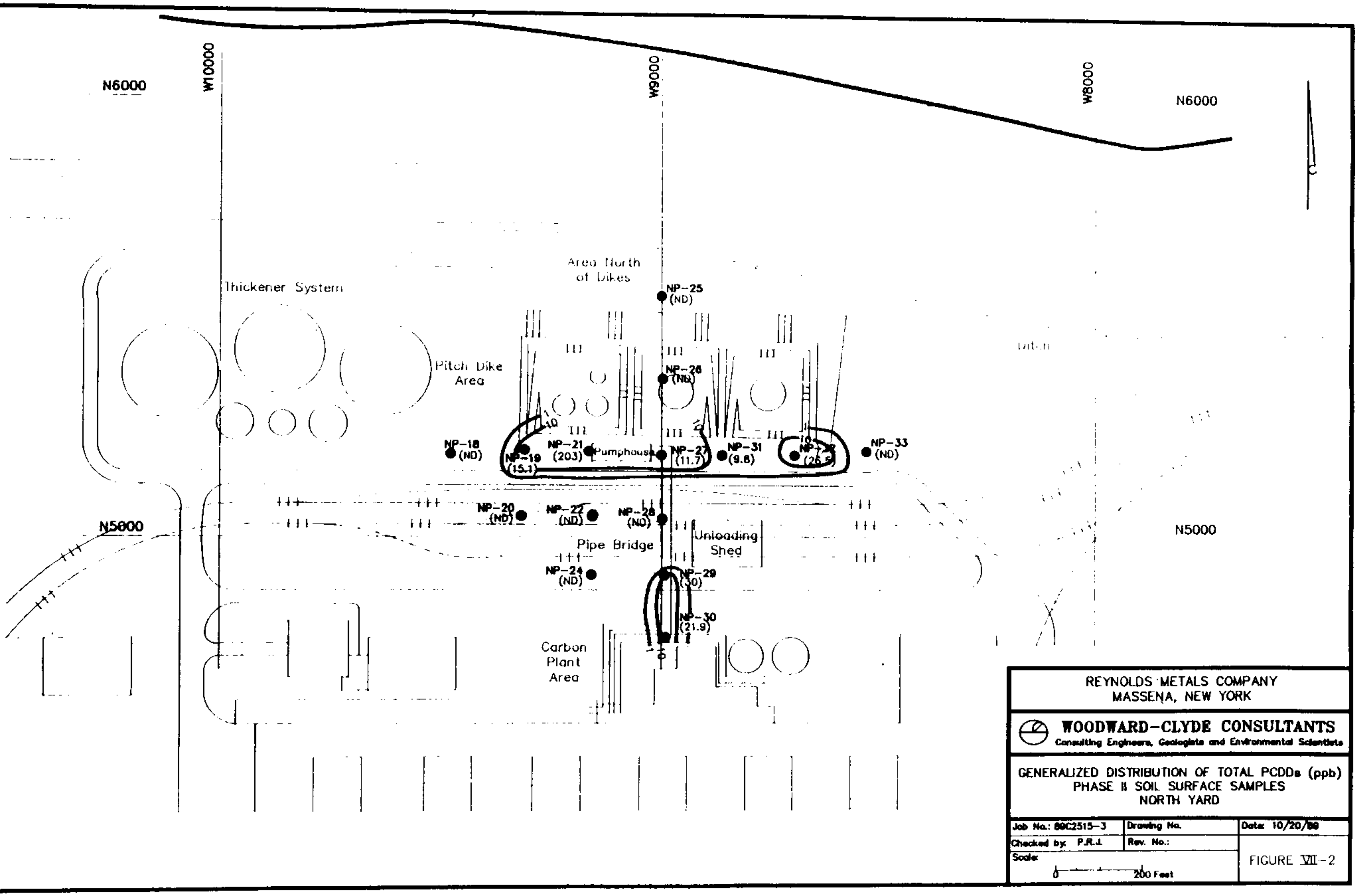
Rev. No.	Date	Type of Revision	Checked by:

GENERALIZED DISTRIBUTION OF TOTAL PCBs (ppm)
NORTH YARD
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515-3 | Drawing No. CDWG | Date: CDATE
Drawn by: T.P. | Checked by: D.M.H.
Scale: 0 — 200 feet

FIGURE VII-1

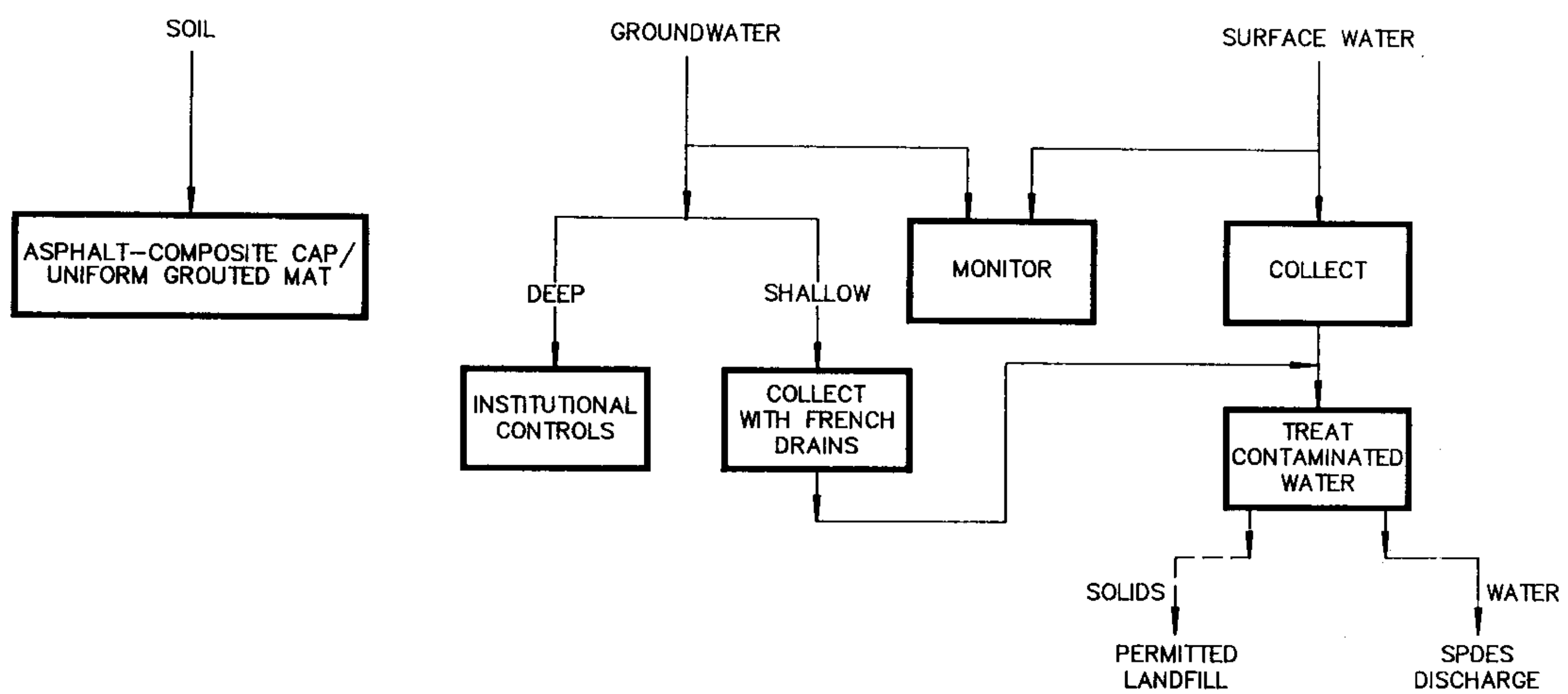


REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

GENERALIZED DISTRIBUTION OF TOTAL PCDDs (ppb)
PHASE II SOIL SURFACE SAMPLES
NORTH YARD

Job No.: 89C2515-3	Drawing No.	Date: 10/20/89
Checked by: P.R.J.	Rev. No.:	FIGURE VII-2
Scale: 0 — 200 Feet		



NOTES:

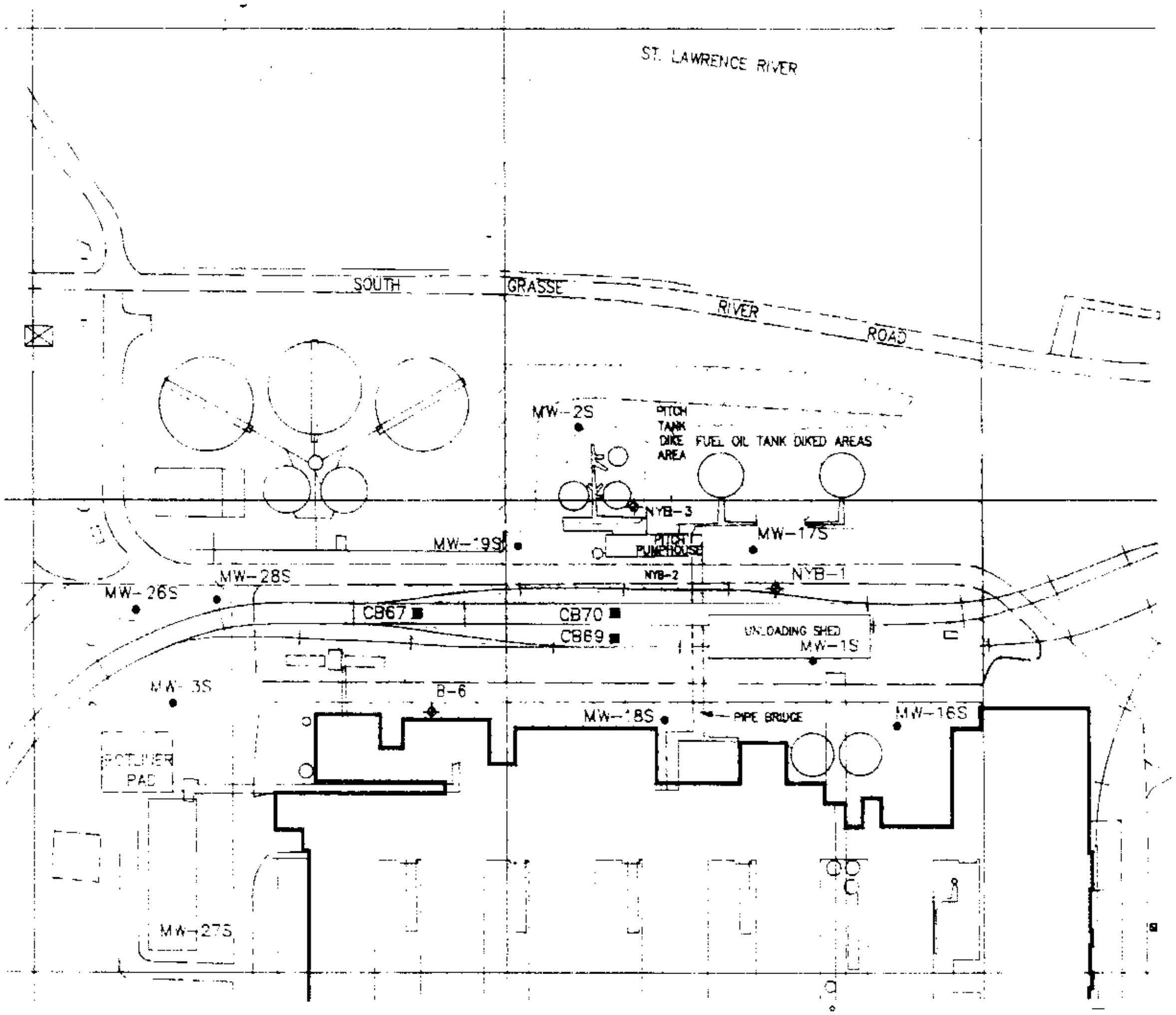
1.) SOLID LINES INDICATE ON–SITE ACTIVITES; DASHED LINES OFF–SITE.

2.) AFTER PLANT CLOSURE, THE NORTH YARD SOILS WOULD BE EXCAVATED AND DISPOSED IN A SECURE, ON–SITE LANDFILL.

PROCESS FLOW DIAGRAM
NORTH YARD
ALTERNATIVE 1
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A–4	Drawing No. 95153020	Date: 05/23/91
Drawn by: D.E.G.	Checked by: D.M.H.	FIGURE VII–3
Scale: N.T.S.		



LEGEND:

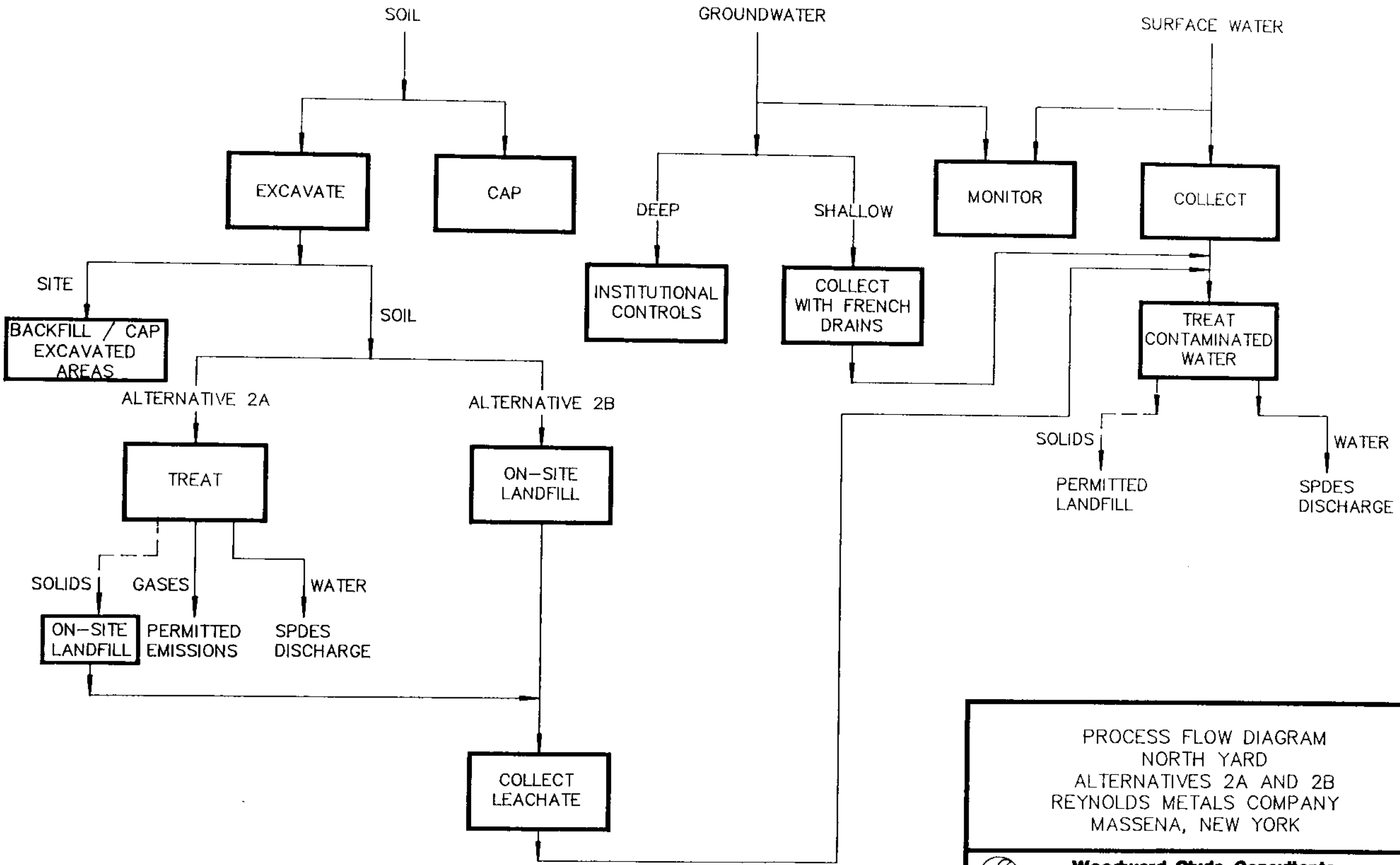
- ● SHALLOW MONITORING WELL
- ✦ BORING LOCATION
- ■ STORMWATER CATCH BASIN
- APPROXIMATE LOCATION OF ASPHALT-COMPOSITE CAP
- APPROXIMATE LOCATION OF UNIFORM GROUTED MAT (TO BE PLACED IN AREAS OF STEEP SLOPES)

AREAS TO BE CAPPED
NORTH YARD
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Rev. No.	Date	Type of Revision	Checked by:

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-3	Drawing No. 95150500	Date: 6/13/90
Drawn by: T.P.	Checked by: M.K.	FIGURE VII-4
Scale: 0 100 FEET		

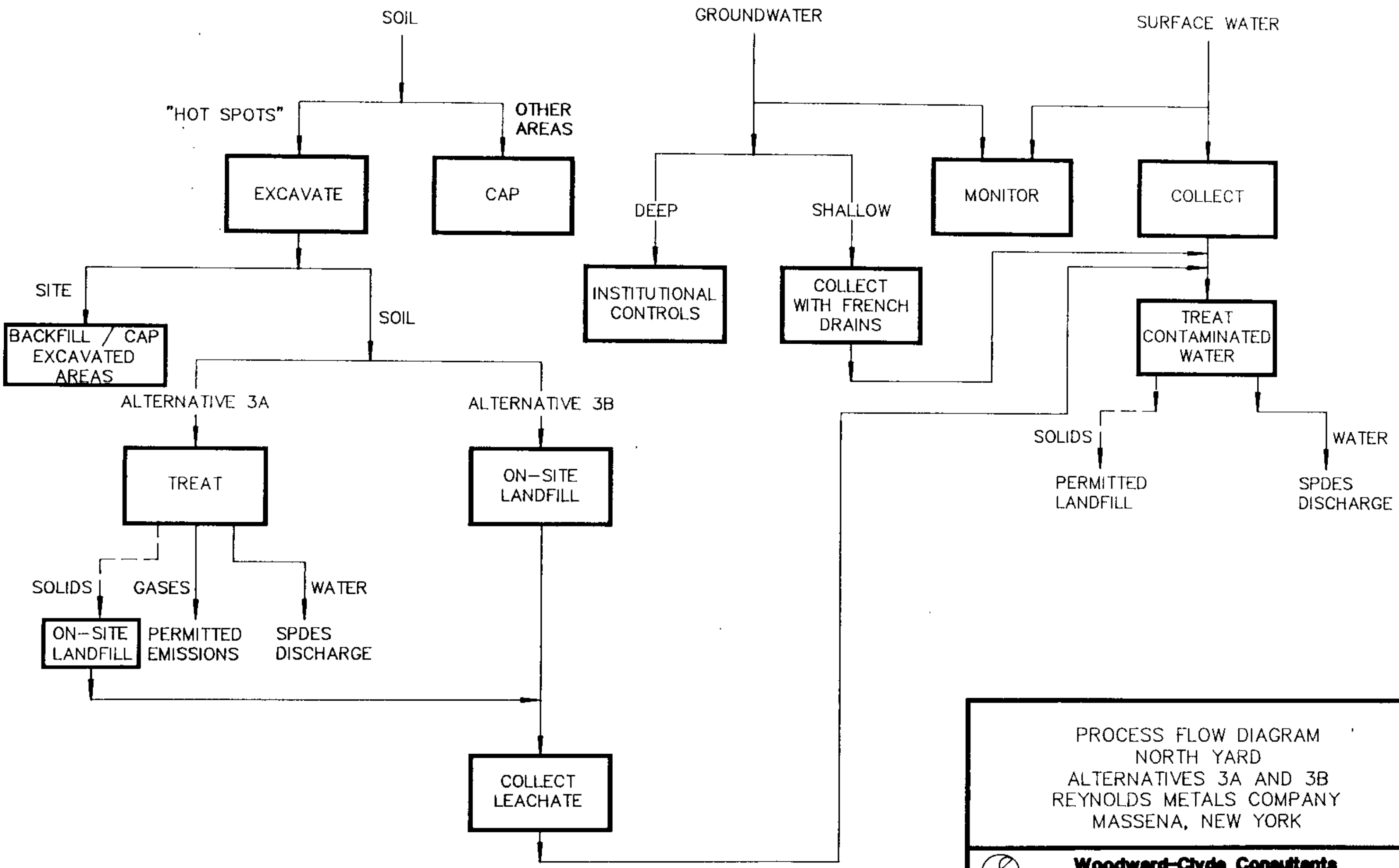


NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES;
DASHED LINES OFF SITE.

PROCESS FLOW DIAGRAM
NORTH YARD
ALTERNATIVES 2A AND 2B
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-4	Drawing No. 95153020	Date: 01/18/91
Drawn by: D.E.G.	Checked by: D.M.H.	FIGURE VII-5
Scale: N.T.S.		



NOTE: SOLID LINES INDICATE ON-SITE ACTIVITIES; DASHED LINES OFF SITE.

PROCESS FLOW DIAGRAM
NORTH YARD
ALTERNATIVES 3A AND 3B
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-4	Drawing No. 95153020	Date: 01/18/91
Drawn by: D.E.G.	Checked by: D.M.H.	FIGURE VII-6
Scale: N.T.S.		

PART VIII: MISCELLANEOUS AREAS

23.0
RECTIFIER YARD

The Preliminary FS identified the Rectifier Yard and its drainageways as a "Miscellaneous Area" beyond the five primary areas of concern at the Plant. The Preliminary FS assumed that this area would be addressed as an IRM, prior to completion of the FS. It is now being included in the FS, as is the area north of Haverstock Road, and the Soil Stockpile adjacent to the Black Mud Pond. The scope of the remedial measures to be implemented, and an analysis of the proposed remediation follows for each area.

23.1 DESCRIPTION OF REMEDIAL MEASURES

The remediation proposed for the Rectifier Yard consists of the following main components:

- Clean out catch basins and related piping throughout the Rectifier Yard (Figure VIII-1)
- Excavate contaminated sediments in the drainageways and open water area leading from the Rectifier Yard to the Wetlands
- Manage contaminated sediment/soils with less than 50 ppm PCBs from catch basins and drainageways by storage in the Former Potliner Storage Area
- Dispose of contaminated sediments with greater than 50 ppm PCBs in a new on-site secure landfill
- Backfill excavated area with crushed stone or washed gravels
- Monitor surface water

The remediation described above for the Rectifier Yard is based on the most cost-effective means of meeting the overall environmental objectives established earlier. However, if treatment (e.g., by incineration) for PCB-contaminated soils is performed for other areas of the site, materials from the Rectifier Yard can be included in that treatment waste stream.

A combination of vacuum trucks, bucket machines, and hydraulic and mechanical scouring equipment would likely be used to remove contaminated sediments from catch basins and related piping. The evaluation of the adequacy of piping and catch basin cleaning will be made through monitoring of downstream surface water. Sediments in the drainageways and ponded water area would be excavated to a depth of approximately 2 feet. Excavated areas would be backfilled with crushed stone to minimize erosion and to promote good stormwater drainage. Contaminated sediments in Rectifier Yard catch basins and related piping would be removed and dewatered prior to disposal.

Low-level contaminated materials removed during remediation of drainage ditches, ponded water area, stormwater pipes, and catch basins would be disposed of in the nearby Former Potliner Storage Area. Disposal of these materials in the Former Potliner Storage Area would provide long-term management of these low- to moderate-level contaminated materials assuming that in-place closure is the selected alternative for the Former Potliner Storage Area. The Area would be RCRA-capped, and have leachate collection and treatment, run-on and run-off controls, and groundwater and surface water monitoring. Low-level contaminated soils could alternatively be disposed of in a new RCRA-style secure landfill cell, if such a facility were built on-site. This option is considered to be environmentally equivalent to disposal in the Former Potliner Storage Area. High-level contaminated sediments would be stockpiled in a temporary staging area on-site and dewatered as necessary prior to disposal in an on-site RCRA-type landfill. Upon completion of remedial activities, surface water monitoring would be implemented to assess the long-term effectiveness of the remedial action.

23.2 EVALUATION

23.2.1 Short-Term Impacts and Effectiveness

Short-term impacts associated with the remediation of the Rectifier Yard and drainageways are expected to be minimal. Excavation of contaminated sediments from the drainageways may mobilize contamination within the ditches; however, proper sediment and water control during construction should mitigate any impacts to adjacent areas. Any accidental releases of contaminated water from the stormwater system and drainageways would likely be contained in the immediate area of the Wetlands, which would undergo remediation subsequent to the Rectifier Yard. Standard health and safety practices would be implemented to minimize exposure to workers.

23.2.2 Long-Term Effectiveness and Permanence

The removal of sediments from the catch basins, stormwater piping, drainageways, and ponded water area would remove the source of contaminated materials. Disposal of low- to moderate-level contaminated materials in the Former Potliner Storage Area and high-level contaminated materials in an on-site landfill would provide long-term management of these materials and would minimize future contact with humans and the environment. The long-term effectiveness of this remediation will also depend on whether leachable contaminants are left as residuals in drainage piping.

23.2.3 Reduction of Toxicity, Mobility, or Volume

This remediation plan reduces the potential for contaminant transport by eliminating the source of contamination from the Rectifier Yard drainages, thus minimizing further migration of PCB contamination. Migration is further reduced by this alternative with long-term management of contaminated materials in the Former Potliner Storage Area and in a new on-site RCRA-type landfill.

23.2.4 Implementability

The technologies required for this remediation are conventional and readily available. The techniques to be used for the drainageway remediation have been applied elsewhere at the Reynolds Plant for IRMs (see Section 5.7). Standard earthwork equipment would be used with the appropriate sediment and surface water controls during remediation. Access roads would be prepared adjacent to the drainageways, if necessary, to provide working area for equipment. Excavation in the ponded water area would be conducted in a manner similar to that in the Wetlands. Techniques for sediment removal in catch basins and stormwater pipes are well known and could be implemented with proper controls.

23.2.5 Compliance With ARARs

All ARARs for this area would be met with this remediation. Removal of contaminated sediments from catch basins, stormwater pipes, drainageways, and ponded water area, with long-term management of these contaminated materials in the Former Potliner Storage Area and a new secure landfill would eliminate contaminants from these areas, and isolate them in a controlled and monitored area. It is likely that surface water quality would improve as a result of the removal of contaminated sediments. Surface water monitoring would be utilized to monitor compliance with ARARs.

23.2.6 Overall Protection of Human Health and the Environment

The remediation of the Rectifier Yard drainage system will be protective of the local environment in the long-term by removing the PCB sources to this part of the Wetlands. Overall surface water quality from the Rectifier Yard is expected to improve and will be monitored to evaluate the potential for residual contaminants to enter the drainageways. Disposal of contaminated sediments above 50 ppm of PCBs in a secure landfill will provide improved environmental quality in the area, as will long-term on-site management of contaminated sediments below 50 ppm of PCBs in the Former Potliner Storage Area.

23.2.7 Cost

The capital cost for implementation of the remedial measures described above is estimated at $760,000 (Table VIII-1). The annual O&M cost is estimated for this alternative. The O&M is primarily associated with surface water monitoring and a small portion of the O&M of a new, on-site landfill, and the Former Potliner Storage Area. O&M costs are, therefore, assumed to be indirectly accounted for by the costs to remediate and monitor other adjacent areas of concern.

23.3 CONCLUSIONS AND RECOMMENDATIONS

The remediation plan described above for the Rectifier Yard and associated drainageways and ponded water area should be implemented as described. This work can be performed as an IRM or integrated into the plant-wide remediation. In either event, this area should be remediated before remediation of the adjoining Wetlands and Former Potliner Storage Areas. Also, use of the Former Potliner Storage Area for long-term management of contaminated sediments from the Rectifier Yard remediation assumes that the Former Potliner Storage Area will be closed in-place with surface water and groundwater controls and a permanent cap, and the use of a new on-site landfill assumes the construction of an on-site cell for the remediation of other areas of concerns.

24.0
AREA NORTH OF HAVERSTOCK ROAD

24.1 DESCRIPTION OF REMEDIAL MEASURES

The remediation proposed for the area north of Haverstock Road (about 1 acre; see Figure I-1) consists of the following main components:

- Excavate soils with PCB concentrations greater than 10 ppm
- Manage contaminated soils with less than 50 ppm PCBs by storage in the Former Potliner Storage Area
- Dispose of contaminated soils with greater than 50 ppm PCBs in a new on-site secure landfill
- Backfill, grade and seed excavated area

Soil would be excavated to a depth of about 2 feet. Pre-screening and confirmatory sampling would be done during remediation to delineate the horizontal and vertical extent of PCB contamination during excavation. Contaminated soils with less than 50 ppm would be managed on-site in the Former Potliner Storage Area if in-place closure is the selected alternative for that area. It would have a RCRA cap, leachate collection and treatment, run-on and run-off controls, and groundwater and surface wate. monitoring. It is assumed that contaminated sediments with greater than 50 ppm could be disposed of in an on-site RCRA-type landfill cell. If no such cell is available, off-site landfilling of the soils with PCB concentrations greater than 50 ppm would be required. The excavated area would be backfilled with clean soils from other parts of the Reynolds property. The area would then be graded and seeded as necessary to promote good surface water drainage.

24.2 EVALUATION

24.2.1 Short-Term Impacts and Effectiveness

Short-term impacts associated with the remediation of the area north of Haverstock Road are expected to be minimal. Proper control of remedial activities should minimize impacts to adjacent area. Standard health and safety practices would be implemented to minimize exposure to workers.

24.2.2 Long-Term Effectiveness and Permanence

The removal of contaminated soils would eliminate the source of contaminated materials. Disposal of low-level contaminated materials in the Former Potliner Storage Area and higher-level contaminated materials in an on-site landfill would provide long-term isolation and management of these materials and would minimize future contact with humans and the environment.

24.2.3 Reduction of Toxicity, Mobility, or Volume

This remediation plan reduces the potential for contaminant transport by eliminating the source of contamination from the area, thus minimizing the possibility of further migration of PCB contamination. Migration is further reduced by this alternative with long-term management of contaminated materials in the Former Potliner Storage Area or in an on-site RCRA-type landfill.

24.2.4 Implementability

The technologies required for this remediation are conventional and readily available. The techniques to be used for the remediation have been applied elsewhere at the Reynolds Plant for IRMs (see Section 5.7). Standard earthwork equipment would be used with the appropriate soil and surface water controls during remediation.

24.2.5 Compliance With ARARs

All ARARs for this area would be met with this remediation. Removal of contaminated soil from the area, with long-term management of these contaminated materials in the Former Potliner Storage Area and a new secure landfill would eliminate contaminants from these areas, and isolate them in a controlled and monitored area.

24.2.6 Overall Protection of Human Health and the Environment

The remediation of the area north of Haverstock Road will be protective of the local environment in the long-term by isolating PCB contaminated materials. Disposal of contaminated sediments in a secure landfill will provide improved environmental quality in the area, as will long-term on-site management of the contaminated sediments with less than 50 ppm of PCBs in the Former Potliner Storage Area.

24.2.7 Cost

The capital cost for implementation of the remedial measures described above is estimated at $260,000 (Table VIII-1). The annual O&M cost is not estimated for this alternative, as it is a small portion of the cost associated with O&M of a new, on-site landfill, and the Former Potliner Storage Area. Thus, O&M costs are indirectly accounted for by the costs to remediate other areas of concern. Annual inspections of the backfilled area is recommended, and minimal maintenance of the area is expected to be required.

24.3 CONCLUSIONS AND RECOMMENDATIONS

The remediation plan described above for the area north of Haverstock Road should be implemented as described. This work can be performed as an IRM or integrated into the plant-wide remediation. Use of the Former Potliner Storage Area for long-term management of low-level contaminated sediments from the area north of Haverstock Road remediation assumes that the Former Potliner Storage Area will be closed in-place with surface water and groundwater controls and a permanent cap, and the use of an on-site landfill assumes the construction of an on-site cell for the remediation of other areas of concern.

25.0
SOIL STOCKPILE

25.1 DESCRIPTION OF REMEDIAL MEASURES

The Soil Stockpile is southwest of the Black Mud Pond and consists of material that contains less than 10 ppm PCBs which was excavated during construction activities at the Reynolds plant. The proposed remedial measure for the pile is to manage the material on-site in the Former Potliner Storage Area. Confirmation sampling would be done to confirm that the underlying soils to be left in place were not adversely impacted by the pile.

25.2 EVALUATION

25.2.1 Short-Term Impacts and Effectiveness

The short-term impacts associated with the on-site management of this relatively small volume of low-level contaminated soils (about 3000 cubic yards) are expected to be insignificant with respect to remedial operations in that area of the plant site. Standard health and safety practices would be implemented to minimize exposure to workers.

25.2.2 Long-Term Effectiveness and Permanence

The removal of the Soil Stockpile would eliminate the source of contaminated materials. Disposal of low-level contaminated materials in the Former Potliner Storage Area would provide long-term management of these materials and would minimize future contact with humans and the environment.

25.2.3 Reduction of Toxicity, Mobility, or Volume

This remediation plan reduces the potential for contaminant transport by eliminating the source of contamination from the area thus minimizing the potential for migration of PCB contamination. Migration is further reduced by this alternative with long-term management of contaminated materials in the Former Potliner Storage Area.

25.2.4 Implementability

The technologies required for this remediation are conventional and readily available. Standard earthwork equipment would be used with the appropriate controls during remediation to minimize short-term impacts. It is expected that about 200 truckloads would be required to transport the soil. No constraints are anticipated with regard to the implementation of the proposed remedial measure.

25.2.5 Compliance With ARARs

All ARARs for this area would be met with this remediation. Removal of the Soil Stockpile from the area southwest of the Black Mud Pond, with long-term management of the contaminated soil in the Former Potliner Storage Area would eliminate contaminants from the area, and isolate them in a controlled and monitored area.

25.2.6 Overall Protection of Human Health and the Environment

The remediation of the Soil Stockpile southwest of the Black Mud Pond will be protective of the local environment in the long-term by removing the PCB source in the area. Long-term on-site management of the low-level contaminated materials in the Former Potliner Storage Area would provide improved environmental quality in the area.

25.2.7 Cost

The capital cost for implementation of the remedial measures described above is estimated at $100,000 (Table VIII-1). The annual O&M cost is not estimated for this alternative, as it is primarily the cost associated with O&M of the Former Potliner Storage Area. Thus, O&M costs are indirectly accounted for in the cost to remediate the Landfill Area. No O&M for the area southwest of the Black Mud Pond is recommended.

25.3 CONCLUSIONS AND RECOMMENDATIONS

The remedial measure described above for the Soil Stockpile southwest of the Black Mud Pond should be implemented as described. This work can be integrated into the plant-wide remediation. Use of the Former Potliner Storage Area for long-term management of low-level contaminated sediments from the Soil Stockpile assumes that the Former Potliner Storage Area will be closed in-place with surface water and groundwater controls, monitoring, and a permanent cap.

26.0
EVALUATION OF REMEDIAL WORK PERFORMED

The remedial projects and discharge abatements performed by RMC since the initiation of the RI were described in Section 5.0 of the report. The adequacy of these projects is discussed below.

26.1 OUTFALL 002

The diversion of the 002 drainage was completed successfully in 1989; as described in Section 5.1. Based on WCC's review of Bechtel's Final Report for Interim Remediation of the 002 Outfall Ditch, this IRM is consistent with the goals and criteria established in this FS for final remediation. In order to ensure the long-term effectiveness of the remedial measures, WCC recommends the following operation and maintenance procedures for the former 002 outfall drainage ditch:

1) Regular inspection of the remediated area for erosion gullies
2) Filling and re-seeding of any gullies observed
3) Routine maintenance of the vegetative cover
4) Regular inspection of the remediated area for erosion potential e.g., riprap layer intact, sediment depositional areas, etc.
5) Maintenance and monitoring of the remediated areas, as necessary
6) Records kept of inspections, maintenance, and corrective actions, as applicable

As part of the 002 diversion project, soil was excavated in the vicinity of the retention basin to enable installation of the Outfall 002 drainage pipeline. During the work, soil samples were taken to confirm that the soil left in place does not contain unacceptable levels of PCBs. Many surface soil samples (over 100 samples) were taken in a detailed grid pattern in the diversion area near the retention basin. Many of the samples collected showed non-detectable levels of PCBs; the majority of the samples were under 5 ppm; and only one sample had PCBs over 50 ppm. In the vicinity of that location, WCC advanced four soil borings and sampled for PCBs at three depth intervals (i.e., 0-2, 4-6, and 8-10 feet). Of these samples, all showed PCB levels to be under 50 ppm; only one sample had PCBs greater than 10 ppm. Therefore, based on the initial results from the detailed grid sampling, and the results from the confirmatory borings, WCC concludes that the soil left in place contains acceptably low levels of PCBs and that the one high concentration sample is an anomaly due to inherent variabilities in concentrations in the soil matrix.

26.2 OUTFALL 004

This remediation work involved the two parts described in Sections 5.4 (diversion of flow from the diked area), and 5.7.2 (removal of contaminated sediments from the 004 drainageway). The remedial measure performed to intercept flow from the diked areas for treatment is not adequate for final remediation. During the winter, water in the interception ditch freezes. Flow from the diked area could then overflow into the remediated 004 drainageway, thus by-passing the collection sump. The recommended remediation to correct for this is described below. WCC recommends that a shallow intercept trench be constructed at the northern base of the containment berms in the North Yard. The area between the berms and the fenceline should be graded towards the new collection trench (i.e., away from the remediated 004 drainageway), and towards the existing collection sump to the east for treatment by the North Yard GAC system. In this manner, surface water flow will be southward and eastward, even if the trench freezes over. The IRM removal of contaminated sediment from the 004 drainageway was evaluated based on WCC's review of O'Brien & Gere's Interim Remedial Activities report. This remediation is consistent with the goals and criteria established in this FS for final remediation. In order to ensure the long-term effectiveness of the remediation, the asphalt pavement should be inspected and maintained annually, as necessary. More frequent maintenance is not deemed necessary because of the low PCB levels left in the subsurface soils.

26.3 WEST DITCH

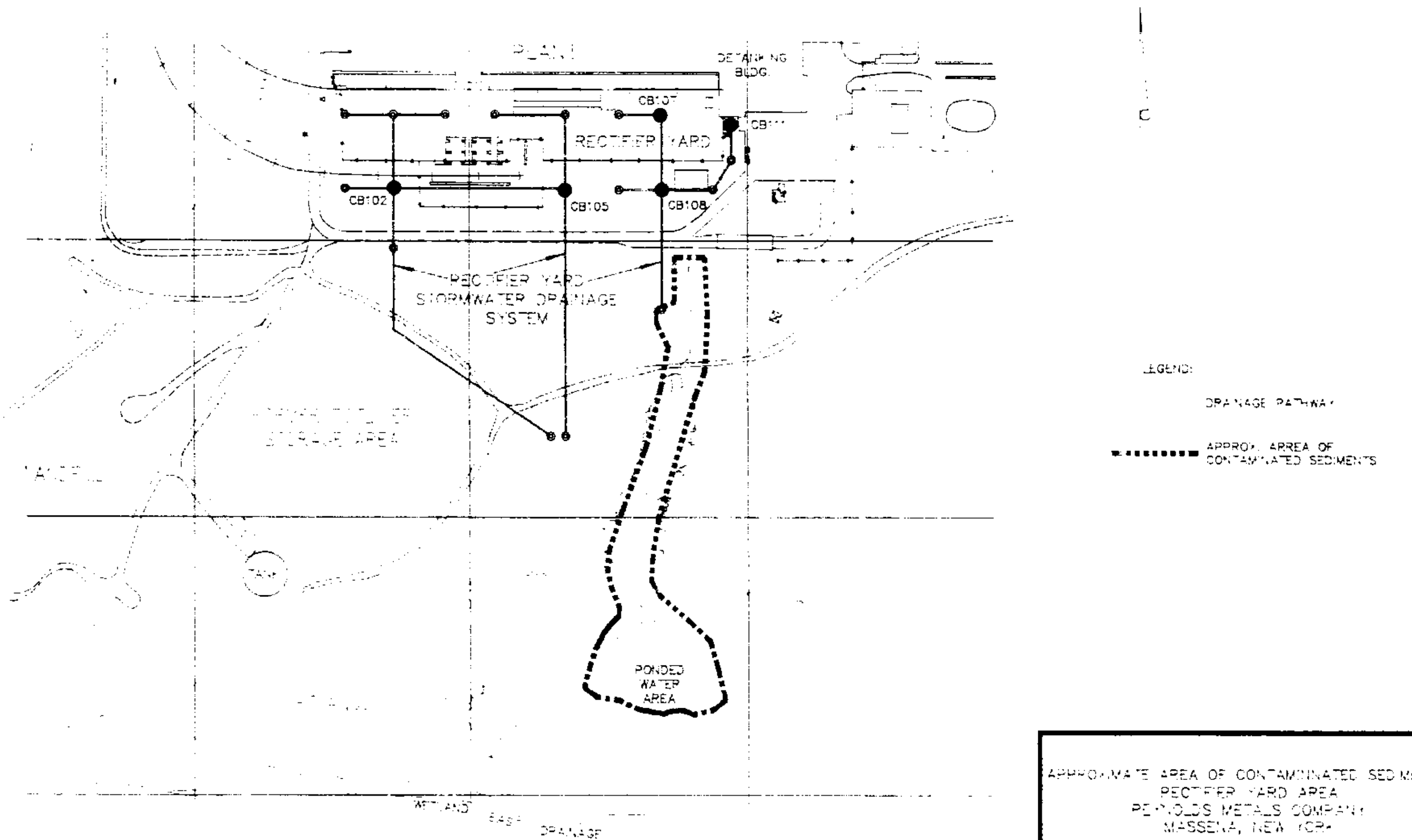
The remediation performed for the remediated portion of the West Ditch is consistent with the goals and criteria established in this FS for final remediation.

26.4 NORTH YARD

Storm drainage from the North Yard has been intercepted by the diversion system and is being rerouted to the GAC treatment system. Similarly, shallow groundwater flow into the French drains is now treated by the North Yard GAC treatment system. This discharge abatement project is adequate to meet its objective of interception of surface water and French drain flow. No further work is recommended relative to these objectives.

Table VIII-1
CAPITAL COST ESTIMATE
MISCELLANEOUS AREAS

REMEDIAL ACTION	UNITS	UNIT COST	RECTIFIER YARD QUANTITY	RECTIFIER YARD COST	N. OF HAVERSTOCK RD QUANTITY	N. OF HAVERSTOCK RD COST	SOIL STOCKPILE QUANTITY	SOIL STOCKPILE COST
***************	*****	****	********	****	********	****	********	****
A. SITE PREPARATION								
1. Water/Sediment Control	LS	As noted		$18,000		$4,000		$2,000
B. EXCAVATION/HANDLING OF CONTAMINATED MATERIALS								
1. Remove Contaminated Sediments from Catchbasins	each	$500	20	$10,000				
2. Remove Contaminated Sediments from Stormwater Pipes	lf	$50	2,600	$130,000				
3. Excavate Sediments	ton	$10	6,495	$64,950				
4. Excavate Contaminated Soils	ton	$5			2980	$14,900	4050	$20,250
C. TRANSPORT AND TREATMENT/ DISPOSAL OF CONTAMINATED MATERIALS								
1. Dispose at On-Site Landfill	ton	$30	4,500	$135,000	1,175	$35,250		
2. On-Site Hauling	ton	$2	6,495	$12,990	2,980	$5,960	4,050	$8,100
D. SITE RESTORATION								
1. Grade and Backfill Excavated Area with Crushed Stone	cuyd	$20	3,000	$60,000				
2. Backfill and Compact Excavated Areas	ton	$5	1,995	$9,975	2,980	$14,900		
3. Grade and Seed Excavated Areas	sqft	$2	18,000	$36,000	43,560	$87,120	17,500	$35,000
DIRECT CAPITAL COSTS				$476,915		$162,130		$65,350
INDIRECT CAPITAL COSTS	(% of Direct Capital Costs)							
A. Implementation	(25%)			$119,229		$40,533		$16,338
B. Administration	(15%)			$71,537		$24,320		$9,803
C. Contingency	(20%)			$95,383		$32,426		$13,070
TOTAL ESTIMATED CAPITAL COSTS				$760,000		$260,000		$100,000



APPROXIMATE AREA OF CONTAMINATED SEDIMENTS
RECTIFIER YARD AREA
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Rev. No.	Date	Type of Revision	Checked by

Job No.: 89C25154-1 Drawing No.: 95150800 Date: 02/13/91
Drawn by: D.E.G. Checked by: M.K.
Scale: 0 200 FEET
FIGURE

PART IX: SUMMARY AND CONCLUSIONS

27.0
SUMMARY OF SELECTED ALTERNATIVES

The FS provides a comprehensive review and evaluation of potential alternatives for the five primary areas of concern at the Reynolds plant. Remediation plans are also proposed for the three Miscellaneous Areas: 1) the Rectifier Yard, 2) the Area North of Haverstock Road, and 3) the Soil Stockpile southwest of the Black Mud Pond. The alternatives considered span a broad range of scenarios, from the perspectives of environmental effectiveness, remedial technologies, and costs. The evaluation of these alternatives was done using the regulatory-specified criteria and methods, which help to ensure an objective and equitable assessment.

As a result of this evaluation, WCC recommends alternatives for each of the five areas, summarized in Table IX-1 and as follows:

- For the Black Mud Pond, WCC recommends alternative 2A, which includes the installation of a permanent cap over the dewatered material in the existing pond, with surface water and groundwater monitoring. The estimated cost for this alternative is $5,200,000.

- For the Landfill and Former Potliner Storage Area, WCC recommends alternative 1B, which includes the installation of a perimeter drain for groundwater/leachate collection and treatment, the installation of a permanent cap, with surface water and groundwater monitoring. This alternative is estimated to cost $7,800,000.

- For the Wetlands, WCC recommends alternative 2A. This requires removing contaminated sediments and water from the existing Wetlands, with surface water and groundwater monitoring. The sediments would be placed in the Former Potliner Storage Area for permanent management. A new wetlands area would be constructed elsewhere to achieve no net loss of wetlands habitat. The cost of this alternative is estimated at $3,700,000.

- For the Potliner Pad Area, alternative 2B is recommended. This alternative requires in-place capping of sediments and soils and collection and treatment of surface water and groundwater, with surface water and groundwater monitoring. The estimated cost of this alternative is $2,000,000.

- For the North Yard, WCC recommends alternative 1, which includes in-place capping of contaminated soils and collection and treatment of surface water and shallow groundwater, with surface water and groundwater monitoring. In addition, this requires excavation, treatment, and disposal after plant closure (assumed to be 30-years post-capping). The estimated cost of this alternative is $11,000,000.

- For the Miscellaneous Areas, the following general approach is proposed: excavation of contaminated soil/sediments; on-site management of contaminated materials with less than 50 ppm of PCBs in the Former Potliner Storage Area; and disposal of high-level contaminated materials in a new, on-site, secure landfill. The estimated capital costs for these areas total $1,100,000.

In summary, the estimated total present worth cost for plant-wide remediation (excluding IRMs already completed) is $31,000,000.

28.0
PLANT-WIDE PERSPECTIVE AND ECONOMIES OF SCALE

The practical approach to this FS requires that remedial alternatives for each Area of Concern be evaluated separately from other areas. This provides for alternatives that address the remedial objectives for each area. The evaluation and selection of alternatives have been performed with a consistent approach relative to the unified objectives of establishing environmentally sound, cost effective, and technically feasible remediations.

Recognizing the commonality of remedial components in selected alternatives for various areas, the actual remediation (and long-term O&M) will undoubtedly integrate those components to achieve economies of scale and minimize duplication of efforts. To some extent, this plant-wide integration has been incorporated into the alternatives described earlier in the FS.

Examples of this plant-wide approach are:

- Mobilization/demobilization costs, including construction of temporary facilities such as decontamination pads and staging areas, would have to be repeated for each area if each area were to be remediated individually. These costs would be a relatively large amount for the remediation of smaller areas (e.g., "Miscellaneous Areas") if they were isolated projects, but have been considered to be negligible, assuming that these areas are remediated in conjunction with other nearby areas.

- Water treatment, where required, has been integrated on a plant-wide basis. Alternatives that include surface water, groundwater, and/or leachate collection and treatment utilize the North Yard GAC system for treatment prior to discharge, with the assumption that the hydraulic capacity of the system is adequate (recognizing the need for additional surge storage capacity). This approach obviates the need for localized treatment at each area of concern.

- The use of the Former Potliner Storage Area (FPSA) for management of contaminated soils and sediments with less than 50 ppm of PCBs integrates the closure of that area with the remediation of several other areas. Such use would not add contaminants to the FPSA that are not already there, and it would provide the required fill material to support a permanent cap with the appropriate grades to promote run-off. Also, it would obviate the need for a new area for low-level soil management.

- For alternatives where on-site landfilling of wastes and/or residuals (exclusive of materials less than 50 ppm PCBs) are included, WCC assumed that one landfill cell would be available to dispose of such materials from all Areas of Concern. The exception to this is with the Black Mud Pond, which was assumed under alternatives 6A and 6B to be disposed of in its own dedicated cell of the same landfill. Details of this landfill are presented in Appendix E.

29.0
CONCLUSIONS

Each of the alternatives recommended by WCC for the areas of concern meet the criteria established by the NYSDEC. In individual cases, other alternatives may surpass the recommended alternative for a specific criterion; however, the recommended alternatives are those that provide the best overall balance of all criteria.

In making this balance, several key concerns were considered:

- The entire plant site is located in a relatively remote, rural area, without human receptors in immediately adjacent areas.

- The plant site is surrounded by a fence and/or within the control zone of Reynolds' security force, preventing public access.

- Monitoring of surface water and groundwater is included in all alternatives to evaluate the effectiveness of remediation and to assure long-term compliance with remedial goals.

Figure IX-1 presents a schematic summary of the main components of each of the recommended alternatives. This illustrates that there are several key components which are included in the alternatives for several areas, thereby providing a unification to the overall approach to plant-wide remediation. As another example of this, Figure IX-2 shows schematically the site-wide approaches for surface water control and drainageway remediation.

TABLE IX-1

SUMMARY OF SELECTED REMEDIAL ALTERNATIVES AND ESTIMATED TOTAL PRESENT WORTH COSTS

BLACK MUD POND: Alternative 2A $5,200,000

- Dewatering of black mud in-place
- Installation of a permanent cap
- Groundwater and surface water monitoring

LANDFILL AND FORMER POTLINER STORAGE AREA: Alternative 1B $7,800,000

- Installation of an improved leachate collection system
- Installation of a permanent cap
- Surface water run-on/run-off controls
- Groundwater/leachate recovery and treatment
- Groundwater and surface water monitoring

WETLANDS: Alternative 2A $3,700,000

- Dewatering/excavation of sediments and vegetation from the impacted area
- Long-term management of excavated materials in Former Potliner Storage Area
- Backfilling, grading and seeding of excavated areas
- Creation of a new wetlands area in a nearby location
- Surface water controls

POTLINER PAD AREA: Alternative 2B $2,000,000

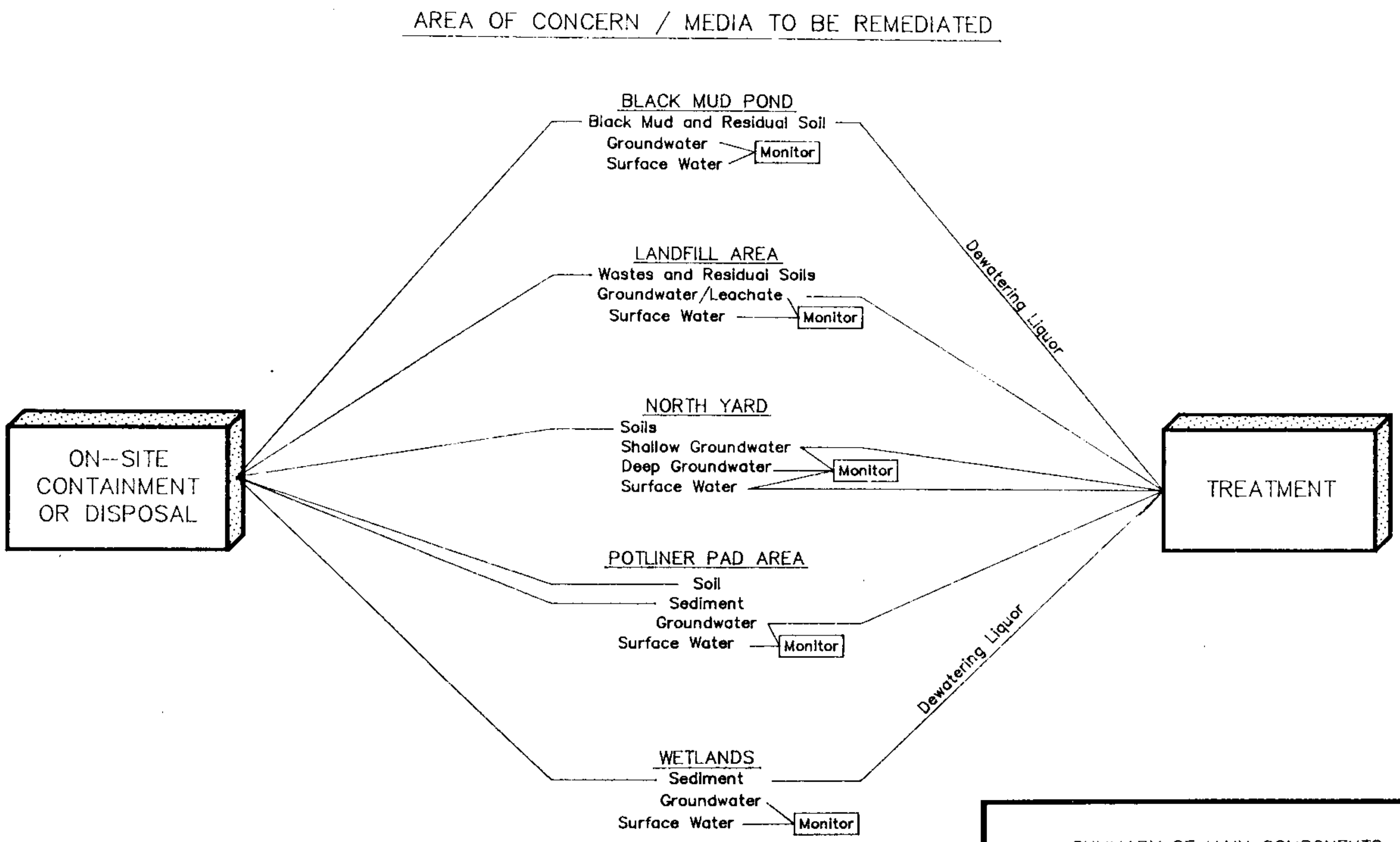
- Capping of sediments and soils
- Potliner Pad rehabilitation
- Groundwater recovery and treatment
- Groundwater and surface monitoring
- Complete remediation upon plant closure

NORTH YARD: Alternative 1 $11,000,000

- Capping of contaminated soils (temporary measure until plant closure)
- Collection and treatment of surface water and shallow groundwater
- Groundwater and surface water monitoring
- Excavation and on-site landfilling of contaminated soils when plant closes

MISCELLANEOUS AREAS $1,100,000

- Removal of contaminated soils/sediments
- Disposal of high-level contaminated soils/sediments in a secure landfill
- Long-term management of low-level contaminated soils/sediments in the Former Potliner Storage Area
- Surface water monitoring



NOTE: SEE TEXT FOR MISCELLANEOUS AREAS

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Rev. No.	Date	Type of Revision	Checked by:

SUMMARY OF MAIN COMPONENTS
OF RECOMMENDED REMEDIAL ALTERNATIVES
REYNOLDS METALS COMPANY
MASSENA, NEW YORK

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No.: 89C2515A-4	Drawing No. 95154010	Date: 05/21/91
Drawn by: T.P.	Checked by: D.M.H.	FIGURE IX-1
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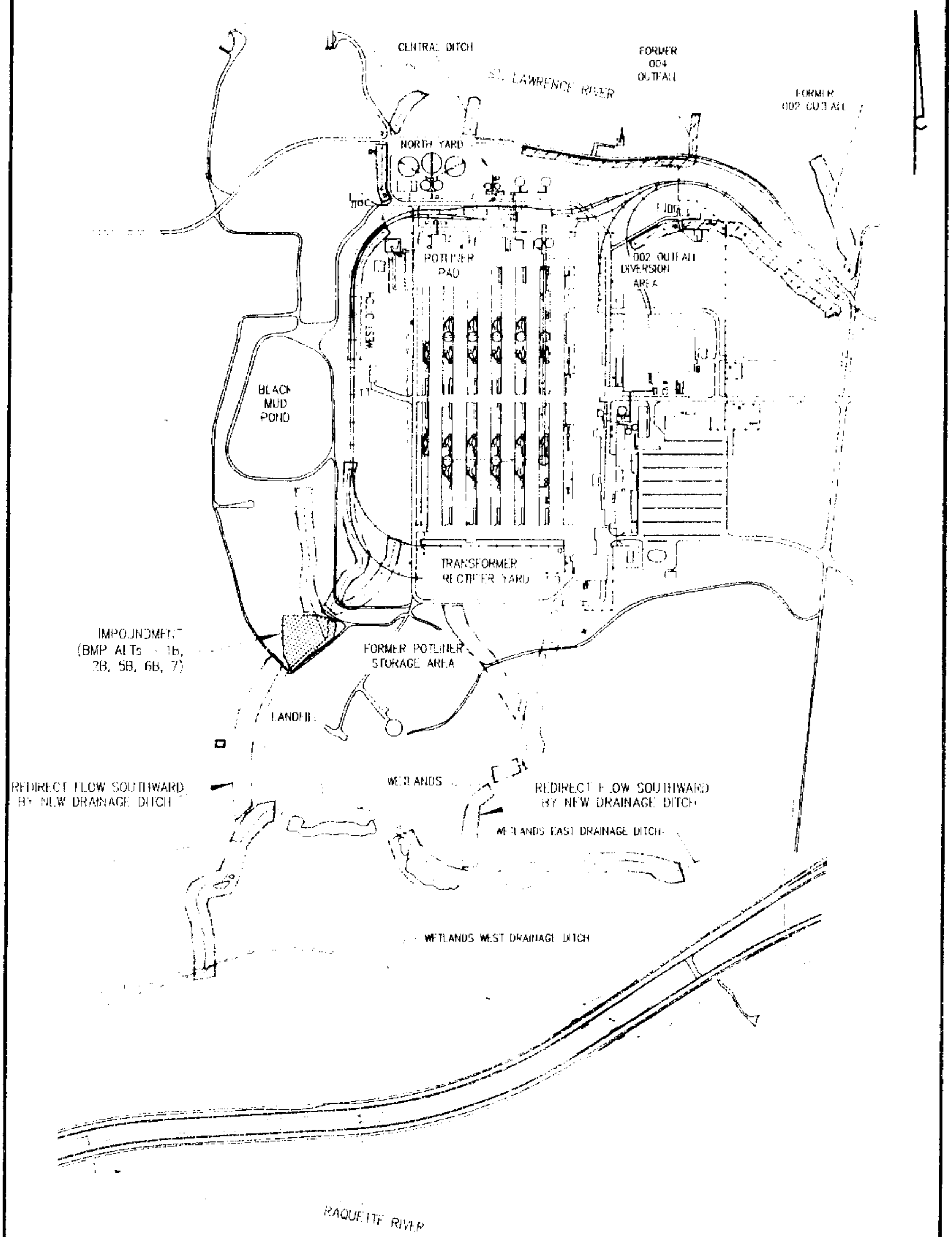

LEGEND:

REMEDIATED DRAINAGEWAYS

DRAINAGEWAY TO BE REMEDIATED

DRAINAGES TO BE MONITORED

NOTE: INDICATED AREAS OF REMEDIATION NOT TO SCALE

REYNOLDS METALS COMPANY
MASSENA, NEW YORK

WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists

SURFACE WATER MANAGEMENT
ST. LAWRENCE REDUCTION PLANT

Job No.: 89C2515A-6	Drawing No. 93150372	Date: 05/14/91
Checked by: PRJ	Rev. No.:	
Scale: 0 200 400 FEET		FIGURE IX-2

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