PHASE III REMEDIAL ACTION PLAN
RTN: 3-3940 FORMER SETTLING LAGOON
LINKED SITE RTN: 3-4356 BEAVERDAM BROOK

FORMER ASSEMBLY PLANT
GENERAL MOTORS CORPORATION
FRAMINGHAM, MASSACHUSETTS

JUNE 2007
REF. NO. 012618 (34)
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1.0 INTRODUCTION

Conestoga-Rovers & Associates Inc. (CRA) has prepared, on behalf of General Motors Corporation (GM), this Phase III Remedial Action Plan (RAP) Report for the combined Former Settling Lagoon (Lagoon) and Beaverdam Brook (Brook) sites (Site). This RAP provides the identification and detailed evaluation of remedial action alternatives to determine the appropriate remedial action required for the Site. The Site is located at the former GM Assembly Plant located at 63 Western Avenue in Framingham, Massachusetts (Property) as shown on Figure 1.1.

The Brook portion of the Site was formerly assigned Massachusetts Department of Environmental Protection (MADEP) Bureau of Waste Site Cleanup (BWSC) release tracking number (RTN) 3-4356. Beaverdam Brook was linked to the Lagoon under RTN: 3-3940, with the submittal of the Lagoon Final Phase II Comprehensive Site Assessment (CSA) Report (CRA, 2006a). Therefore, for the purposes of this RAP, and future MADEP submittals, the Site, including both the Lagoon and Brook, has been assigned the primary RTN: 3-3940.

This Phase III RAP has been prepared in accordance with 310 Commonwealth of Massachusetts Regulations (CMR) 40.0000 [the Massachusetts Contingency Plan (MCP)] (MADEP, 2006) and applicable MADEP and United States Environmental Protection Agency (USEPA) guidance. The Phase III RAP was prepared to identify, develop, and screen potential remedial alternatives, which satisfy the remedial action objectives for the Site. The Phase III RAP identifies, evaluates, and selects a Comprehensive Remedial Action for the Site based on initial screening and subsequent detailed evaluation of remedial action alternatives with applicable evaluation criteria, feasibility evaluations, and benefit-cost analysis.

The Phase III RAP considers Performance Standards of achieving a condition of No Significant Risk (NSR) and achieving or approaching background levels, as applicable. In accordance with the MCP (specifically 40.0853), Phase III evaluations will identify and evaluate remedial action alternatives which are reasonably likely to achieve a level of NSR considering the oil and/or hazardous materials (OHM) present, media impacted, and Site characteristics. In addition, the Phase III RAP must include a recommendation of a remedial action alternative that is either a Permanent or Temporary Solution, where a Permanent Solution includes measures that reduce, to the extent feasible, the concentrations of OHM in the environment to levels that achieve or approach background.

This Phase III RAP was prepared based on the results of the Interim and Final Phase II CSAs. The Interim Phase II CSAs were submitted to MADEP separately for the Lagoon (CRA, 2005a and 2005c) and Brook (CRA, 2005a and 2005b) under RTN: 3-3940 and RTN: 3-4356, respectively. The Interim Phase II CSA Reports documented and presented the results of the extensive historical and recent environmental, wetland delineation, and other investigations completed for the Site. The Interim Phase II CSA Reports also included the Tier I Permit Applications based on re-classifications of the Lagoon and Brook as Tier IB sites.

The Final Phase II CSA Reports and Completion Statements were submitted to MADEP separately for the Lagoon (CRA, 2006a) and Brook (CRA, 2006b) under RTN: 3-3940 and RTN: 3-4356, respectively. The Phase II CSA Reports included updates to the Interim Phase II CSA Reports, and the Human Health Risk Assessment (HHRA) and the Ecological Risk Assessment (ERA) for the two sites.

This Phase III RAP provides the selection of the comprehensive remedial action to be implemented as part of the Phase IV Remedy Implementation Plan (RIP) to achieve the Remedial Action Outcome (RAO). The selected remedial action determined by the Phase III RAP will be documented in a Phase IV RIP submitted to MADEP. Copies of the Phase III Completion Statement and the BWSC Transmittal Form 108 were submitted electronically using eDEP on June 14, 2007 and are included with this report in Appendix A.

MADEP and GM entered into an Administrative Consent Order and Penalty (ACOP-NE-05-3A0421) for the Lagoon (RTN: 3-3940) in March 2006 and in May 2006 MADEP and GM also entered into an ACOP (ACOP-NE-05-3A043) for the Brook (RTN: 3-4356). The submittal of this Phase III RAP addresses and fully complies with paragraph VII.D.2 of both ACOPs, which required the submittal of Final Phase III Reports by June 15, 2007.

1.1 RELATED RTNS

The Property has the following additional disposal sites or RTNs associated with it:

- RTN 3-317 Former Assembly Plant; and
- RTN 3-3939 Former Landfill Site.

The Former Assembly Plant which is the responsibility of ADESA Auctions, Inc. (ADESA) and the Former Landfill Site which is GM's responsibility have been addressed separately from this Site and are, therefore, not included in this report.

1.2 SCOPE OF PHASE III RAP

A Phase III evaluation must be conducted for all Sites for which a Phase II CSA has been completed and an RAO has not been achieved. The Phase III RAP has been prepared in accordance with MCP requirements and consideration of other applicable State and local regulations and by-laws.

In accordance with the MCP, the Performance Standards for a Phase III remedial alternative evaluation shall result in:

1. *the identification and evaluation of remedial action alternatives which are likely to achieve a level of No Significant Risk considering the oil and hazardous material present, media contaminated, and site characteristics;*
2. *the recommendation of a remedial action alternative that is a Permanent or Temporary Solution, where a Permanent Solution includes measures that reduce, to the extent feasible, the concentrations of oil and hazardous material in the environment to levels that achieve or approach background; and*
3. *a Phase III Remedial Action Plan shall describe and document the information, reasoning and results used to identify and evaluate remedial action alternatives in sufficient detail to support the selection of the proposed remedial action alternative.*

The Phase III RAP was also prepared in accordance with applicable MADEP and USEPA guidance, including the following:

> "*Conducting Feasibility Evaluations under the MCP,*" *Policy #WSC-04-160, Commonwealth of Massachusetts, Executive Office of Environmental Affairs,* (MADEP, 2004).

1.3 REPORT ORGANIZATION

The Phase III RAP is presented in the following sections:

- 1.0 Introduction;
- 2.0 Conceptual Site Model;
- 3.0 Remedial Action Objectives;
- 4.0 Identification and Evaluation of Initial Remedial Action Alternatives;
- 5.0 Detailed Evaluation of Remedial Action Alternatives;
- 6.0 Selection of Remedial Action Alternative;
- 7.0 Feasibility Evaluation; and
- 8.0 References.

The Conceptual Site Model (CSM) for the Site is presented in Section 2.0.

The remedial objectives to be met and addressed for the Site are presented in Section 3.0.

The identification of potential remedial action alternatives and the initial screening of alternatives based on technical and practical feasibility is presented in Section 4.0.

The further development and detailed evaluation of remedial action alternatives is presented in Section 5.0.

The selected Comprehensive Remedial Action is presented in Section 6.0.

A Feasibility Evaluation (FE) for the selected Comprehensive Remedial Action is provided in Section 7.0.

References are provided in Section 8.0.

2.0 CONCEPTUAL SITE MODEL

This Section presents the CSM to be used in the development and evaluation of remedial alternatives for the Site. The CSM includes the following subsections:

2.1 Site Characterization;
2.2 Environmental Setting;
2.3 Nature and Extent of Contamination;
2.4 Exposure Scenarios and Complete Exposure Pathways;
2.5 Summary of Risks; and
2.6 Additional Considerations.

2.1 SITE CHARACTERIZATION

2.1.1 SITE LOCATION

The Property is located at 63 Western Avenue in the Town of Framingham, Middlesex County, Massachusetts. GM purchased the Property in 1947 and the Former GM Assembly Plant operated from the 1940s to 1994 when GM sold the Property to ADESA. As part of the sale, GM retained the responsibility for addressing certain environmental issues. ADESA currently uses the Property as an automobile storage and auctioning facility. Currently, with the exception of the area of the Lagoon (owned by ADESA) and the property to the south (wetlands owned by GM), CSX Corporation owns the majority of the property to the west of the Site, adjacent to the Property and upstream of the Property.

The Site consists of the Lagoon including the West Outfall Area (WOA) located on the northwest corner of the Property and the Brook located along the western Property line as well as the wetland area between the WOA and Brook, south of the Lagoon (Wetland Soil Area).

2.1.2 SITE DESCRIPTION

According to the MADEP Site Scoring Maps, there are no Protected Open Spaces, Areas of Critical Environmental Concern (ACEC), Potentially Productive Aquifers, or USEPA Sole Source Aquifers in close vicinity of the Site as shown on Figures 2.1 and 2.2 for the

Lagoon and Brook, respectively. A Protected Open Space is located approximately 600 feet (ft) to the west of the Brook at its southern reach on the Property. There is a medium yield Potentially Productive Aquifer located approximately 600 ft west of the Property. There are a number of wetlands on and in the area of the Site as described in the Wetland Delineation Report (CRA, 2005a) and summarized in Section 2.1.2.3.

The Site features are presented on Figures 2.3 through 2.5. The 100-year floodplain is shown on Figure 2.6.

2.1.2.1 LAGOON

Stormwater and wastewater from the Former Assembly Plant drained by gravity to the former Pump House and was then pumped to the west end of the Lagoon. The stormwater and wastewater flowed generally from west to east within the Lagoon and drained to the Brook via Outfall #3. The Lagoon was constructed in 1964 and its use for wastewater management was discontinued in 1968 when a wastewater treatment plant was constructed. The use of the Lagoon for permitted stormwater management was discontinued in 1989.

The Lagoon consists of an approximately 1.68-million-gallon former retention pond, the WOA, the former Pump House, and the former Valve House as shown on Figure 2.4. The WOA was designed to contain stormwater overflow from the Lagoon.

The Lagoon is approximately 400 feet (ft) in length by 68 ft in width with depths ranging from approximately 5 to 9 ft below ground surface (bgs). The bottom of the Lagoon slopes slightly from west to east towards the former Valve House and gravity discharge outfall (Outfall #3) to the Brook. The valve at the former Valve House is currently closed to minimize surface water and sediment discharges from the Lagoon to the Brook.

The WOA is located to the southwest of the Lagoon in a forested wetland area. The retention area of the WOA is contained to the north by the sidewall of the Lagoon, and in the remaining directions by an earthen berm. The top of the earthen berm and sidewall are approximately 3 to 3.5 ft and 4 to 8.5 ft higher, respectively, than the elevation of the Lagoon discharge outfall pipe. There is a break in the earthen berm located on the south side of the WOA as shown on Figure 2.4.

2.1.2.2 BEAVERDAM BROOK

Beaverdam Brook flows in a northerly direction and the reach on the Property is approximately 3,250 ft in length.

The land to the west of the Brook is generally heavily vegetated and unoccupied, undeveloped wetlands. At the time of historical investigations, the south (upstream) portion of the Brook on-Property was primarily undeveloped land. To the north (downstream of the Property), there are industrial, commercial, residential, and vacant properties on both sides of the Brook. Approximately 2.2 miles downstream of the Property, Beaverdam Brook converges with Course Brook and discharges into Fiske Pond located in the town of Natick, Massachusetts. Fiske Pond empties into Lake Cochituate, which is approximately 2.6 miles northwest of the Property.

Beaverdam Brook is a freshwater surface water body and is not directly used as a water supply. There are no parklands or other designated recreational areas in the area of the Site on the Property, however, fishing and other recreational activities may occur at downstream locations.

The existing discharge structures located along the reach of the Brook on-Property include four historical surface water collection system stormwater outfall structures (Outfall #1 to Outfall #4) as shown on Figure 2.3.

The wetland outfall (Outfall #1) is the most upstream on-Property drainage feature which discharges to the Brook. Wetland A is located to the south and west of the Property and is hydraulically connected to the Brook through a stormwater sewer located on the southwest portion of the Property as shown on Figure 2.3. The northwest end of the sewer discharges through Outfall #1. An enclosed drainage pipe was installed in 1964 in the open channel between the wetlands and the Brook to control flooding and provide hydraulic balancing between the wetlands and the Brook. The stormwater sewer pipe runs through the Former Landfill (RTN: 3-3939) and was investigated and lined as part of the Phase IV RIP for the Former Landfill. The sewer pipe also collects Property drainage from catch basins then discharges to a stormwater retention pond (North Pond) which overflows and discharges to the Brook. Wetland A is considered part of the Brook site since it is hydraulically connected via the storm sewer as described in Phase II CSA submittals.

The second on-Property outfall (Outfall #2) is located approximately 1,000 ft downstream from Outfall #1 and consists of a 54-inch outfall. Outfall #2 was formerly used between 1947 and 1964 to discharge stormwater from the Former Assembly Plant roof and parking lots to the Brook. In 1964, the stormwater was diverted to a Pump House that directed the discharge to the Lagoon. The stormwater was diverted from the roof drain outfall to the Lagoon to provide settling of contaminants in the roof runoff prior to discharge to the Brook.

The third on-Property outfall (Outfall #3) is located approximately 225 ft downstream from the former roof runoff outfall and it gravity discharged overflow from the Lagoon to the Brook.

The fourth on-Property outfall (Outfall #4) along the Brook is located 400 ft further downstream, and collects stormwater runoff from the paved area along the northwest border of the Brook. In 2005, this outfall was rerouted to discharge to ADESA's wetland replication project on-Property.

Other potential drainage sources to the Brook are from stormwater sheet flow runoff from primarily paved and some open areas of the Property. A portion of stormwater runoff from the roof of the Property buildings drains by sheet flow into the wetland to the south, and into existing ADESA stormwater collection systems to the north and east.

There are no other known current stormwater discharges or discharges from wastewater treatment plants or any other disposal or treatment facility located along the reach of the Brook on-Property.

2.1.2.3 WETLANDS

The Phase II CSA activities provided the delineation of approximately 45 acres of wetlands located at and in the vicinity of the approximately 90-acre Property as shown on Figure 2.5. Nine separate wetlands of various types were delineated in accordance with the United States Army Corps of Engineers (USCOE), MADEP, and FCC regulations and delineation requirements and practice.

Wetland A (90.6 acres within the Framingham Town Line) is located to the south of the Former Landfill Site, and is connected hydraulically to the Brook by a 3 to 4-ft diameter storm sewer.

The Lagoon is considered Wetland F, and is bordered by Wetland G to the south and Wetland H to the north. Wetland F is 0.76 acres and occurs entirely on the Property.

The Lagoon is classified as an open-water area (OW) with a narrow fringe of emergent wetland vegetation.

Wetland G (18.5 acres) is a palustrine-emergent/palustrine-scrub/shrub (PEM/PSS) wetland located on the west side of the Brook and south of the Lagoon on CSX property.

Wetland H (15.4 acres) is a PEM/PSS/Palustrine-forested (PFO) wetland located on the west side of the Brook north of the Lagoon on CSX property. Together, Wetlands G and H cover the entire length and both banks of the Brook on the Property.

2.2 ENVIRONMENTAL SETTING

2.2.1 GEOGRAPHY

The Universal Transverse Mercator (UTM) Coordinates are 300,720 mE and 4,682,049 mN for the center of the Lagoon and are 300,628 mE and 4,681,442 mN upstream, and 300,886 mE and 4,682309 mN downstream for the Brook.

The latitude and longitude of the Lagoon is 42 degrees, 15 minutes, and 54.7409 and 71 degrees, 24 minutes, and 58,46249 seconds, respectively. The upstream latitude and longitude of the Brook is 42 degrees, 15 minutes, and 35.70629 seconds and 71 degrees, 25 minutes, and 0.54063 seconds, respectively. The downstream latitude and longitude of the Brook is 42 degrees, 16 minutes, and 4.05638 seconds and 71 degrees, 24 minutes, and 51.24975 seconds, respectively.

2.2.2 TOPOGRAPHY

The Property lies on the broad lowland belt of eastern Massachusetts (Nelson, 1975). The Site is situated in a relatively low-lying area in which ponds are commonly observed during high flow seasons. The Lagoon was constructed in a relatively flat area with a slight inclination southwest towards the Brook. The earthen embankment, which forms the sidewalls of the Lagoon above grade, was constructed with a 3 to 1 interior side slope and the top of the embankment is approximately 8 ft wide. The exterior side slope is 2 to 1, and the slopes are graded into native soil on each side of the Lagoon. The bottom of the Lagoon slopes west to east.

The WOA at the southwest end of the Lagoon is located in a forested wetland area. This overflow stormwater retention area is contained to the north and northeast by Lagoon sidewalls, to the south and southeast by an earthen berm, and to the west and southwest by what was historically described as a topographic rise in the ground surface. The earthen berm and topographic rise are comprised of fill material of unknown origin. It is likely that the topographic rise was constructed from material related to the construction of the railroad tracks and the earthen berm is fill material generated during the construction of the Lagoon.

The surface topography in the area of the Brook, on-Property, is relatively flat, and according to the United States Geological Survey (USGS) Framingham 7.5 Series Quadrangle Map, the elevation is approximately 150 ft above mean sea level (amsl). There is an approximate three percent slope from the west side of the Former Assembly Plant towards the Brook. The wetlands in the area of the Brook have varying local topography.

2.2.3 GEOLOGY

Regional Geology

The regional geology of Framingham is characterized by an undulating bedrock surface covered with varying thickness of glacial deposits. All of the rock units in the area have been deformed by faulting, folding or hydrothermal alteration. Major faults occurring in the Framingham area are part of a large, continuous fault system. The Bloody Bluff fault zone, which extends northeast and occurs approximately 4 miles northwest of the Site, is a series of steeply dipping, southeast-directed thrust faults. The glacial till (mixture of boulders, gravel, sands, silts and clay sized material) is present as a thin veneer over bedrock. The thickness of the bedrock unit underlying the Site is likely to be as much as 6000 ft (Nelson, 1975).

Site Geology

Geological cross-sections for the Lagoon based on the results of the Phase II CSA are presented on Figures 2.7 to 2.9.

The elevation of the present land surface surrounding the Lagoon indicates that the sidewalls or embankments were likely built up to approximately 10 ft above ground surface. Sandy clay with an average thickness of 5 ft occurs in the north embankment and the remaining fill soil used for the south, west, and east embankments is silty sand.

The stratigraphy in the vicinity of the Lagoon consists of approximately 0.25 to 0.5 ft of natural organic sediment underlain by silt and sand. Directly beneath the Lagoon, brown sand was found from 0.5 to 2 ft bgs, underlain by gray sand. A layer of peat approximately 0.25 ft in thickness was typically encountered during historical investigations from 5 to 9 ft bgs. Beneath the peat, a medium gray, moderately well sorted fine silt and sand was found with some evidence of peat, at approximately 12 ft bgs. It is likely that the sand and silt extends down to the bedrock. Bedrock underlying the Site consists of mostly quartz pebble conglomerate, porphyritic lava of intermediate composition, and massive fine-grained crystal tuff. The rocks are bound by faults to the north, south and west, and by intrusive rocks to the east. Bedrock outcrops were observed at the southwest of the Property between the two rail spurs during the Former Landfill Phase II CSA investigations conducted by CRA. A bedrock ledge at six inches into the sediment was observed in the Brook at a historical sampling location during the historic sediment profile transects. A municipal storm sewer, which runs approximately east to west, is reportedly present to the south of the Lagoon. In addition, an old 1875 water main exists that reportedly extends from Washakum Lake and runs beneath the Lagoon.

The sediment in the center of the Brook has historically been observed to be approximately one foot thick on-Property and is characterized as medium to fine sand underlain by fine gray silty clay to clayey silt. The banks of the Brook generally consist of dark brown organic sandy silt with some fibrous roots overlying medium sand, which overlies gray clay/silt. Transects of the Brook, conducted historically in the area of the Site, indicated that the underlying clay/silt layer was encountered at the majority of the locations with the exception of one location where a bedrock ledge was observed, and off-Site locations where the layer was not present. Transects also were conducted during the Phase II CSA investigations to determine the amount of sediment present in the Brook. These transects are presented on Figures 2.10 through 2.17 and indicate that the thickness of sediment ranges from approximately 0.1 to 4.1 ft with an average thickness of 1.2 ft within the Brook on-Property.

2.2.4 HYDROGEOLOGY

Regional Hydrogeology

The Framingham area typically receives approximately 43 inches of precipitation on average per year, where approximately half evaporates or transpires. Groundwater is contained within the glacially deposited sediments and crystalline bedrock. The water saturated sand and gravel deposits constitute the most productive aquifers in the area and reach a maximum saturated thickness of approximately 140 ft. There is a medium yield Potentially Productive Aquifer located approximately 600 ft to the west of the on-Property reach of the Brook.

Site Hydrogeology

According to the City of Framingham, Flood Insurance Rate Map (FIRM) (Community – Panel No. 250193 011 B), the Site is located within the 100-year flood plain as shown on Figure 2.6.

Groundwater contours for wells located in the area of the Lagoon for November 2004, May 2005, and July 2005 are presented on Figures 2.18, 2.19, and 2.20, respectively. In November 2004, the groundwater table was measured at approximate depths ranging from 5.92 to 8.36 ft bgs in the area of the Lagoon. In May 2005, the approximate depths of the groundwater table ranged from 5.85 to 7.06 ft bgs, and in July 2005, the approximate depths ranged from 5.3 to 7.7 ft bgs. The shallow overburden groundwater flow direction was observed to change during the 2004/2005 sampling events, likely due to the influence of flooding due to beaver dams and precipitation events which would increase the water levels. For the November 2004 event, the groundwater flow direction was to the east towards the Brook. In May 2005, the predominant groundwater flow direction was also towards the east, with a minor component in the west Lagoon area, flowing toward the WOA. In the July 2005 event, the predominant groundwater flow direction was toward the WOA.

The horizontal hydraulic gradient in the area of the Lagoon was calculated based on the groundwater elevation data collected in May 2005, which had a flow component towards both the east (in the direction of the Brook) and the west (northern end of WOA). The average horizontal hydraulic gradients were 0.005 ft/ft and 0.014 ft/ft for the eastern and western halves of the Lagoon, respectively. For both sections, a hydraulic conductivity of 0.71 ft/day (based on historical data), and an effective porosity of 0.25 were used. Based on these assumptions, the estimated groundwater velocities for the eastern and western portions of the Site were approximately 0.014 ft/day and 0.040 ft/day, respectively.

Historical investigations indicated the Brook to be relatively shallow ranging in depth from 0.6 ft to 2.5 ft (2 ft average) and in width from 15 ft to 28 ft (20 ft average). It had an average flow rate of approximately 1.5 ft/sec. In August 2004, after recent large rainfall events, the depth of water in the Brook was observed to be at least 5 ft as a result of beaver dam-building activity south of the Lagoon outfall. Following the removal of the beaver dams in November 2004, Interim Phase II CSA investigations conducted in 2005 indicated that the depth of the Brook to be an average of 1.6 ft, and the width of the Brook to be an average of 23 ft.

2.2.5 BEAVER DAM BREACHING AND SOIL/SEDIMENT

After the breaching of beaver dams in December 2004, the banks along both sides of the Brook were observed to be distinct and the water level dropped below the high point of the banks. The removal action was successful and water flow in the Brook was restored, reducing the flooding and potential future flooding to neighboring properties. Maintenance trapping as well as other actions may be appropriate in the future to provide beaver control and stormwater management.

The sediment which is present in the wetlands located to the south and southeast of the WOA is considered soil since the sediment is located above the bank of the Brook and the Lagoon/WOA and mean high water levels. There is no standing surface water, which could support aquatic habitat and organisms.

2.3 NATURE AND EXTENT OF CONTAMINATION

2.3.1 SOURCES OF OHM

The primary historical sources of OHM impacts to the Site were related to stormwater runoff from the roof of the Former Assembly Plant via Outfall #2 and from the Lagoon to the Brook via Outfall #3. The roof was known to have lead and other metal contamination from air emissions related to former paint shop and welding operations. In addition, these emissions would have contained polycyclic aromatic hydrocarbons (PAHs). The roof was remediated as part of facility decommissioning activities prior to the sale of the property to ADESA in 1994. Prior to 1964, the stormwater runoff discharged directly to the Brook via Outfall #2. Following the construction of the Lagoon in 1964, the stormwater runoff from the roof discharged to a storm sewer collection system which gravity drained to a Pump House and was pumped to the Lagoon. The Lagoon gravity discharged to the Brook via Outfall #3. Wastewater and stormwater runoff from several sources (e.g., spray booth paint wastes, welding booths, caustic stripping wastes, washing wastes, and some oily wastes) would have contained metals and petroleum hydrocarbons from the use of gasoline, lubricating oils, and fuel oils as part of Former Assembly Plant operations. The heavier fuel oils would also have contained PAHs. In addition, plasticizer coatings applied to new vehicles and the use of plastic materials in assembly operations would have contributed to the presence of phthalates in surface water runoff.

Other portions of stormwater runoff from the Former Assembly Plant and exterior areas discharged to a retention pond (North Pond) located to the northwest of the Former Landfill, a discharge outfall to the Brook located to the south of the Lagoon (Outfall #1), a discharge outfall to the Brook located to the north of the Lagoon (Outfall #4), and sheet flow from exterior areas. These stormwater runoff sources also likely contributed, to some degree, to OHM present in the Brook sediment.

A portion of stormwater runoff from the roof of the Property buildings drains by sheet flow into the wetland to the south, and into existing ADESA stormwater collection systems to the north and east. There is some stormwater sheet flow from the area of the Former Landfill towards the Brook.

There are no known current discharges from wastewater treatment plants or any other disposal or treatment facility located along the reaches of the Brook on the Property. There were no active manufacturing or related operations at the Property adjacent to the Site, with the exception of the former Pump House.

2.3.2 NATURE AND EXTENT OF CONTAMINATION

For the Site, the primary impacted media is sediment and secondarily soil. Some relatively minor odors were detected during field investigation activities, primarily associated with sediment sampling, so some impacts to ambient air were identified. Shallow overburden groundwater and subsurface soil in the area of the Lagoon and the soil directly below the impacted sediment within the Lagoon have minimal to no impact from OHM based on the results of the Phase II CSA and historical investigations.

OHM detected at the Site are lead and other metals, PAHs, phthalates, and petroleum hydrocarbons. Metals, PAHs, polychlorinated biphenyls (PCBs), and petroleum hydrocarbons were detected at concentrations in sediment collected from within the Lagoon, which exceeded the sediment freshwater screening benchmark values. For surficial soil in the area of the Lagoon, lead and benzo(a)pyrene were detected at concentrations exceeding S-2/GW-3 and/or S-3/GW-3 soil criteria. For soil and sediment collected from the Brook, certain metals, PAHs, phthalates, and petroleum hydrocarbons were detected at concentrations exceeding GW-3/S-2 or GW-3/S-3 soil criteria, Massachusetts Surface Water Quality Standards (adopted USEPA Ambient Water Quality Criteria (AWQC)), and freshwater sediment benchmark screening values.

Based on the analytical data that has been collected during the Phase II CSA and historical investigations for the Brook and Lagoon, volatile organic compounds (VOCs), petroleum hydrocarbons, PCBs, and pesticides/herbicides are not present or are not significant contaminants of concern based on the characterization and risk assessments completed.

2.3.3 IDENTIFICATION OF COPCS

The HHRAs for the Lagoon and Brook identified certain OHM as chemicals of potential concern (COPCs) based on the detected concentrations being above MADEP background levels, Site-specific background levels, or professional judgment. The ERAs identified certain OHM as COPCs based on a comparison to ecological screening benchmarks (conservative levels of potential concern identified in the MCP and scientific literature) and professional judgement.

2.4 EXPOSURE SCENARIOS AND COMPLETE EXPOSURE PATHWAYS

An exposure pathway describes a mechanism by which human or ecological receptors may come into contact with site-related COPCs. An exposure pathway is considered complete if there is a COPC source, migration route, exposure point and route by which the COPC could result in a receptor contacting a COPC. If any of these four elements are not present, the exposure pathway is considered incomplete and does not contribute to the total exposure from the Site.

Based on the four components of an exposure pathway and the current/future conditions of the Site, exposure pathways were developed for the risk assessments.

2.4.1 <u>HHRA</u>

Since the current and future land use in the area of the Site is industrial/commercial, the potential human populations considered relevant to the HHRAs included a recreational user, trespasser, maintenance/outdoor worker, utility worker, and construction worker.

Based on the physical conditions of the Site, potential exposure routes associated with on-and off-Property surface soil include incidental ingestion, direct dermal contact, and inhalation (i.e., airborne particulate and/or vapors). Potential exposure routes associated with on-and off-Property sediment include incidental ingestion and direct dermal contact. Potential exposure routes associated with on-and off-Property surface water include incidental ingestion, direct dermal contact, and vapor inhalation. Based on the current and future use of the Property and the presence of some edible biota present at the Site, the ingestion of biota that has contacted contaminated media at the Site is a potentially viable pathway. However, the Site does not have sufficient habitat for edible-sized fish. As a result, this pathway was not considered in the HHRA.

Based on these assumptions and the results of the media-specific screening, the exposure scenarios and pathways quantified in the HHRAs are summarized on Figure 2.21 for the Lagoon and Figure 2.22 for the Brook. The Exposure Site Models illustrated on Figure 2.21 and 2.22 present a summary of the exposure media, exposure pathways, exposure routes, and exposed receptors considered in the HHRAs for the sites.

2.4.2 <u>ERA</u>

For the Site, terrestrial exposure pathways that were assessed include the uptake of OHM directly from soil or sediment by plant roots, soil invertebrates contacting and/or ingesting contaminated soil, and mammals and birds contacting or incidentally ingesting contaminated soil/sediment (during feeding or grooming). Direct contact/ingestion of surface water was considered a secondary exposure pathway for mammals and birds at the Site. The ingestion of COPCs in plants and/or prey is also an important exposure pathway for fish and wildlife receptors. However, in the absence of measured concentrations of chemical constituents in food items, this pathway was assessed qualitatively in the ERA. Inhalation may be an exposure pathway when soils are contaminated by VOCs; however, it is difficult to quantify exposure by inhalation with any degree of accuracy. Also, there is a paucity of data in the toxicology literature by which to evaluate the inhalation pathways for birds or mammals. Therefore, the inhalation pathway was not assessed. Aquatic exposure pathways that were assessed include contact/uptake of chemical constituents from sediment and surface water by aquatic benthic invertebrates and fish, as well as uptake of chemicals from surface water and sediment by aquatic and wetland plants. Ingestion of contaminated prey by aquatic receptors was qualitatively assessed.

In the risk characterization, the measurement endpoints are evaluated to determine whether they support a conclusion of no significant risk. In addition, the weight of evidence is considered for each assessment endpoint to evaluate the risk of harm. Where the effects assessment indicates that the exposure for a given receptor exceeds the effects threshold, adverse effects are possible. A weight-of-evidence approach is used to integrate different types of data to support conclusions regarding potential risk to ecological receptors. For the Site ERA, these data include the results for the habitat assessment, the wetland delineation, the Stage I environmental screening, the bioavailability assessment (AVS/SEM), the macroinvertebrate field study (rapid bioassessment protocol (RBP)) and sediment toxicity tests, and the results of the Stage II environmental risk characterization.

Based on these assumptions and the results of the media-specific screening, the exposure scenarios and pathways quantified in the ERAs are summarized on Figure 2.23 for the Lagoon and Figure 2.24 for the Brook. The Exposure Site Models illustrated on Figure 2.23 and 2.24 present a summary of the exposure media, exposure pathways, exposure routes, and exposed receptors considered in the ERAs for the sites.

2.5 SUMMARY OF RISKS

2.5.1 HUMAN HEALTH

A Method 3 HHRA was conducted in accordance with the MCP to characterize the risk of harm to health, safety, and public welfare associated with potential exposures to OHM present in soil, groundwater, sediment, and surface water associated with the Lagoon and Brook, including the WOA and Wetland Soil Area.

Based on the results of the Method 3 HHRA, there were no excess lifetime cancer risks greater than 10^{-5} for the Lagoon or Brook sites.

The following cumulative screening level non-cancer risk hazard indices (HI) were determined to be greater than 1.0:

Lagoon

Primary Media	*Receptor*	*Cumulative Screening Level HI*
Soil (surface and subsurface), Sediment, Surface Water, and Groundwater	Construction Worker	2.9

West Outfall Area

Primary Media	*Receptor*	*Cumulative Screening Level HI*
Surface Soil, Sediment, and Surface Water	Trespasser	1.4
Soil (surface and subsurface), Sediment, Surface Water, and Groundwater	Construction Worker	2.7

Brook (on-Property)

Primary Media	*Receptor*	*Cumulative Screening Level HI*
Surface Soil, Sediment, and Surface Water	Trespasser	1.9

Initially, a screening level non-cancer HI for a given receptor group is calculated based on all chemicals of concern for all exposure routes and all exposure points to provide a conservative estimate of the actual HI (MADEP, 1995). The screening level non-cancer HI is conservative because it reflects the sum of toxicities for multiple OHM, regardless of the chemical's health endpoint, target organ, or mechanism of action. For a true HI, the only endpoints which should be treated as additive are those which produce adverse effects on the same organ system by the same mechanism.

In accordance with 310 CMR 40.0933(6), the screening level HI is compared to the MCP cumulative receptor non-cancer risk limit which is an HI of 1.0. If the screening level HI is less than or equal to 1.0, then the noncancer risks are considered to be acceptable and no additional effort is needed to characterize noncancer risks.

If the screening level HI exceeds 1.0, then separate HIs for chemicals with similar toxic effects and mechanisms of action should be calculated for different exposure periods (i.e., chronic, subchronic, acute) (MADEP, 1995). This approach is consistent with the

MCP which states under the regulations for conducting a Method 3 Risk Assessment at 310 CMR 40.0993(5)(b): "*For receptors who may be exposed to mixtures of OHM, or through multiple Exposure Pathways at the disposal site, the cumulative risk shall reflect those exposures. Risk estimates are presumed to be additive unless an alternative mechanism is demonstrated to be appropriate*".

The cumulative HI for multiple OHM with similar health endpoints and mechanisms of toxicity should then be compared to the MCP cumulative receptor non-cancer HI of 1.0. If any of these HIs exceed 1.0, then the Site poses Significant Risk of harm to human health based on the cumulative risk of non-cancer health effects from multiple OHM (MADEP, 1995).

2.5.1.1 LAGOON

For the Lagoon, there were no excess lifetime cancer risks greater than 10^{-5}.

The cumulative screening level non-cancer risk HI of 2.9 is greater than 1.0 for the future construction worker's reasonable mean exposure (RME) to Lagoon soil (surface and subsurface), groundwater, sediment, and surface water through ingestion, dermal contact, and ambient air inhalation. The RME cumulative HI of 2.9 primarily results from dermal exposure to antimony, cadmium, lead, and nickel in sediment and ingestion, dermal, and inhalation exposure to lead and manganese in soil. Lead in soil and sediment, manganese in soil, and antimony, cadmium, and nickel in sediment account for approximately 22, 10, 23, 12, and 10 percent, respectively, for a total contribution of 77 percent of the cumulative HI. The hazard index for each of these COPCs is below 1.0 and the associated target organ cumulative HIs are also below 1.0, therefore, there is no unacceptable risk or significant hazard for the future construction worker associated with these COPCs in the soil and sediment.

The cumulative screening level HI of 1.4 was greater than 1.0 for the current/future trespasser's RME to the WOA portion of the Lagoon Site surface soil, sediment, and surface water through ingestion, dermal contact, and ambient air inhalation. The RME cumulative HI of 1.4 primarily results from ingestion and dermal exposure to cadmium and lead in surface soil, and ingestion and dermal exposure to antimony, cadmium, lead, manganese, nickel, and TPH (C11-C22) aromatic in sediment. Cadmium and lead in surface soil and sediment, and antimony, manganese, nickel, and TPH (C11-C22) aromatic account for approximately 20, 20, 28, 5, 6, and 7 percent, respectively, for a total contribution of 86 percent of the cumulative HI. The HI for each of these COPCs is below 1.0 and the associated target organ cumulative HIs are also below 1.0, therefore, there is no significant hazard for the trespasser associated with these COPCs in the soil and sediment.

In addition, the cumulative screening level HI of 2.7 was greater than 1.0 for the future construction worker's RME to WOA surface soil, groundwater, sediment, and surface water through ingestion, dermal contact, and ambient air inhalation. The RME cumulative HI of 2.7 primarily results from ingestion, dermal, and inhalation exposure to arsenic, cadmium, lead, manganese, and TPH (C11-C22) in soil, and ingestion and dermal exposure to lead in sediment. Arsenic, cadmium, manganese, and TPH (C11-C22) aromatic in soil, and lead in soil and sediment account for approximately 16, 7, 13, 17, and 27 percent, respectively, for a total contribution of 80 percent of the cumulative HI. The HI for each of these COPCs is below 1.0, and the associated target organ cumulative HIs are also below 1.0, therefore, there is no significant hazard for the future construction worker associated with these COPCs in soil (surface and subsurface) and sediment.

Therefore, a condition of NSR of harm to human health exists for the Lagoon (including the WOA and Wetland Soil Area) since there are no non-carcinogenic HIs greater than one for OHM with similar toxic effects and mechanisms of action and no excess lifetime cancer risks greater than 10^{-5}.

2.5.1.2 BEAVERDAM BROOK – ON-PROPERTY

For the on-Property portion of the Brook, there were no excess lifetime cancer risks greater than 10^{-5}.

The cumulative screening level non-cancer risk HI is greater than 1.0 for the current/future trespasser exposure to on-Property surface soil, sediment, and surface water. All other receptors had a cumulative non-cancer risk less than 1.0. The HI of 1.9 for the trespasser primarily results from exposure to antimony, cadmium, lead, and manganese in sediment through the ingestion and dermal contact exposure routes. Antimony, cadmium, lead, and manganese account for approximately 48, 11, 12, and 7 percent, respectively, for a total contribution of 78 percent of the cumulative HI. The HI for each of these COPCs is well below 1.0. The cumulative HI for the target organs associated with antimony, cadmium, lead, and manganese are below 1.0, therefore there is no significant hazard for the trespasser associated with these COPCs in surface soil, sediment, and surface water.

Therefore, a condition of No Significant Risk of harm to human health exists for the Brook (on-Property) since there are no non-carcinogenic HIs greater than 1.0 for OHM with similar toxic effects and mechanisms of action and no excess lifetime cancer risks greater than 10^{-5}.

2.5.1.3 BEAVERDAM BROOK – OFF-PROPERTY

There were no exceedances of the cumulative screening level HI of 1.0 or excess lifetime cancer risk of 10^{-5} for the media and receptors evaluated for the off-Property portion of the Brook.

Therefore, a condition of No Significant Risk of harm to human health exists for the Brook (off-Property) since there are no non-carcinogenic cumulative screening level HIs greater than one and no excess lifetime cancer risks greater than 10^{-5}.

2.5.2 PUBLIC WELFARE

2.5.2.1 LAGOON

A level of No Significant Risk of harm to public welfare does currently and for the foreseeable future exist for the Lagoon since:

- There are no occupied buildings at the Lagoon currently and there will not be any at the Lagoon in the foreseeable future and there are minimal low concentrations of VOCs in soil and groundwater, therefore, ambient air and indoor air will remain free of persistent and noxious odors. No persistent or noxious odors were observed at the Lagoon and ambient levels of VOCs were measured to be the same as background levels based on organic vapor monitoring conducted during the Phase II CSA activities.
- The Town of Framingham is serviced by municipal water supply, the Site is not located in a Current or Potential Drinking Water Source Area, and there are no known public or private wells in the vicinity of the Site. The former Valve House gate is closed, thereby, minimizing discharges of surface water and sediment to Beaverdam Brook.

- There were no parameters with arithmetic average concentrations greater than the MCP Upper Concentration Limits (UCLs) for soil (surface and subsurface) and groundwater.
- There are no livestock in the immediate area of the Site that will be impacted by the Site and the human health and environmental risk characterizations are protective of potential livestock exposures.
- There has been and will be no loss of active or passive use(s) or non-pecuniary effects for the foreseeable future attributable to the release of OHM associated with the Site.
- The Site is zoned and used for industrial/commercial use currently and for the foreseeable future. The closest residents (approximately ½ mile from the Site) and the community in the area of the Site have not experienced significant adverse impacts from the OHM released at the Site. MADEP has not made a determination that immediate or accelerated response actions are necessary at the Site.

2.5.2.2 BEAVERDAM BROOK

A level of No Significant Risk of harm to public welfare does currently and for the foreseeable future exist for the Brook since:

- There are no occupied buildings at the Brook currently and there will not be any at the Brook in the foreseeable future and there are minimal low concentrations of VOCs in soil, therefore, ambient air and indoor air will remain free of persistent and noxious odors. No persistent or noxious odors were observed at the Brook and ambient levels of VOCs were measured to be the same as background levels based on organic vapor monitoring conducted during the Phase II CSA activities.
- The surface water from the Brook is not currently used as a source of drinking water and the Property is not in a potentially productive aquifer (PPA) area and is, therefore, classified as GW-3. The adjacent property and the Town of Framingham are serviced by a municipal water supply. Therefore, Brook surface water will not impact accessible drinking water with noxious taste and odors.
- There were no compounds with arithmetic average concentrations greater than the MCP UCLs.
- There are no livestock in the immediate area of the Site that will be impacted by the Site and the human health and environmental risk characterizations are protective of potential livestock exposures.

- The current property owners do not consider the Site OHM/condition to contribute to the existence of nuisance conditions, loss of active or passive property use(s), and any non-pecuniary effects not otherwise considered in the characterization of risk of harm to health and safety.
- MADEP has not made a determination that immediate or accelerated response actions are necessary at the Site.

2.5.3 SAFETY

2.5.3.1 LAGOON

A level of No Significant Risk of Harm to Safety does not currently and for the foreseeable future exist at the Site due to the physical hazards associated with the open Lagoon. It is noted that the Site is secured with fencing and infrequent access is only provided under controlled conditions for construction, utility, and maintenance workers. Some signs of trespassers have been observed in the area of the Lagoon.

2.5.3.2 BEAVERDAM BROOK

A level of No Significant Risk to safety does currently and for the foreseeable future exist since the conditions associated with the Site OHM do not currently and will not in the foreseeable future pose a threat of physical harm or bodily injury to people. Such release-related conditions include, but are not limited to:

- There are no visible rusted or corroded drums or containers, open pits, lagoons or other dangerous structures at the Site;
- There is no threat of fire or explosion, including the presence of explosive vapor resulting from a release of OHM based on the nature and type of OHM at the Site and the results of the organic vapor screening; and
- There are no known uncontained materials at the Site that exhibit these characteristics.

2.5.4 ENVIRONMENT

2.5.4.1 LAGOON

The results of the wetland delineation, habitat assessment, imminent hazard evaluation, sediment toxicity studies, chemical analyses, a Stage I environmental screening, and a Stage II environmental risk characterization were integrated into the ERA for the Lagoon for the Phase II CSA.

For the Lagoon, the weight of evidence (i.e., the results of the Stage I and Stage II screening processes) indicates that ecological risk cannot be concluded to be negligible. Chromium, PAHs, and PCBs in sediment were identified in the Stage II Risk Characterization as COPCs that cannot be ruled out as "*clearly unlikely to result in environmental harm.*" Based on the criteria specified in the MCP, it cannot be concluded, based on the results of this ERA, that a condition of "no significant risk of harm" has been met for the Lagoon. It is also noted that PCB risks were evaluated based on the data from only one sample and are, therefore, uncertain.

Copper, iron, and lead in WOA surface water exceeded AWQC. However, ecological risk associated with these exceedances is likely to be low given that the WOA is only periodically inundated and does not provide habitat for aquatic receptors, with the possible exception of aquatic invertebrates, which may become temporarily established during extended wet periods. Similar to the Lagoon, chromium, PAHs, and PCBs were identified in the Stage II Risk Characterization as the sediment COPCs in the WOA that cannot be ruled out as "clearly unlikely to result in environmental harm." Similar to the Lagoon, PCB risks were evaluated based on the data from only one sample, and concentrations were low (less than one part per million). The aquatic habitat limitations associated with the WOA suggest that ecological risk associated with the exceedance of sediment-screening values is likely to be low for this exposure area.

2.5.4.2 BEAVERDAM BROOK

The results of the wetland delineation, habitat assessment, RBP assessment, sediment toxicity studies, chemical analyses, a Stage I environmental screening, and a Stage II environmental risk characterization were integrated into the ERA for the Brook for the Phase II CSA.

For the Brook, the weight of evidence indicates that risk cannot be concluded to be negligible for two reaches of the Brook. The potential for adverse effects to benthic organisms from exposure to PAHs and possibly cadmium, chromium, lead, PCBs, DDT, and DDD exists for certain on-Property Brook locations. The 1999 sediment toxicity studies and RBP assessment showed that toxic effects were most likely related to exposure to PAHs, and were limited to that portion of the Brook below the former roof drain outfall (Outfall #2) (Reaches 3 and 4) and that some recovery was occurring in the furthest downstream off-Property station, in Reach 5. Therefore, a condition of "*no significant risk of harm*" has not been met for the Brook Reaches 3 and 4 (downgradient of the former roof drain outfall and adjacent to the Property). For the reaches of the Brook upstream of Outfall #2 (Reaches 1 and 2), the MCP criteria have been met and a condition of "*no significant risk of harm to the environment*" exists for this portion of the Site.

For the sediment in Wetland A south of the Site and adjacent to the Former Landfill, the weight of evidence indicates that the four criteria specified in the MCP have been met and a condition of "*no significant risk of harm to the environment*" can be concluded for this exposure area/portion of the Site.

For the soil samples collected along the upper western bank of the Brook and in the wetlands adjacent to the Brook and south of the Lagoon (Wetland Soil Area), the weight of evidence indicates that risk cannot be concluded to be negligible for all locations. Soil samples collected from areas adjacent to Reaches 3 and 4 had the highest concentrations of COPCs. Therefore, a condition of "*no significant risk of harm*" has not been met for these locations. Soil samples collected upstream of Outfall #2 (Reach 2) and further west towards the adjacent property meet the MCP criteria and a condition of "*no significant risk of harm to the environment*" exists for these locations.

2.6 ADDITIONAL CONSIDERATIONS

The MCP requires that the extent of OHM in all impacted media associated with a Site be delineated as part of the Phase II CSA. Based on the First, Second, and Final Phase II CSA Reports, the extent of OHM has been substantially and essentially delineated for the purposes of completing the Phase II CSA risk characterizations and identifying and evaluating appropriate further response actions for the Site. This conclusion is based on the following:

1. The large majority (over 90%) of the mass of OHM due to historic releases currently present at the Property is present in sediment near the source areas on the Property.
2. The primary sources of releases to the Brook were impacted sediment in historical stormwater runoff from the Property and discharges from the Lagoon.
3. Based on evaluation of the sediment data over time and consideration of the sediment characteristics and Brook flow and other conditions, there has generally been minimal migration of OHM impacted sediment since the Former Assembly Plant was closed in the early 1990s and characterization activities were first conducted. Impacted sediment with elevated OHM concentrations is largely limited to on-Property areas in the vicinity and immediately downstream of the source areas (i.e., Outfall #2 and Outfall #3).
4. There is a decreasing trend in concentrations of OHM in sediment from the on-Property source areas downstream on and off-Property for all samples except for the two furthest downstream samples. Based on the statistical evaluation conducted for the Brook Phase II CSA (CRA, 2006b), the two furthest downstream samples are statistical outliers and are inconsistent with the decreasing trend.
5. The downstream off-Property OHM sediment concentrations are generally significantly lower than on-Property source area concentrations and approach upstream background but are higher than those concentrations. There are numerous point and non-point discharge sources downstream off-Property that would contribute OHM to the Brook but are not related to the Site. The downstream off-Property OHM sediment concentrations are lower than the on-Property data set concentrations at a statistically significant level, not including the two furthest downstream samples.
6. Certain OHM were identified in a few surface water samples from the Brook which are believed to be due primarily to suspension of impacted sediment.
7. The predominant OHM COPCs are phthalates, PAHs, and metals such as chromium, antimony, and lead. These types of OHM adhere to sediment with higher organic content and do not have high water solubilities, and this supports the determination that the infrequent detection of OHM in surface water is due to sediment suspension. The low flow and velocity of surface water in the Brook and the comparative evaluation of sediment data over time indicates that there has not been significant migration of impacted sediment from the primary source areas (Reaches 3 and 4) to downstream reaches of the Brook.

8. The predominant OHM COPCs are similar in type and concentration to those found in Lagoon sediment that is the major source of impacted sediment in the Brook.
9. There are no significant levels of VOCs detected in Site media.
10. No free phase product or OHM were identified in sediment that may result in a condition of substantial release migration.
11. No condition that may cause an imminent hazard condition was identified regarding the Site. No recreational users have been observed at the Site at or near the Property, Property access is restricted, and the Brook on and immediately downstream off-Property is not amenable for recreational activities, such as boating and fishing. There is a safety hazard associated with the open Lagoon, however, the Site is fenced and access is controlled.
12. The Brook is not used as a water supply in the area of the Property and there are no parklands or other designated recreational areas in the area of the Brook in the area of the Property. However fishing and other recreational activities may occur at further downstream locations. Various property uses along the Brook, including residential, commercial and industrial, result in a fragmented ecological habitat, limiting the wildlife to small birds, beavers, and other mammals common to urban environments.
13. Surface water from Lake Cochituate, approximately four miles downstream of the Property, is not directly used as a source of drinking water. However, groundwater is extracted by the Town of Natick via pumping wells located near the lake. The nearest well field is the Natick Springvale public supply wells located adjacent to Lake Cochituate approximately five miles downstream of the Property. The extracted groundwater includes a portion of surface water that infiltrates from the lake to the underlying aquifer.
14. No OHM exceeding applicable MCP standards used as an indication of risk were identified in groundwater based on sampling conducted in the area of the Site.

The designation for the Site will continue to be industrial/commercial in the foreseeable future since no development and subsequent use of the Site for residential purposes is currently planned. The designation for the portion of the banks of Beaverdam Brook on ADESA and CSX Property will continue to be industrial/commercial in the foreseeable future since no development for residential purposes is currently planned and the Brook will continue to be a public water body. It is also anticipated that CSX will continue to operate the railroad loading/unloading operation to the west of Site for the foreseeable future.

3.0 REMEDIAL ACTION OBJECTIVES

This Section presents the remedial action objectives for screening potential remedial action technologies and process options which are reasonably likely to be feasible based on OHM present, media contaminated, and Site characteristics.

The technologies which are identified will be initially screened in Section 4.0 to select those technologies/process options which meet the remedial action objectives and are technically feasible. The retained technologies/process options will then be assembled into remedial action alternatives for further evaluation in Section 5.0 with respect to the criteria described in 310 CMR 40.0858.

In general, the remedial action objectives developed for a Site remedy should:

- eliminate any Substantial Hazards for the Site;
- achieve a condition of No Significant Risk;
- approach or achieve background concentrations, if feasible;
- comply with applicable local, State, and Federal regulations;
- provide protection of public health and the environment;
- provide practical, cost-effective remediation; and
- utilize remedies, which are completed in a short time frame, where applicable.

Included in the remedial action objectives are media-specific goals for the protection of human health and the environment. The remedial action objectives are based primarily on the MCP and other applicable regulatory requirements (e.g., Wetlands Protection Act) as well as the findings of the HHRA, ERA, Site conditions, current, and foreseeable future uses, and OHM present at the Site.

As presented in the Phase II CSA, no substantial or imminent hazards exist due to Site conditions and a level of no significant risk to public welfare and safety exists currently and for the foreseeable future for the Site, except for the potential physical safety hazard associated with the open water Lagoon. Addressing this physical hazard as part of remedial actions, as necessary, is complicated by the interpretation that the Lagoon is a regulated, although inadvertent, wetland and should ideally be maintained as such.

3.1 SEDIMENT

OHM was detected in the sediment samples collected from the Brook, the Lagoon, and the WOA during historical investigations and the Phase II CSA. Concentrations of OHM in Brook sediment exceeded background concentrations for the eight upstream sediment samples collected from the Brook in 2006. In addition, Site-related OHM was detected at concentrations exceeding sediment screening values as indicated in the Phase II CSA Reports for the Brook and Lagoon. The detection of OHM in surface water in the Brook, Lagoon, and WOA is also attributed to the suspension of OHM-impacted sediment in the surface water samples.

Carcinogenic and non-carcinogenic human health risks associated with exposure to OHM in sediment for the Brook, Lagoon, and WOA are below the MCP criteria and do not pose a Significant Risk, based on the results of the Method 3 Risk Assessments as summarized and discussed in Section 2.5.1.

Based on the results of the Stage II Ecological Risk Characterization conducted for the ERA, sediment in the Lagoon, WOA, and Brook are impacted primarily by metals, phthalates, and PAHs resulting in the following conditions:

- for the Lagoon and WOA sediment, the weight of evidence indicates that ecological risk cannot be concluded to be negligible and that a condition of "no significant risk of harm" cannot be concluded to have been met; and
- for Beaverdam Brook sediment, the weight of evidence indicates that risk cannot be concluded to be negligible and a condition of "*no significant risk of harm*" cannot be concluded to have been met for Reaches 3 and 4 (downgradient of Outfall #2 to the downstream Property boundary).

For the Lagoon and WOA sediment, chromium, PAHs, and PCBs were identified in the Stage II Ecological Risk Characterization as COPCs that cannot be ruled out as "clearly unlikely to result in environmental harm."

For Beaverdam Brook, the potential for adverse ecological effects to benthic organisms from exposure to PAHs and possibly PCBs, DDT, DDD and certain metals including cadmium, chromium, and lead exists for on-Property Brook locations primarily within the portion of the Brook below the former roof drain outfall (Outfall #2) to the downstream Property boundary (Reaches 3 and 4).

For the sediment in Wetland A south of the Site and adjacent to the Former Landfill, the weight of evidence indicates that the MCP criteria have been met and a condition of "*no significant risk of harm to the environment*" exists for this portion of the Site.

Remedial objectives are, therefore, likely required to address ecological risks associated with OHM-impacted sediment in the Lagoon, WOA, and Brook from Outfall #2 to the downstream Property boundary. Additional ecological assessment will be required during remedial action pre-design activities as discussed in Section 3.6 to determine Site-specific ecologically-based cleanup criteria for sediment which will achieve a condition of No Significant Risk. The additional assessment will also further refine the extent of materials in the areas of the Lagoon, WOA, and Brook that exceed the Site-specific sediment cleanup criteria.

For the purposes of the Phase III RAP, the following areas and volumes of sediment have been assumed to require remedial action.

The volume of sediment assumed to require remedial action in the Brook is estimated to range from approximately 1,000 to 3,900 cubic yards. The minimum volume is based on the length of the Brook between Outfall #2 and Outfall #4 (approximately 750 linear ft) where the highest concentrations of OHM were detected in sediment during the Phase II CSA and the average sediment cross-sectional area of 28 square ft for the transects completed during the Phase II CSA. The maximum volume of sediment is based on the length of the Brook between Outfall #2 and the downstream Property boundary (approximately 1,350 linear ft), an average width of 21 ft, and a sediment depth of 3.0 ft based on the average maximum sediment thickness at each transect and assuming an additional thickness of approximately 1 ft of material underlying the sediment. As a contingency, an additional 25 percent of the calculated minimum and maximum volumes have been assumed to account for additional non-impacted material collected from dredging operations during remedial action.

The volume of sediment assumed to require remedial action in the Lagoon is estimated to range from approximately 1,600 to 3,200 cubic yards. The interior dimensions of the Lagoon are approximately 400 ft in length and 70 ft in width. Based on the borehole sampling conducted beneath the sediment in the Lagoon during the Phase II CSA, the depth of OHM-impacted sediment is estimated to range from 1.5 to 3.0 ft. The volume of OHM-impacted sediment in the Lagoon is, therefore, estimated to range from approximately 1,600 to 3,200 cubic yards.

The volume of sediment assumed to require remedial action in the WOA is estimated to range from approximately 200 to 400 cubic yards.

3.2 SURFACE SOILS

OHM was detected in the surface soil samples collected from the Wetland Soil Area between Beaverdam Brook and the WOA, south of the Lagoon. In addition, OHM was detected in certain surface soil samples collected from the on-Property western bank of the Brook.

Carcinogenic and non-carcinogenic human health risks associated with exposure to OHM in surface soil for the Site are below the MCP criteria and do not pose a Significant Risk based on the results of the Method 3 Risk Assessments, as summarized and discussed in Section 2.5.1.

For the soil samples collected along the upper western bank of the Brook and in the Wetland Soil Area between the Brook and WOA and south of the Lagoon, the weight of evidence indicates that ecological risk cannot be concluded to be negligible for all locations. Soil samples collected from areas adjacent to the reaches of the Brook between Outfall #2 and the downstream Property boundary had the highest concentrations of OHM. Based on the comparison of Site soil concentrations to conservative screening values conducted for the ERA, a condition of "*no significant risk of harm*" has not been met for these locations. Soil samples collected upstream of Outfall #2 and further west toward CSX property meet the four criteria specified in the MCP and a condition of "*no significant risk of harm to the environment*" can be concluded to exist for these locations.

Soil screening criteria and background concentrations were exceeded for certain metals including antimony, chromium, copper, lead, manganese, selenium, vanadium, zinc, and phthalates detected in soil samples from the WOA and Wetland Soil Area. Therefore, the risk of harm to terrestrial receptors cannot be ruled out as "*clearly unlikely to result in environmental harm*" for these areas. The environmental significance of exceeding the screening values for these OHM is not currently known with certainty.

Remedial objectives, therefore, may be required to address ecological risks associated with OHM-impacted surface soil associated with the on-Property banks of the Brook and the Wetland Soil Area. Additional ecological assessment will be conducted as part of remedial action pre-design activities as discussed in Section 3.6 to determine Site-specific ecologically-based cleanup criteria for surface soil and to further refine the extent of material in these areas, if any, which exceed the Site-specific surface soil cleanup criteria.

For the purposes of the Phase III RAP, the following areas and volumes of surface soil have been assumed to require remedial action.

The volume of surface soil from the on-Property banks of the Brook assumed to require remedial action is estimated to range from approximately 700 to 1,250 cubic yards. These volumes are based on a 10-foot width on each bank of the Brook to a depth of 1 foot coinciding with the minimum and maximum lengths of the Brook requiring remedial action as described in Section 3.1. As a contingency, an additional 25 percent of the calculated minimum and maximum volumes have been assumed to account for non-impacted material inadvertently collected from dredging operations during remedial action.

The volume of surface soil from the WOA and adjacent Wetland Soil Area assumed to require remedial action is estimated to range from approximately 1,300 to 2,600 cubic yards. For purposes of the Phase III RAP, the maximum total area of the WOA and adjacent Wetland Soil Area requiring remedial action for surface soil is estimated to be approximately 70,000 square ft. The minimum volume of soil in these areas requiring remedial action is estimated to be 50 percent of the maximum or approximately 1,300 cubic yards.

3.3 SUBSURFACE SOILS

OHM detected in the subsurface samples collected from the area of the Lagoon and WOA did not exceed the MCP Method 1 Criteria for category S-3 soil & GW-3 (S-3/GW-3). In addition, concentrations of OHM in subsurface soil samples are similar to MA background levels for "natural soil" (MADEP, 2002a).

Additionally, carcinogenic and non-carcinogenic human health risks associated with potential exposure to OHM in subsurface soil are below the MCP criteria and do not pose a Significant Risk based on the results of the Method 3 Risk Assessments, as summarized and discussed in Section 2.5.1.

There were no significant risks of harm identified from subsurface soil to ecological receptors based on the results of the ERA.

Remedial objectives for subsurface soil are, therefore, not required for the Site.

3.4 GROUNDWATER

OHM detected in the groundwater samples collected from the area of the Lagoon and WOA did not exceed the MCP Method 1 Criteria for category GW-3 groundwater.

Additionally, carcinogenic and non-carcinogenic human health risks associated with exposure to OHM in groundwater were below the MCP criteria and do not pose a Significant Risk based on the results of the Method 3 Risk Assessments, as summarized and discussed in Section 2.5.1.

There were no significant risks of harm identified for ecological receptors from groundwater because there is no exposure of ecological receptors to groundwater and groundwater/surface water is addressed by remedial objectives for surface water.

Remedial objectives for groundwater are, therefore, not required for the Site.

3.5 SURFACE WATER

Carcinogenic and non-carcinogenic human health risks associated with exposure to OHM in surface water are below the MCP criteria and do not pose a Significant Risk based on the results of the Method 3 Risk Assessments, as summarized and discussed in Section 2.5.1.

For the Brook, concentrations of Site-related OHM in surface water samples collected during the Phase II CSA were below AWQC except for estimated concentrations (J qualified) of lead and copper that were no more than 10 percent above the criteria at one to two sample locations. Therefore, effects would not be expected to be significant from these surface water exposures.

For the Lagoon, OHM was not detected in surface water at concentrations exceeding AWQC.

For the WOA, concentrations of copper, iron, and lead in surface water exceeded AWQC. However, based on the results of the Stage II Ecological Risk Assessment, the ecological significance of these exceedances is low since the WOA is only periodically inundated and does not provide habitat for aquatic receptors, with the possible exception of aquatic invertebrates, which may become temporarily established during extended wet periods. The aquatic habitat limitations associated with the WOA suggest the ecological significance of exceeding sediment-screening values for this exposure area is low.

The ERAs concluded that there is no physical evidence of a continuing release of OHM at or from the Site to surface waters and/or wetlands which significantly affects environmental receptors.

Remedial objectives for surface water are, therefore, not required for the Site. This determination is contingent on sediment remedial objectives being addressed since OHM detected in surface water are likely due to sediment deposition and future sediment suspension will occur.

3.6 ECOLOGICAL IMPACT DELINEATION STUDY

Based on the results of the ERA conducted for the Phase II CSA, sediment from the Lagoon, WOA, and Beaverdam Brook, and surface soil associated with the Brook and WOA are impacted primarily by certain metals, phthalates, and PAHs resulting in the following conditions:

- for the Lagoon and WOA sediment, the weight of evidence indicates that ecological risk cannot be concluded to be negligible and that a condition of "*no significant risk of harm*" has not been met;
- for Beaverdam Brook sediment, the weight of evidence indicates that risk cannot be concluded to be negligible and a condition of "*no significant risk of harm*" has not been met for Reaches 3 and 4 (downgradient of Outfall #2 to the downstream Property boundary); and
- for some areas along the upper western bank of Beaverdam Brook, adjacent to Reaches 3 and 4 and in the wetlands adjacent to the Brook and south of the Lagoon, the weight of evidence indicates that risk cannot be concluded to be negligible for all locations and a condition of "*no significant risk of harm*" has not been met for these locations.

For each of these areas, an Ecological Impact Delineation Study will be conducted during pre-design activities to determine appropriate Site-specific sediment and soil cleanup criteria and to refine the extent of the above areas that will require remedial action.

The Ecological Impact Delineation Study Work Plan will be developed to describe the approach to be used including a specific strategy for each area, define data needs, and sampling and analysis design (e.g., number and type of samples, analytical parameters, and quality assurance/quality control requirements).

The scope of work will define a strategy for:

- determining whether and to what extent Site-related OHM pose unacceptable ecological risk requiring a response action, and if so;
- developing quantitative site-specific ecologically-based cleanup criteria; and
- defining the areal extent and depth of sediment and surface soil associated with these areas that will require remediation.

The scope of work will focus on the following tasks for each of the three main areas:

- Brook - due to the physical characteristics of this system, the additional ecological risk assessment tasks will focus on benthic macroinvertebrates as receptors as there is no permanent fish community in the Brook. This approach is deemed to be environmentally protective because benthic macroinvertebrates are intimately associated with sediment, are known to be sensitive to site-related OHM, and are expected to be maximally exposed to site-related OHM;
- Lagoon – ecological risks to piscivorous birds (e.g., great blue heron) and omnivorous mammals (e.g., raccoon) via exposure through diet (fish, amphibians, invertebrates, and sediment) will be evaluated; and
- Wetland/Floodplain Soils (Wetland Soil Area) - bioaccumulation of OHM in soil invertebrates will be investigated to allow quantitative assessment of risk to terrestrial wildlife (e.g., shrews and robins).

For the purposes of the Phase III RAP, it is assumed that response actions are necessary to address ecological impacts of Site-related OHM for the Brook, Lagoon, WOA, and Wetland Soil Area based on the results of the ERAs presented in the Final Phase II CSA Reports. The Ecological Impact Delineation Study will provide further refinement of the extent of the sediment and surface soil in these areas that require response actions based on the Site-specific ecological sediment and soil cleanup criteria.

3.7 SUMMARY OF REMEDIAL ACTION OBJECTIVES

No response actions are required due to human health risks associated with the Site. However, until the Ecological Impact Delineation Study is complete, it is assumed that certain remedial action objectives/response actions are required to achieve a condition of NSR for ecological risks for the current and anticipated future uses of the Site. For the purposes of the Phase III RAP, the following areas and estimated approximate volumes of sediment and surface soil are assumed to represent a reasonable range of materials that will require remediation:

- 1,000 to 3,900 cubic yards of sediment within the Brook from Outfall #2 to the downstream Property boundary;
- 1,600 to 3,200 cubic yards of sediment within the Lagoon;
- 200 to 400 cubic yards of sediment within the WOA;
- 700 to 1,250 cubic yards of surface soil from the on-Property banks of the Brook from Outfall #2 to the downstream Property boundary; and
- 1,300 to 2,600 cubic yards of surface soil from the WOA and adjacent Wetland Soil Area.

This assumption and the above volume estimates are based solely on the results of previous ecological risk assessment work, including comparison of concentrations of site-related OHM in sediment and soil to screening criteria and background.

The Ecological Impact Delineation Study will provide further refinement of the extent of sediment and surface soil in these areas and will provide a basis for the Site-specific ecological sediment and soil cleanup criteria. The results of the Ecological Impact Delineation Study may result in a conclusion that risk is negligible and a condition of NSR has been met for certain sediment and/or soil associated with portions of each of the three areas, or in some or all areas in their entirety.

The following specific remedial action objectives have been developed based on the presence of Site-related OHM, and the results of the HHRA and the ERA to achieve a condition of NSR for the current and anticipated future uses of the Site:

1. eliminate any Substantial Hazards for the Site associated with ecological risk;
2. achieve and maintain a level of NSR at the Site for ecological risk posed by exposure to OHM present in sediment and surface soil;
3. ensure that OHM present in sediment and surface soil do not cause future potential releases of OHM to surface waters and/or wetlands, which may cause a condition of substantial release migration and/or significantly affect environmental receptors;
4. the selected remedy should prevent contact with, contain, reduce, and/or detoxify the impacted materials (i.e., Permanent or Temporary Solution) to ensure a condition of NSR is maintained for the Site;
5. address the potential exceedances of the UCL for lead in soils if the OHM-impacted sediments within the Lagoon and Brook are dewatered and left on-Site;
6. address the physical safety hazard of the open Lagoon;
7. minimize damage to the natural environment during remediation activities;
8. remove impacted sediment and soil to restore wetlands and natural resources rather than provide replacement wetlands;
9. minimize potential impacts and exposures to the public during remediation activities;
10. minimize impacts to ADESA operations and potential impacts and exposures to employees; and
11. minimize long-term Operation, Maintenance, and Management (OMM) activities required to maintain the conditions of NSR (e.g., AULs and OMM inspection, monitoring and maintenance activities) and the natural environment.

4.0 IDENTIFICATION AND EVALUATION OF INITIAL REMEDIAL ACTION ALTERNATIVES

This Section identifies and describes the remedial response actions for the Site, including technologies, and process options that are potentially appropriate to satisfy the remedial action objectives developed in Section 3.0.

The remedial response actions, technologies, and process options were selected to address the impacted sediment and soil associated with the Site that requires remediation. As discussed in Section 3.0, sediment from the Lagoon, WOA, and Beaverdam Brook, and surface soil associated with the banks of the Brook and the Wetland Soil Area are impacted by OHM resulting in potential ecological impacts requiring remedial alternative development, evaluation, selection, and implementation.

The initial screening of remedial technologies/process options will identify remedial action alternatives for further evaluation which are reasonably likely to be feasible, based on the OHM present, media contaminated, and site characteristics. Consistent with 310 CMR 40.0856, remedial action alternatives are reasonably likely to be feasible if:

- the technologies to be employed by the alternative are reasonably likely to achieve a Permanent or Temporary Solution; and
- individuals with the expertise needed to effectively implement available solutions would be available, regardless of arrangements for securing their services.

Potential remedial response actions, technologies, and process options for addressing the remedial action objectives for the Site are as follows:

Remedial Response Action	*Technology*	*Process Options*
1. No Action	--	--
2. Limited Action	a) Long-Term Environmental Monitoring Program	- Groundwater Sampling - Surface Water Sampling - Sediment/Soil Sampling
	b) Institutional Controls	- Activity and Use Limitation (AUL)

Remedial Response Action	*Technology*	*Process Options*
3. On-Site Containment	a) Engineered Barrier b) Capping	- Containment Layer - Separation Layer - Modified RCRA Subtitle C Cap
4. In Situ Treatment	a) Biological Treatment b) Chemical Treatment c) Physical Treatment	- Phytoremediation - Enhanced Biodegradation - Chemical Oxidation - Chemical Fixation/ Stabilization In-Place
5. Ex Situ Treatment	a) Excavation/Physical/ Chemical Treatment b) Biological	- Solidification/Stabilization - Landfarming
6. Removal/Disposal	a) Excavation/Off-Site Disposal b) Excavation/On-Site Disposal	- Disposal as daily cover at MA Landfill - Disposal at Subtitle B Non-Hazardous Landfill - Disposal at Subtitle C Hazardous Waste Landfill - Consolidation

4.1 NO ACTION

Under the No Action alternative, no actions would be taken to address remedial action objectives for the Site. OHM requiring remediation will remain at the Site.

The No Action alternative is included as a baseline reference for comparative evaluation to other alternatives.

4.2 LIMITED ACTION

Long-Term Environmental Monitoring

This alternative consists of long-term groundwater, surface water, and sediment monitoring. This alternative would provide information and data to evaluate potential ongoing impacts from the migration of OHM in sediment and soil to other media and potential off-Site migration. The sampling locations would potentially include sediment and surface water in Beaverdam Brook, the Lagoon, and the WOA, and groundwater in the area of the Lagoon. The multi-media samples would be collected and analyzed for a Site-specific parameter list of known OHM present in Site sediments. Monitoring would be conducted at a minimum quarterly frequency for the first year. The number of samples and the frequency of further monitoring would be assessed based on the first year of monitoring but it is anticipated that the frequency would be semi-annually for the next four years and annually thereafter. The results would be documented and evaluated in semi-annual reports submitted to MADEP. If a Temporary Solution is selected as the remedy, five-year review reports would be prepared to evaluate the results of the semi-annual monitoring program and provide ongoing assessments for identifying and implementing additional remedial actions, including a Permanent Solution. Long-term monitoring by itself would not provide any OHM reduction, detoxification, removal, or a condition of NSR.

Activity and Use Limitation

An AUL may include a Grant of Environmental Restriction implemented in accordance with 310 CMR 40.1071, an Environmental Restriction implemented by MADEP in accordance with 310 CMR 40.1073, or a Notice of AUL implemented in accordance with 310 CMR 40.1074. For the purposes of the Phase III RAP, a reasonable remedial option to be considered for portions of the Site is a Notice of AUL. An AUL is appropriate to achieve and/or maintain a level of NSR for a Permanent Solution (either Class A or B RAO) or manage a substantial hazard for a Temporary Solution (Class C RAO). Site activities or uses, which are permitted, and obligations and conditions are stipulated in the AUL which is registered on the property title. An AUL can be used to minimize access to a Site and set out the requirements for permitted activities or uses to control exposure and minimize risk.

4.3 ON-SITE CONTAINMENT ACTION

MADEP Engineered Barriers

The requirements for engineered barriers presented herein are in accordance with the draft "Guidance on the Use, Design, Construction, and Monitoring of Engineered Barriers" (MADEP, 2002b) (MADEP Engineered Barrier Guidance), USEPA Region I guidance, and engineered barrier design and construction practice in New England.

Engineered barriers are used for Sites where OHM concentrations in soil exceed MADEP UCLs. The MADEP Engineered Barrier Guidance states:

"*The use of an engineered barrier shall be limited to disposal sites where there are no other feasible alternative(s) to:*

- *reduce concentrations of OHM in soil to levels below UCLs; and/or*
- *fixate OHM present in soil in a manner that will reduce or eliminate environmental mobility and physiological availability*".

If the sediment at the Site requiring remedial action is dewatered, stabilized/fixated or otherwise left in a state following remedial action where it is essentially no longer in contact with surface water such as in the Brook or Lagoon, then the UCLs which are for soil would apply. Based on the results of the Phase II CSA, the UCL for lead would likely be exceeded for sediment in the Lagoon and an engineered barrier would be an appropriate remedial technology to evaluate for those alternatives where Lagoon sediment is consolidated on-Site.

No engineered barrier would be required on the sides and bottom of the Lagoon since the Phase II CSA demonstrated that the adjacent soils are of relatively low permeability and adequate thickness and have not been significantly impacted over the decades of direct contact with impacted sediment and water in the Lagoon.

Engineered barriers are designed to isolate human and biota contact from contaminated media and, if necessary, also contain volatile and/or soluble contaminants. The design of the engineered barrier must account for long-term usage of the Site and must consider the physical forces relating to differential settlement, thermal expansion, freeze/thaw cycles, erosion, and abrasion.

The components of an engineered barrier must include a separation layer and a defining layer, and where required a containment layer, which includes a drainage layer, flexible membrane liner, low hydraulic conductivity layer, and a gas vent layer. A description of the components is discussed in the following paragraphs.

The separation layer is required to isolate contaminants from human contact. The separation layer is typically constructed of the following components:

- 12 to 48 inches of clean soil; or
- 8 inches of bituminous pavement; or
- 5 inches of reinforced concrete (8 inches at Sites where highly toxic contaminants exist); or
- some combination thereof.

If additional barriers are not required, the separation layer must provide all the necessary isolation and encapsulation of the OHM. The soil layer should be covered with either a vegetated layer or an armored top surface such as pavement or concrete.

The purpose of the defining layer is to identify the OHM impacted media to prevent exposures during future intrusive Site activities. The defining layer consists of a geofabric, horizontal plastic snow fencing, horizontal chain-link fencing, grids of warning tape, or other inert material or unit that visually distinguishes the area of concern. The defining layer is installed below the separation layer. In cases where a drainage layer is required, geosynthetic materials used as a drainage layer may be considered a defining layer.

If a containment layer is required, it should be constructed using natural and/or synthetic materials that are designed to minimize surface water infiltration to contaminated sediments and soils and/or manage the migration of contaminant vapors and/or biogenic gases. The containment layer should contain the following components:

- gas vent layer – should be constructed from 6 to 12 inches of compact soils with a hydraulic conductivity of $1x10^{-2}$ cm/sec. All the components of the gas vent layer (supporting piping and venting network) should be constructed below the low permeability barrier.
- low permeability barrier – include low hydraulic layer in direct contact with a flexible membrane liner (FML) and should at minimum consist of the following:

- 24 inch layer of compacted natural or amended soil with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec, in contact with a minimum of 0.5 mm FML; or
- 12 inch layer of compacted natural or amended soils with a maximum hydraulic conductivity of $1x10^{-4}$ cm/sec, in contact with a minimum of 1.5 mm FML.

An engineered barrier is required to extend 4 ft beyond the horizontal limit of OHM. An engineered barrier would prevent direct contact with sediment and soil OHM and reduce infiltration and contaminant migration but would not reduce the volume or toxicity of the contaminated materials.

An AUL and long-term OMM of an engineered barrier would be required to maintain the integrity and effectiveness of the barrier, and to provide an ongoing demonstration of the effectiveness of the remedy.

RCRA Cap

A Subtitle C RCRA landfill cap or modified RCRA-type cap would be an alternative to a MADEP engineered barrier if UCLs are not exceeded for the OHM-containing material placed within the Lagoon or if the OHM is permanently fixated in the soil/sediment. Although an engineered barrier would not necessarily be required in this case, a cap would still be an appropriate remedial component to maintain the long-term effectiveness of the remedy and to eliminate the physical hazard of the existing open Lagoon. The cap would be constructed over the stabilized materials placed in the Lagoon to prevent long-term erosion, exposure, breakdown of the stabilization agents, and migration to the environment, including the wetlands and Brook.

The proposed cap is a modified version of a Subtitle C RCRA landfill cap. The proposed cover system for the containment unit such as the Lagoon would consist of the following components (bottom to top):

- soil barrier layer – clay (12 inches);
- Geocomposite Clay Liner;
- Geonet drainage layer;
- common fill (12 inches); and
- vegetative cover (6 inches).

The bottom layer of the cover system would consist of an one-foot thick layer of compacted low-permeability soil directly overlying the OHM-impacted sediments and soil to reduce infiltration to the impacted sediments/soil layer. The barrier layer would be covered with a Geocomposite Clay Liner (GCL) to provide additional reduction in infiltration and also significantly reduce the hauling necessary to import additional low-permeability barrier materials. GCL is also generally easier to install than low-permeability soil, less susceptible to differential settlement, and more forgiving of freeze/thaw damage.

A Geonet Drainage layer would be placed over the GCL to facilitate efficient lateral drainage. This layer typically consists of a drainage net and geotextile filter fabric. The use of a geonet drainage layer effectively reduces infiltration, and significantly reduces the hauling and construction equipment necessary to import and install sand drainage materials.

The drainage layer would be covered with 12 inches of common fill to provide protection to the lower cap layers from intrusion by plant roots or burrowing animals. The common fill layer would be constructed using imported soil from an approved source and would be free of unsuitable materials.

A 6-inch topsoil and vegetative cover layer would be placed over the common fill layer to prevent wind and water erosion, provide storage for vegetation, maximize evapotranspiration, and significantly reduce the volume of infiltrating stormwater that would migrate to the drainage layer or potentially come in contact with the impacted sediments/soil. The vegetative layer also functions to enhance aesthetics and to promote a self-sustaining ecosystem on top of the cover system. The landfill cover system and surrounding areas would be seeded to prevent soil erosion. Topsoil material used as part of the cover system would be imported from an approved source and would be free of unsuitable materials.

An AUL and long-term OMM of the modified RCRA cap would be required to maintain the integrity and effectiveness of the barrier, and to provide an ongoing demonstration of the effectiveness of the remedy.

4.4 IN SITU TREATMENT

In Situ Phytoremediation

Phytoremediation involves the use of vegetation to extract contaminants by absorption into roots, shoots, leaves, and woody tissues of plants. As the plant material becomes saturated, the plants are harvested and then recycled or disposed. This technology is particularly effective for metals at shallow depths (in general, 3 to 10 ft). Some contaminants and concentrations are toxic to certain plants and multiple growing seasons are required. The Site conditions, the length of the growing season, and the cleanup levels required are factors which determine the effectiveness of this technology.

In Situ Enhanced Biodegradation

In-situ biodegradation (aerobic or anaerobic) is a treatment process whereby contaminants are metabolized into less toxic or non-toxic compounds by naturally occurring microorganisms. The microorganisms utilize the contaminants as a source of carbon and energy. In order to stimulate biological activity, biodegradation processes can be enhanced by the injection of nutrients, microbial cultures, suitable electron acceptors and carbon/energy sources. Site conditions can be manipulated to enhance in situ biodegradation processes and speed up degradation rates of Site contaminants. In this process, several techniques can be applied to enhance biodegradation of the Site-specific contaminants, such as:

i) injection of oxygen sources such as air, oxygen hydrogen peroxide, or oxygen release compound (orc) to enhance the biodegradation under aerobic conditions;

ii) supplementation with suitable sources of nitrogen and phosphorus to enhance biodegradation of contaminants by indigenous microbial population; and

iii) injection of microbial cultures to improve the effectiveness of the microbial population in degrading the compounds of concern.

Chemical Fixation/Stabilization

Remediation by chemical fixation/stabilization in-place is a conventional method, which involves the immobilization of the contaminants within the sediment medium. The contaminants are not removed from the sediment and soils but they are prevented by chemical means from leaving the media. This technique is effective for heavy metals and non-volatile organics such as PAHs and PCB. Examples of stabilization agents are Portland cement, asphalt, and trisodium phosphate.

<u>In Situ Chemical Oxidation (ISCO)</u>

In situ chemical oxidation (ISCO) is an innovative technology that is a cost-effective method for destroying a wide range of organic compounds, particularly chlorinated compounds and volatiles. Chemical oxidation is a good technology for treating hot spots and source areas and the use of strong oxidizing agents can result in the complete oxidation of the contaminants within relatively short periods. In a chemical oxidation reaction, the oxidizing agent breaks the double carbon bonds in unsaturated compounds and converts them into non-hazardous or less toxic compounds, primarily carbon dioxide and water. The oxidizing agents most commonly used are potassium permanganate ($KMnO_4$), Fenton's Reagent, persulfate or ozone. $KMnO_4$ and Fenton's Reagent are effective when delivered in an aqueous solution, and reacts throughout a wide range of contaminants. The reactions yield primarily carbon dioxide and water. Fenton's Reagent and $KMnO_4$ are inexpensive and readily available in large quantities. They are also relatively safe and easy to handle when normal health and safety procedures are followed.

ISCO is site specific, and successful treatment is typically a function of the effectiveness of the delivery system (being able to deliver sufficient amounts of oxidant to the impacted sediment and soil and making sufficient "contact") and subsequent transport of the oxidant within the sediments and soils. The treatment performance is dependent to a great extent on the sediment and soil chemistry. A critical factor in the evaluation of ISCO treatment is determining the dosages of oxidant that are required to effectively oxidize the contaminants present (referred to as stoichiometric demand) as well as the competing reactions. The competing reactions are typically caused by the presence of natural organic materials such as humates and fulvates as well as reduced metal species. The consumption of oxidants by these non-target compounds is defined as natural oxidant demand (NOD). In order to determine the optimum dosage, treatability studies are required.

Chemical oxidation would be effective in treating PAHs by converting them into carbon dioxide and water by a free radical oxidation mechanism. Fenton's Reagent or potassium permanganate is commonly used oxidants for treatment of PAHs. This technology would not treat the metals.

4.5 EX SITU TREATMENT

Ex Situ Solidification/Stabilization

Ex situ solidification/stabilization results in contaminants that are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).

There are seven distinct innovative processes or groups of processes that may be applicable to the Site sediment and soils including: (1) bituminization, (2) emulsified asphalt, (3) modified sulfur cement, (4) polyethylene extrusion, (5) pozzolan/Portland cement, (6) soluble phosphates, and (7) vitrification/molten glass.

In the bituminization process, wastes are embedded in molten bitumen and encapsulated when the bitumen cools. The process combines heated bitumen and a concentrate of the waste material, usually in slurry form, in a heated extruder containing screws that mix the bitumen and waste. The final product is a homogenous mixture of extruded solids and bitumen.

Asphalt emulsions are very fine droplets of asphalt dispersed in water that are stabilized by chemical emulsifying agents. The emulsified asphalt process involves adding emulsified asphalts having the appropriate charge to hydrophilic liquid or semi-liquid wastes at ambient temperature. After mixing, the emulsion breaks, the water in the waste is released, and the organic phase forms a continuous matrix of hydrophobic asphalt around the waste solids. In some cases, additional neutralizing agents, such as lime or gypsum, may be required. Following curing, the waste is uniformly distributed throughout the resulting solid asphalt and is impermeable to water.

Modified sulfur cement is a commercially-available thermoplastic material that is easily melted (at 127° to 149° C) and then mixed with the waste to form a homogenous molten slurry which is discharged to suitable containers for cooling, storage, and disposal. A variety of common mixing devices, such as, paddle mixers and pug mills, can be used. The use of relatively low temperatures limits emissions of sulfur dioxide and hydrogen sulfide to allowable threshold values.

The polyethylene extrusion process involves the mixing of polyethylene binders and dry waste materials using a heated cylinder containing a mixing/transport screw. The heated, homogenous mixture exits the cylinder through an output die into a mold, where it cools and solidifies. Polyethylene's properties produce a very stable, solidified product. The process has been tested on nitrate salt wastes at plant-scale, thereby establishing its viability, and on various other wastes at the bench and pilot scale.

The Pozzolan/Portland cement process consists primarily of silicates from pozzolanic-based materials like fly ash, kiln dust, pumice, or blast furnace slag and cement-based materials like Portland cement. These materials chemically react with water to form a solid cementious matrix which improves the handling and physical characteristics of the waste. They also raise the pH of the water, which may help precipitate and immobilize some heavy metal contaminants. Pozzolanic and cement-based binding agents are typically appropriate for inorganic contaminants. The effectiveness of these binding agents with organic contaminants varies.

The soluble phosphates process involves the addition of various forms of phosphate and alkali for control of pH as well as for formation of complex metal molecules of low-solubility to immobilize (insolubilize) the metals over a wide pH range. Unlike most other stabilization processes, soluble phosphate processes do not convert the waste into a hardened, monolithic mass. One application of soluble phosphates and lime is in stabilizing fly ash by immobilizing the lead and cadmium in the ash.

Vitrification, or molten glass, processes are solidification methods that employ heat up to 1,200° C to melt and convert waste materials into glass or other glass and crystalline products. The high temperatures destroy any organic constituents with very few byproducts. Materials, such as heavy metals and radionuclides, are actually incorporated into the glass structure which is, generally, a relatively strong, durable material that is resistant to leaching. In addition to solids, the waste materials can be liquids, wet or dry sludges, or combustible materials. Borosilicate and soda-lime are the principal glass formers and provide the basic matrix of the vitrified product.

Solidification may be conducted on-Site or as part of off-Site treatment/disposal as determined by the selected disposition mode and treatment/disposal facility.

Landfarming

Biodegradation would be enhanced by landfarming. Landfarming is an ex-situ technology where the sediment and soil is excavated and placed in lined beds approximately 18 inches deep. Biological degradation where naturally occurring organisms metabolize contaminants into less toxic compounds is the primary method of remediation. Landfarming is effective at removing organics such as PAHs. However, this technology would not address the metals. The sediment moisture, aeration and pH are carefully monitored to provide conditions for optimal biological degradation. Aeration is obtained by periodically tilling the sediment while irrigation can serve to regulate the sediment moisture. A pH range of 6 to 8 is optimal and if sediment pH does not fall within this range it should be adjusted by adding lime or elemental sulfur. Once sediment has been remediated to the desired level of treatment, the sediment is removed from the lined bed and replaced with contaminated sediment where the process is repeated. To speed up remediation time, a portion of the remediated sediment can be left in the lined beds to provide the new sediment with an established and healthy microbial population.

4.6 REMOVAL AND DISPOSAL

Excavation and Off-Site Disposal

Excavation and off-Site disposal consists of the excavation of impacted sediments and soils, dewatering/stabilization (if necessary), transportation, and disposal off-Site. Off-Site disposal would occur at a permitted hazardous waste, industrial waste, or municipal solid waste (MSW) disposal facility, as appropriate, based on the OHM concentrations, waste characterization, and regulatory requirements.

Compliance with MADEP Policy COMM-94-007 for dredged sediments would be required at a minimum to characterize the sediment and soil prior to transport and off-Site disposal. Additional testing for Toxicity Characteristic Leaching Procedure (TCLP) parameters would be required for any OHM and samples that exceed a TCLP trigger value. Based on the concentrations of certain metals such as lead, it is likely that a portion of the dredged sediment/soil may be classified as a RCRA characteristically hazardous waste (i.e., D008 waste) that would require disposal at a RCRA hazardous waste/treatment disposal facility such as the Waste Management Facility in Model City, NY. Some of the dredged and dewatered sediment/soil may be more economically disposed at a MA-lined landfill or it may be suitable for use as daily cover material or direct disposal at the Turnkey Landfill in Rochester, NH. Both of these non-hazardous disposal options would require characterization of the materials on a batch basis to demonstrate compliance with solid and hazardous waste regulations, and disposal facility permit requirements.

Once the excavated OHM-impacted sediment and soil has been removed from the Site, OHM concentrations and/or mass in the environment at the Site that pose a significant risk would be essentially eliminated. Therefore, excavation provides "source removal" and mitigation of potential future releases.

Off-Site disposal would not decrease the volume of OHM or provide detoxification unless the soils were stabilized/solidified or otherwise treated as part of the off-Site disposal process. Based on the high moisture content of the impacted materials some dewatering and/or stabilization would be required to allow the materials to be transported and accepted for disposal. The stabilization of the materials would provide some or complete fixation of OHM which may leach above RCRA TCLP standards and, therefore, would reduce the cost of disposal by not requiring disposal at a RCRA hazardous waste landfill. Stabilization/solidification after and/or as part of dewatering would add to the volume of sediment/soil requiring disposal by approximately 25 percent.

Excavation and On-Site Disposal

Excavation and On-Site disposal consists of the dredging of sediments within the Brook, excavation of impacted sediments and soils within the WOA and Wetland Soil Area, transportation, consolidation/stabilization, and disposal within the Lagoon. The lagoon sediments would be excavated, dewatered/stabilized, and consolidated with any other sediments/soil from the Brook, WOA, and/or Wetland Soil Area requiring remedial action prior to placement back into the Lagoon. Alternatively, the Lagoon sediments may be stabilized in-place.

An engineered barrier or cap would be constructed over the stabilized materials placed in the Lagoon to prevent long-term erosion, exposure, breakdown of the stabilization agents, and migration to the environment, including the wetlands and Brook.

Excavation and on-Site disposal provides a reduction in the risk to human health and the environment as the OHM are physically isolated and contained, thereby eliminating exposure pathways contributing to unacceptable risk and potential future migration to the environment.

If the sediments in the Brook, Lagoon, and WOA are removed and dewatered and disposed on-Site such that they become part of the terrestrial environment and by definition soil (i.e., no longer submerged or essentially in direct contact with surface water), then the soil UCLs would be applicable to this material. Based on the results of the Phase II CSA, lead would likely exceed its UCL for soil for Lagoon sediment in which case an engineered barrier would be required as described in Section 4.3.

However, if the excavated and dredged sediments are stabilized/solidified such that OHM has been permanently immobilized or fixated, an engineered barrier would not be required. The specific determination and applicability of the UCL and the need for a full engineered barrier would be confirmed as part of the Phase IV engineering design activities.

On-Site disposal would not decrease the volume of contaminants or provide detoxification unless the sediments and soils were stabilized/solidified or otherwise treated as part of the on-Site disposal option (i.e., combined with ex situ solidification/stabilization). Stabilization/solidification would add approximately 25 percent to the volume of sediment/soil requiring disposal.

An AUL and long-term OMM of the Lagoon engineered barrier or cap would be required to maintain the integrity and effectiveness of the remedy, and to provide an ongoing demonstration of its effectiveness.

4.7 RETAINED REMEDIAL ACTION TECHNOLOGIES/ PROCESS OPTIONS

The following technologies/process options are considered to be appropriate and effective options to meet the remedial action objectives for the Site and have been retained for the development of Site-wide alternatives for detailed evaluation in Section 5.0:

- Limited Action – Long-term monitoring and AUL;
- On-Site Containment Capping – modified RCRA Cap;
- Ex Situ Treatment – Solidification/Stabilization;
- Off-Site Disposal - direct disposal at a MA-lined landfill, direct disposal at Turnkey Landfill, and hazardous waste disposal at Model City Landfill; and
- On-Site Disposal – Consolidation within the Lagoon.

The following remedial technologies/process options were eliminated from further consideration.

On-Site Containment Capping – MADEP Engineered Barrier

The engineered barrier would not be required if the concentrations of OHM in the consolidated sediment and soil are less than UCLs or if OHM is permanently fixated by stabilization/solidification such that it is not leachable or bioavailable. Based on the results of the Phase II CSA, the average concentration of lead for the Lagoon sediment likely exceeds its UCL for soil. However, depending on the final volumes to be consolidated from the Lagoon, Brook, WOA, and Wetland Soil Area, the final concentration of lead in the soil and sediment to be placed within the Lagoon may be less than its UCL. In addition, the OHM-impacted sediment and soil would be dewatered and stabilized/solidified prior to placement in the Lagoon to ensure that on-Site containment is effective and permanent in the long-term. Stabilization/solidification would fixate OHM present in soil and sediment and would also reduce the concentration of lead in the stabilized/solidified mass.

The modified RCRA cap would be constructed over the stabilized materials placed in the Lagoon to prevent long-term erosion, exposure, breakdown of the stabilization agents, and migration to the environment, including the wetlands and Brook.

Therefore, for the purposes of the Phase III RAP, an engineered barrier is not retained for further evaluation as OHM concentrations will either be below UCLs and/or OHM will be permanently fixated and managed as such.

The specific determination and applicability of the UCL and the need for a full engineered barrier would be confirmed as part of the Phase IV engineering design activities.

In Situ Treatment – Phytoremediation, Enhanced Biodegradation, Chemical Oxidation, and Chemical Fixation/Stabilization In Place

The in situ treatment technologies would be difficult to implement for the Brook as it would not be practical to treat the Brook sediments in place. The in situ treatment technologies would potentially be applicable to the Lagoon, WOA, and Wetland Soil Area.

Chemical oxidation would be effective in treating the PAHs but this technology would not treat the metals. Chemical oxidation also is considered not to be cost-effective due to the cost of reagent and the likely high natural oxidant demand of the sediment.

Phytoremediation could be applied to sediments and soil within the Lagoon, WOA, and Wetland Soil Area. It would address all the sediment chemistry; however the potential for leaching and the disposal of foliage and brush containing OHM such as metals would need to be addressed. In addition, the Lagoon would require dewatering prior to phytoremediation. The plants used for phytoremediation may not be consistent with the native wetland vegetation in these areas.

Chemical fixation/stabilization would be the most effective remedy for the sediments because all of the Site-related OHM can all be stabilized effectively. However, chemical fixation/stabilization is considered to be more effective ex situ for the Site and is, therefore, retained as an ex situ technology.

In Situ phytoremediation, enhanced biodegradation, chemical oxidation, and chemical fixation/stabilization in place are, therefore, not retained for further evaluation.

Ex Situ Treatment – Landfarming

Biodegradation by landfarming could be applied to the consolidated sediment and soil within the Lagoon. However, landfarming would treat the majority of the organic compounds but would not address metals. Landfarming is, therefore, not retained for further evaluation.

5.0 DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES

A detailed evaluation of the remedial action alternatives identified by the initial screening conducted in Section 4.0 is necessary to determine which alternatives will meet the performance standards and requirements set forth in 310 CMR 40.0850, 40.0900 and 40.1000, and whether these alternatives achieve a Permanent or Temporary Solutions.

Remedial action alternatives are selected based on the detailed evaluation criteria contained in 310 CMR 40.0858 and in accordance with the provisions provided in 310 CMR 40.0850, 40.0900 and 40.1000. A remedial action alternative which is a Permanent Solution will be selected if a feasible Permanent Solution has been identified and its implementation is determined to be more cost-effective and timely than would be the implementation of a Temporary Solution. If a Permanent Solution is not feasible, a Temporary Solution for the elimination of Substantial Hazard will be selected and implemented and a plan will be prepared pursuant to 310 CMR 40.0861(2)(h) for the identification and development of a Permanent Solution. Any selected Permanent Solution will, to the extent feasible, reduce the concentrations of OHM in the environment to levels that achieve or approach background.

The following four remedial alternatives were developed using the technologies/process options retained from the initial screening conducted in Section 4.0:

- Alternative 1: No Action.
- Alternative 2:
  - Brook: Sediment Removal/Off-Site Disposal.
  - Lagoon/WOA/Wetland Soil Area: AUL and Monitoring.
- Alternative 3:
  - Brook: Sediment Removal/Off-Site Disposal.
  - Lagoon/WOA/Wetland Soil Area: Sediment and Soil Removal/Off-Site Disposal.
- Alternative 4:
  - Brook: Sediment Removal/On-Site Consolidation.
  - Lagoon/WOA/Wetland Soil Area: Sediment and Soil Removal/On-Site Consolidation.

This Section provides a detailed evaluation of these four alternatives. The Preferred Alternative is selected in Section 6.0 based on the results of the detailed evaluation.

5.1 CRITERIA FOR EVALUATION

The detailed evaluation of the remedial action alternatives provides the basis for the selection of the preferred remedial action alternative. The detailed evaluation evaluates and compares the remedial alternatives using the criteria described in 310 CMR 40.0858. The criteria used in the detailed evaluation are as follows:

1. effectiveness;
2. short-term and long-term reliability;
3. difficulty of implementation;
4. costs;
5. risk;
6. benefits;
7. timeliness; and
8. relative effects.

Descriptions of the criteria are provided in the following sections.

5.1.1 EFFECTIVENESS

Each alternative will be evaluated in terms of their effectiveness of:

- achieving a Permanent or Temporary Solution;
- reusing, recycling, destroying, detoxifying, or treating OHM at the Site; and
- reducing levels of untreated OHM at the Site to concentrations that achieve or approach background levels (for Class A RAOs).

The MCP defines a Permanent Solution to be a measure or combination of measures which will, when implemented, ensure attainment of a level of control of each identified substance of concern at a disposal Site or in the surrounding environment such that no substance of concern will present a significant risk of damage to health, safety, public welfare, or the environment during any foreseeable period of time. A Temporary Solution is any measure or combination of measures which will, when implemented, eliminate any substantial hazard which is presented by a disposal Site or by any OHM at or from such Site in the environment until a Permanent Solution is achieved. In accordance with the MCP, a Permanent Solution will be implemented if:

- a level of NSR does not yet exist at the disposal Site;
- Permanent Solutions are feasible; and
- immediate implementation of one or more Permanent Solutions would be more cost effective than phased implementation of Temporary Solutions and Permanent Solutions.

5.1.2 SHORT-TERM AND LONG-TERM RELIABILITY

Each alternative will be evaluated in terms of their reliability of:

- attaining a degree of certainty that the alternative will be successful; and
- achieving long-term effectiveness of any measures that are required to manage the residues or remaining wastes or control emission or discharges to the environment.

5.1.3 DIFFICULTY OF IMPLEMENTATION

Each alternative will be evaluated for their difficulty in implementation in terms of:

- technical complexity;
- integration of the alternative with existing facility operations and other current or potential remedial actions (if applicable);
- necessary monitoring, operations, maintenance, or Site access requirements or limitations;
- availability of necessary services, materials, equipment or specialists; and
- ability to meet MADEP regulatory requirements or requirements of any other applicable local or state agency.

5.1.4 COSTS

Each alternative will be evaluated for their costs in terms of:

- costs of implementation (including design, construction, equipment, Site preparation, labor, permits, disposal, OMM, and other applicable costs);
- costs of environmental restoration (including impact to surface waters, wetlands, wildlife, fish and shell-fish, as applicable); and
- costs of energy resources and externalities.

5.1.5 RISKS

Each alternative will be evaluated for their risks, including:

- short-term on-Site and off-Site risk of implementation (including excavation, transportation, disposal, containment, construction, operation or maintenance activities) or discharges or damages to the environment from remediation;
- on-Site and off-Site risk posed over the period of time required to attain applicable remedial goals (including transportation, disposal, containment, operation or maintenance activities) or discharges from remedial systems;
- risk of harming health, safety, public welfare or the environment by OHM remaining at the Site after completion of remedial actions; and
- other applicable risks.

5.1.6 BENEFITS

Each alternative will be evaluated for their benefits, including:

- minimizing environmental impacts due to remediation and restoration of natural resources;
- providing for the productive reuse of the Site;
- avoided costs of relocating people, businesses or providing alternative water supplies; and
- avoided loss of value to the Site, including wetlands and Riverfront Areas.

5.1.7 TIMELINESS

Each alternative will be evaluated for their timeliness of eliminating any uncontrolled sources of OHM and achieving a level of NSR.

5.1.8 RELATIVE EFFECT

Each alternative will be evaluated for their relative effect upon non-pecuniary interests, such as aesthetic values.

5.2 EVALUATION OF ALTERNATIVES

5.2.1 ALTERNATIVE 1 - NO ACTION

The evaluation of the No Action Alternative provides a basis for comparison with other remedial alternatives.

The No Action alternative does not include any active remedial measures. The primary OHM of concern at the Site are metals, PAHs, and phthalates in the sediment within the Brook, Lagoon, and WOA, and soil within the Wetland Soil Area and these OHM will not substantially naturally degrade in a timely fashion.

The No Action alternative is not a Permanent or Temporary Solution and would not result in a condition of NSR for the Site.

5.2.1.1 ALTERNATIVE 1 – EFFECTIVENESS

The No Action alternative provides no reduction in the toxicity, mobility, or volume of chemicals at the Site beyond what would be achieved through natural attenuation processes such as biodegradation. This alternative does not reuse, recycle, destroy, detoxify or treat OHM, nor does it reduce levels of untreated OHM at the Site to concentrations that achieve sediment and soil cleanup objectives. Since the implementation of the No Action alternative does not treat, provide containment of or otherwise manage or control OHM such that a condition of NSR to the environment is achieved, this alternative does not achieve a Permanent or Temporary Solution.

5.2.1.2 ALTERNATIVE 1 – SHORT-TERM AND LONG-TERM RELIABILITY

There is no short-term or long-term reliability provided by the No Action alternative.

5.2.1.3 ALTERNATIVE 1 – DIFFICULTY OF IMPLEMENTATION

The No Action alternative is difficult to implement since it does not comply with environmental, stormwater, and wetland protection regulatory requirements (i.e., USACOE, Massachusetts Environmental Protection Act (MEPA), and MCP).

5.2.1.4 ALTERNATIVE 1 – COSTS

The No Action alternative has no associated costs for implementation. Since this alternative does not comply with MCP and other regulations, there are likely costs associated with ongoing compliance fees and enforcement penalties.

5.2.1.5 ALTERNATIVE 1 - RISKS

The No Action alternative has no short-term risks associated with its implementation. The No Action alternative would not reduce risks to the environment associated with OHM in Site sediment and soils in the short-or long-term and would not achieve a condition of NSR.

5.2.1.6 ALTERNATIVE 1 - BENEFITS

The No Action alternative does not provide any benefits to the environment as there will be no changes to Site conditions and there is no remedial action.

5.2.1.7 ALTERNATIVE 1 – TIMELINESS

The No Action alternative does not achieve a level of NSR for the exposure of ecological receptors to Site-related OHM within a reasonable timeframe. The primary OHM of concern at the Site are PAHs, phthalates, and metals and these are not expected to substantially naturally degrade and attenuate in a timely manner.

5.2.1.8 ALTERNATIVE 1 - RELATIVE EFFECTS

The No Action alternative does not affect non-pecuniary factors since the Site would remain an MCP disposal Site and no remedial actions would be conducted.

5.2.2 ALTERNATIVE 2 - BROOK: SEDIMENT REMOVAL/ OFF-SITE DISPOSAL LAGOON/WOA/WETLAND SOIL AREA: AUL AND MONITORING

Alternative 2 includes the removal and off-Site disposal of impacted sediment from the Brook and the implementation of an AUL for the Lagoon, WOA, and Wetland Soil Area. Alternative 2 does not include any active remedial measures for the Lagoon, WOA, and Wetland Area. The primary remedial areas for Alternative 2 are shown on Figure 5.1.

The remedial action that would be conducted for Alternative 2 would result in a Permanent Solution (Class A-2 RAO) for the Brook. The implementation of the AUL would result in a Temporary Solution (Class C-1 RAO) for the Lagoon, WOA, and Wetland Soil Area as a permanent remedial action would not be conducted for these areas.

Alternative 2 is designed to minimize the disturbance of the sediment and soil in the Lagoon, WOA, and Wetland Soil Area as any remedial action in these areas may be detrimental to the designated wetlands and riverfront areas in these locations. However, consistent with 310 CMR 40.0956, in order to ensure that a condition of No Substantial Hazard is maintained in these areas for ecological receptors, an AUL and long-term OMM program would be necessary to ensure that OHM does not migrate to additional environmental media or resources resulting in a substantial release migration or significant risk of harm in the future.

As discussed in Section 3.6, the specific areas of the Site and volumes of material requiring remediation will be determined by the Ecological Impact Delineation Study to be conducted during the pre-design activities. The Ecological Impact Delineation Study will also determine the appropriate ecological-based cleanup criteria to be used for sediment and soil. For the purposes of the Phase III RAP, the maximum volume of OHM-impacted sediment requiring removal is based on that portion of the Brook that contains OHM in sediment at concentrations exceeding screening values based on the most recent data collected for the Phase II CSA in 2004, 2005, and 2006. This Section of the Brook, between Outfall #2 and the downstream Property boundary, also coincides with the Section of the Brook exhibiting the highest ecological toxicity based on the results of the ERA. The minimum volume of sediment assumes that the Section of the Brook exhibiting the highest concentrations of OHM in sediment, between Outfall #2 and Outfall #4 will require removal.

It should be noted that the Ecological Impact Delineation Study for the Lagoon, WOA, and Wetland Soil Area may indicate that a portion or none of the sediment and soil in one or more of these areas requires remedial action. The additional information obtained during pre-design activities will define the limits of remediation, if any, in these areas. For the purposes of the Phase III RAP, it is assumed that these areas will require remedial action.

The volume of sediment requiring removal from the Brook is estimated to range from approximately 1,000 to 3,900 cubic yards. The minimum volume is based on the length of the Brook between Outfall #2 and Outfall #4 (approximately 750 linear ft) and an average sediment area of 28 square ft at each transect. The maximum volume of sediment is based on the length of the Brook between Outfall #2 and the downstream Property boundary (approximately 1,350 linear ft), an average width of 21 ft, and a sediment depth of 3.0 ft based on the average maximum sediment thickness at each transect and assuming an additional thickness of approximately 1 foot of material underlying the sediment. As a contingency, an additional 25 percent of the calculated volumes have been assumed to account for additional non-impacted material inadvertently collected during dredging operations.

In addition to the sediment, it has been estimated that between 700 to 1,250 cubic yards of impacted soil from the banks of the Brook would require removal. These volumes are based on a 10-foot width on each bank of the Brook to a depth of 1 foot coinciding with the minimum and maximum lengths of the Brook requiring remedial action as described above.

Removal of the sediment from the Brook would be completed in the following four major steps:

- clearing and grubbing;
- stormwater control and Brook by-pass;
- sediment removal; and
- restoration.

Extensive vegetation would have to be removed from the Brook and areas which are used to access the Brook as part of the sediment removal. Access of heavy equipment along the Brook would require the removal of dense vegetation and brush along the waterway and banks. Prior to clearing and grubbing, erosion control fence would be installed along the perimeter of the disturbed area.

Surface water flow diversions would be required during the removal of the impacted sediment from the Brook. The work area (i.e., a segment of the Brook being remediated) would be isolated by installing a coffer dam allowing the remedial contractor to work along one-side of the Brook bed/bank at a time. A coffer dam, approximately 600 ft in length, would be installed down the centerline of the Brook, cutting off inflow at either end of the dam thereby isolating the work area. The surface water flow would be routed around the coffer dam while work is completed in the dry section as shown on Figure 5.2.

The coffer dam would consist of interlocking highway jersey barriers along and at each end of the work area. The jersey barriers would be lowered into the Brook with a hydraulic excavator. The outside of the jersey barrier would be wrapped in a plastic wrap and anchored with sand bags. Once the coffer dam is installed, the remedial contractor would begin dewatering the work area using a sump installed in the work area. As the water level within the work area drops, workers would reduce significant leaks by placing sand bags around the dam. In instances where a significant leak cannot be stopped by sand bags, the contractor would install a clay plug against the inside of the coffer dam.

During large storm events, the contractor would place geotextile matting over the entire work area, anchored with sand bags, to maintain control of sediments. All heavy equipment, machinery, and personnel would evacuate the work area until the water levels drop sufficiently. Once the work area is considered safe to access, the contractor would dewater the area and resume work.

Surface water within the work area would be collected and pumped to either a treatment facility or to the Lagoon. Although inflow into the work area would be minimized to the extent practicable, if a vacuum excavator is used, less water control would be needed.

Access to the Brook will be a controlling factor in designing and executing dredging and removal activities. Access from the banks may not be feasible in all locations due to adjacent wetlands. It is likely that the most suitable access would be along the Brook itself initially entering from the access road/culvert to the Lagoon. Therefore, as sediment is removed from the work area behind the coffer dam and later restored, the coffer dam would be moved across and down the Brook in sequence, such that the entire width of each (downstream) segment is remediated and then restored. Alternatively, the contractor may choose to excavate and restore the entire length of the Brook requiring remediation, then move to the other side for its entire length. It is estimated that the most efficient process would involve using the coffer dam to isolate up to four separate work areas to excavate 1,350 ft of Brook.

Once the surface water controls are in place, the impacted sediment would be removed from the Brook. Based on the sampling and grain size results for the sediment within the Brook, the streambed consists of sediment over a hard-pan clay. It is likely that the upper layers of the clay have some fractures and may be partially loose. It is therefore expected that sediment removal could most efficiently be completed with a vacuum truck which would also minimize damage to the wetlands by construction equipment. The vacuum nozzle may be fitted with a high-pressure excavating tool, which may be sufficient to remove any contaminated clay layers to a relatively shallow depth. If pre-design trials demonstrates that the sediments (and/or underlying clay) are not suitable for removal by a vacuum excavator, then a conventional bucket excavator could be used. Regardless of the excavation methods used, the stormwater controls and sediment handling from the Brook would be similar. The vacuum excavator would load a smaller transport container truck which would transport and unload the sediments at the on-Site staging facility for dewatering.

Confirmatory sediment and soil sampling of the streambed and bank would be conducted following dredging to confirm that all OHM-impacted sediment/soil above cleanup criteria has been removed. Additional dredging may be required, as necessary.

Following all dredging-related activities, the areas of the Brook that were impacted by sediment removal activities would be restored to prevent erosion. Excavated creek bed areas would be backfilled with a well-graded aggregate stone similar to the existing native material in texture and size. No hydric or topsoil would be placed in the Brook as natural processes would result in the re-accumulation of clean organic material/sediment over time. Disturbed banks and work areas outside the Brook would be graded to a stable slope and overlain with topsoil, natural seed mix, and erosion control fabric. The restoration activities would be completed prior to the transfer/removal of the coffer dam, to ensure sediments are not released into the watercourse. Restoration of the banks of the Brook and upland work areas would include planting of shrubs and trees.

The OHM-impacted sediment and soils removed from the Brook would be staged, dewatered, and tested prior to transportation and disposal off-Site. Sediment would be transported to a staging area that is constructed outside the limits of the floodplain for dewatering prior to disposal as shown on Figure 5.1. The staging area would be constructed to contain the water that drains from the sediment. Water from the staging/dewatering area would also be disposed by treatment and discharge to the Brook and/or by transport and disposal off-Site.

If required, the sediment would be stabilized prior to disposal. It is assumed for the purposes of he Phase III RAP, that all Brook sediment would be stabilized. The sediment would be stabilized with the addition of a stabilizing agent such as kiln dust, fly ash, and/or Portland cement (approximately 25% by volume).

Additional analytical parameters and test frequencies would be required to characterize the sediment prior to transport and off-Site disposal. The testing of parameters and frequency referenced in MADEP Policy COMM-94-007 for dredged sediment would be required at a minimum. Additional testing for TCLP parameters would be required for any OHM and samples that exceed a TCLP trigger value. Based on the concentrations of certain metals such as lead, it is likely that a portion of the dredged sediment/soil may be classified as a characteristically hazardous waste (i.e., D008) that would require disposal at a RCRA hazardous waste/treatment disposal facility such as the Waste Management Facility in Model City, NY. Some of the dredged and dewatered sediment/soil may be economically disposed at a MA-lined landfill. Alternatively, it may be suitable for use as daily cover material or direct disposal at Turnkey Landfill in Rochester, NH. For the purposes of the Phase III RAP, the following quantities and disposal options have been assumed for cost estimating :

- direct disposal at a MA-lined landfill – 70 percent of material;
- direct disposal at Turnkey Landfill – 20 percent of material; and
- hazardous waste at Model City Landfill-10 percent of material.

A Class A RAO would be achieved for the Brook portion of the Site. A Class C RAO would be achieved for the Former Lagoon, WOA, and Wetland Soil area. An AUL would be prepared and registered on the Property, in the area surrounding and including the Lagoon, WOA, and the Wetland Soil Area to support the Class C RAO.

The AUL would require soil management plans, including health and safety measures, for any construction or excavation activities that would be required in the future. The AUL would also require the long-term monitoring of groundwater, surface water, sediment, and soil conditions at the Site to monitor conditions and potential OHM migration. The environmental monitoring data would be used to evaluate Substantial Release Migration, unacceptable exposures to human and ecological receptors and impacts to natural resources, and to ensure that a condition of No Substantial Hazard is maintained.

The monitoring program would include the collection of groundwater samples from the previously installed monitoring wells in the area of the Lagoon, sediment, surface water, and soil samples from the area of the Lagoon, WOA, and Wetland Soil Area. For the purposes of the Phase III RAP, it is assumed that sampling would be conducted quarterly for the first year, semi-annually for 4 years, and annually thereafter. The samples would be analyzed for SVOCs, VOCs, and metals for the first year, and SVOCs and metals thereafter. OMM Reports would be submitted to the MADEP every 6 months.

Alternative 2 would include the demolition of the former Pump House and Valve House as these structures have not been in use since 1989 and are no longer required. Measures would be taken during the demolition of the Valve House to ensure that the outfall (Outfall #3) from the Lagoon to the Brook is permanently blocked to prevent potential discharges to the Brook.

Pre-design studies would be required to determine design parameters and remedial conditions, such as a stabilization treatability study, pilot vacuum extraction, and surface flow/hydrology in order to complete the engineering design for this alternative. The Ecological Impact Delineation Study would also be conducted during the pre-design stage.

The following permits would be required for the implementation of Alternative 2:

- MADEP BWSC – Tier 1B (in place);
- FCC Order of Conditions;
- USACOE – Section 404 Type 2 Programmatic/Individual General Permit;
- MADEP - Bureau of Resource Protection (BRP) Wetlands and Waterways – Section 401 Water Quality Certification (WQC) for Dredging Activities;
- MADEP - BRP Waterways Regulation Program-Chapter 91 Waterways License; and

- MADEP – MEPA-Environmental Notification Form (ENF)/Environmental Impact Report (EIR).

A Site review would be completed every five years to provide a re-evaluation of the Temporary Solution remedial alternative for the portion governed by the Class C RAO. Available new technologies, and OMM information and data regarding Site conditions collected over the past five years would be evaluated. The Five-Year Review would evaluate further actions that could be implemented to achieve a Permanent Solution for the Lagoon, WOA, and Wetland Soil Area, as appropriate.

5.2.2.1 ALTERNATIVE 2 - EFFECTIVENESS

Alternative 2 would result in a Permanent Class A-2 RAO for the Brook portion of the Site as a condition of NSR to the environment would result immediately following the remediation of the Brook. The stabilization and off-Site disposal of the OHM-impacted sediments and soil would effectively remove OHM above cleanup criteria from the Brook. Alternative 2 would not reduce levels of untreated and/or residual OHM in the Brook to concentrations that achieve or approach local conditions or background levels depending, in part, on the final remedial requirements determined from the Ecological Impact Delineation Study.

The AUL and monitoring program implemented for Alternative 2 would result in a Temporary Class C-1 RAO for the Lagoon, WOA, and Wetland Soil Area of the Site. The AUL and long-term OMM program would provide controls and ongoing monitoring data to demonstrate that a condition of No Substantial Hazard is maintained in these areas for ecological receptors. Alternative 2 does not reuse, recycle, destroy, detoxify or treat OHM for these areas of the Site nor does it reduce levels of untreated OHM to concentrations that achieve or approach local conditions or background levels. The AUL would also provide certain controls over permitted uses and restricted activities in the area of the Lagoon, WOA, and Wetland Soil Area to ensure that disturbance, exposures and subsequent migration of OHM would be managed in the future.

5.2.2.2 ALTERNATIVE 2 – SHORT-TERM AND LONG-TERM RELIABILITY

Alternative 2 provides short-term and long-term reliability for the Brook. It effectively reduces OHM exposure to humans and the environment to attain a level of NSR immediately following remedial action. Following the remedial action, no further remedial activities would be required for the Brook.

Alternative 2 provides short and long-term reliability by restricting use, access, and development of the Lagoon, WOA, and Wetland Soil Area, except environmental receptors will not be controlled and access via the public waterway can only be restricted to a certain degree. Additionally, monitoring Site conditions and potential OHM discharges to the environment from the Lagoon, WOA, and Wetland Soil Area should provide information and data to demonstrate on an ongoing basis that a condition of No Substantial Hazard is maintained for the Site. However, this alternative does not include specific measures to prevent further potential OHM migration by natural processes to the environment and, therefore, does not manage or control potential environmental impacts that may occur due to natural processes. If the long-term OMM program indicates that OHM has migrated to additional environmental media or resources resulting in a Substantial Release Migration or significant risk of harm, remedial action would be necessary in the future.

5.2.2.3 ALTERNATIVE 2 – DIFFICULTY OF IMPLEMENTATION

The remedial action for the Brook is somewhat difficult to implement due to access issues, extensive vegetation beside and in the Brook, space availability for support facilities, erosional and sedimentation control issues, and the need to minimize impacts to the upland wetland area and banks of the Brook during dredging activities. A number of Federal, State, and local permits are also required to effect implementation.

Coordination would be required with ADESA, the current owner of the Property, the State, and Town of Framingham for access to work areas in the public waterway and the establishment of a temporary staging and dewatering facility on ADESA property. Work may be restricted to the spring/summer months since there is minimal available space during ADESA's busy period from September to March.

The upland wetland area, the banks of the Brook, and within the Brook in the area of the reaches of the Brook that would require dredging is heavily vegetated. Access to the Brook would necessitate the destruction/removal of substantial vegetation in these sensitive areas. Following dredging activities, these areas would have to be rehabilitated.

The implementation of Alternative 2 would require measures to mitigate downstream sediment migration and stream bed and bank erosion in the Brook during dredging activities. Additional protection measures would be required during significant storm events.

The MCP regulatory requirements and other applicable local and State agency requirements would be met for Alternative 2. The remedial action for the Brook would require certain permits as discussed in Section 5.2.2. The permit conditions would include erosion and sediment controls, monitoring, water treatment/discharge requirements, restoration, public communication, notifications, and documentation of remedial activities.

The long-term OMM program for the Lagoon, WOA, and Wetland Soil Area is readily implementable. However, the AUL would require the cooperation of the current land owner, ADESA, and the long-term commitment for the OMM program, regular reporting and review, and the need of implementing a Permanent Solution in the future.

5.2.2.4 ALTERNATIVE 2 - COSTS

A detailed cost breakdown for Alternative 2 is presented in Table 5.1. The total capital cost is estimated to range from $2,048,000 to $3,051,000 and the estimated annual OMM cost is estimated to be $74,000. The total present worth of this alternative is estimated to range from $3,185,000 to $4,188,000 based upon a 5 percent discount rate over a 30-year period.

The construction costs for Alternative 2 are sensitive to the volume of sediment and soil that would require removal and off-Site disposal. The cost estimate for Alternative 2 is based on a reasonable range of volumes of sediment and soil requiring remediation based on the results of the Phase II CSA. The specific extent and volumes of these materials requiring remediation and the Site-specific soil and sediment cleanup criteria would be determined by the Ecological Impact Delineation Study to be completed during pre-design activities.

5.2.2.5 ALTERNATIVE 2 - RISKS

Alternative 2 has short-term on-Site and off-Site risks associated with remedial activities for the Brook. There is a risk of release of OHM impacted sediment and soil from the

Brook during dredging, material handling, and stabilization activities. Control measures that would be required include erosion and sediment controls and stormwater management controls to protect adjacent wetlands, Riverfront Areas, and the Brook downstream of the work areas. Since OHM would be removed from the Brook to a level that achieves sediment and soil cleanup criteria, there would be no long-term risk to human health and the environment associated with OHM in Brook sediment and soil.

Since the AUL and long-term OMM program for the Lagoon, WOA, and Wetland Soil Area does not involve active remedial action, there is no change in current short-term risk associated with these areas. Although Alternative 2 monitors potential OHM migration from the Lagoon, WOA, and Wetland Soil Area in order to demonstrate a condition of No Substantial Hazard, this alternative does not prevent potential OHM discharges and migration. Therefore, there is a potential risk of future releases to the environment and/or exposures by humans and biota to OHM. The AUL would provide some control of Site access and restrict activities in the area of the Lagoon, WOA, and Wetland Soil Area but access by environmental receptors and via the public water way cannot be fully controlled.

5.2.2.6 ALTERNATIVE 2 - BENEFITS

Alternative 2 would avoid loss of value to the Site by minimizing the damage and disruption to the wetlands and Riverfront areas as the wetlands in the Lagoon, WOA and Wetland Soil Area would not be affected other than by OMM activities. There is no current or future use of these areas contemplated as these areas are regulated wetlands.

The remedial action for the Brook would restore the natural resources associated with the Brook by removing OHM-impacted sediment and soil above the Site-specific soil and sediment cleanup objectives. The remedial action for the Brook would result in temporary damage to vegetation and disruption of ecological habitat as a result of clearing and grubbing, and dredging and hauling activities.

The wetland areas are currently zoned industrial/commercial, except the Brook which is a public waterway. The remedial actions would not change the Lagoon, WOA, and Wetland Soil Area land use classification or assist in allowing development so no benefit would result.

5.2.2.7 ALTERNATIVE 2 – TIMELINESS

Alternative 2 would achieve a level of NSR within a reasonable timeframe (i.e., approximately one year) for the Brook as the dredging and off-Site disposal of Brook sediment and soil would eliminate the source of OHM within the Brook.

Alternative 2 does not eliminate uncontrolled sources of OHM or achieve a level of NSR for the exposure of ecological receptors to Site-related OHM within a reasonable timeframe for the Temporary Solution implemented for the Lagoon, WOA, and Wetland Soil Area. The primary OHM of concern at the Site are PAHs, phthalates, and metals and these are not expected to substantially naturally degrade and attenuate in a timely manner.

5.2.2.8 ALTERNATIVE 2 - RELATIVE EFFECTS

Alternative 2 would not affect non-pecuniary factors for the Brook.

For the Lagoon, WOA, and Wetland Soil Area, Alternative 2 does not affect non-pecuniary factors since the Site would remain an MCP disposal Site and no further active remedial actions would be conducted unless a Permanent Solution is required in the future.

5.2.3 ALTERNATIVE 3 - BROOK: SEDIMENT REMOVAL/ OFF-SITE DISPOSAL LAGOON/WOA/WETLAND SOIL AREA: SOIL AND SEDIMENT REMOVAL/OFF-SITE DISPOSAL

Alternative 3 is similar to Alternative 2 for the Brook as described in Section 5.2.2. In addition to the removal and off-Site disposal of impacted sediment from the Brook, Alternative 3 also includes the removal and off-Site disposal of impacted sediment and soil from the Lagoon, WOA, and Wetland Soil Area. An AUL and OMM would not be required for Alternative 3 since a Permanent Solution would be achieved for the entire Site. The primary remedial areas for Alternative 3 are shown on Figure 5.3.

The remedial action that would be conducted for Alternative 3 would result in a Permanent Solution (Class A-2 RAO) for the Site including the Brook, Lagoon, WOA, and Wetland Soil Area.

As discussed in Section 3.0, the specific extent and volumes of material requiring remediation will be determined based on the ecological-based cleanup criteria established from the pre-design Ecological Impact Delineation Study.

It is noted that the Ecological Impact Delineation Study for the Lagoon, WOA, and Wetland Soil Area may indicate that a portion or none of the sediment and soil in one or more of these areas requires remedial action. The additional information obtained during pre-design activities will define the limits of remediation, if any, in these areas. For the purposes of the Phase III RAP, it is assumed that these areas will require remedial action.

The remedial action for the Brook consists of the same clearing and grubbing, stormwater control and Brook by-pass, sediment removal, and restoration activities described for Alternative 2 in Section 5.2.2.

In addition to the removal of approximately 1,000 to 3,900 cubic yards of sediment for the Brook as described for Alternative 2, Alternative 3 includes the removal of impacted sediment from the Lagoon and WOA and soil from the Wetland Soil Area.

The interior of the Lagoon is approximately 400 ft long and 70 ft wide. The thickness of sediment within the Lagoon is estimated to range from approximately 0.5 to 2 ft. The volume of OHM-impacted sediment in the Lagoon is, therefore, estimated to range from approximately 1,600 to 3,200 cubic yards (prior to stabilization) based on approximate excavation depths of 1.5 and 3.0 ft, respectively.

For purposes of the Phase III RAP, the maximum total area of the WOA and adjacent Wetland Soil Area requiring remedial action is estimated to be approximately 81,000 square ft and includes approximately 3,000 cubic yards (prior to stabilization) of OHM-impacted sediment and soil based on an approximate depth of 1 ft. The minimum volume of sediment and soil in these areas requiring remedial action is estimated to be 50 percent of the maximum or approximately 1,500 cubic yards. These areas will be refined by the Ecological Impact Delineation Study.

The removal of sediment for the Brook would be conducted first, prior to the Lagoon, WOA, and Wetland Soil Area. The Lagoon would be used as storage for surface water pumped out of the Brook during sediment removal from the Brook unless there is not enough capacity in the Lagoon in which case some of the water would be treated and discharged to the Brook or off-Site. The surface water and sediment in the Lagoon would be removed after all the Brook work is completed.

The approach evaluated for removing the sediment from the Lagoon would include the following steps. Any surface water pathways such as ditches or swales and the Valve House that could allow sediments and Lagoon water to drain out to the Brook or the surrounding wetlands would be more permanently blocked. Sediment and erosion control measures would be installed around the work zone which would include the Lagoon and the equipment access and material handling work areas. The Lagoon would be dewatered to remove existing surface water. The water would be tested to determine if it is suitable for batch discharge to the Brook. If the water meets the discharge criteria, the water would be pumped through a filtration system to ensure that sediment is not entrained prior to discharge to the Brook. An excavator would then remove wet sediments from the Lagoon and load them into off-road haul trucks for transportation to the staging area that would be constructed outside the limits of the floodplain for dewatering. The staging area would be constructed to contain the water that drains from the sediments. The water collected in the staging/drying area would be disposed off-Site. Alternatively, after water removal, the sediment in the Lagoon may be stabilized in situ and then excavated for transportation and off-site disposal.

Confirmatory sediment and soil sampling of the streambed of the Brook and the base of the Lagoon, the WOA, and the Wetland Soil Area would be conducted following dredging/excavation to confirm that OHM-impacted sediment/soil above cleanup criteria has been removed. Additional dredging/excavation may be required, as necessary.

Following all dredging-related activities, the areas of the Brook that were impacted by sediment removal activities would be restored to prevent erosion. Excavated creek bed areas would be backfilled with a well-graded aggregate stone similar to the existing native material in texture and size. No hydric or topsoil would be placed in the Brook as natural processes would result in the accumulation of organic material over time. Disturbed banks would be graded to a stable slope and overlain with topsoil, natural seed mix, and erosion control fabric. The restoration activities would be completed prior to removal of the coffer dam, to ensure sediments are not released into the watercourse. Restoration of the banks of the Brook, upland work areas, the WOA, and the Wetland Soil Area would be conducted as well. No restoration activities would be conducted for the Lagoon.

The OHM-impacted sediments and soils removed from the Brook, Lagoon, WOA, and Wetland Soil Area would be staged, dewatered, and tested prior to transportation and disposal off-Site. Sediments and soil would be transported to a staging area that is constructed outside the limits of the floodplain for dewatering prior to disposal as shown on Figure 5.3. The staging area would be constructed to contain the water that drains from the sediments and soil. Water from the staging/dewatering area would also be treated and discharged to the Brook and/or transported and disposed off-Site.

If required, the sediments and soil would be stabilized prior to disposal. It is assumed for costing purposes, that all the sediments and soil would be stabilized. The sediments and soil would be stabilized with the addition of a stabilizing agent such as kiln dust, fly ash, and/or Portland cement (approximately 25% by volume).

Similar to Alternative 2, additional analytical parameters and test frequencies would be required to characterize the sediment/soil prior to off-Site disposal. The testing of parameters and frequency referenced in MADEP Policy COMM-94-007 for dredged sediments would be required at a minimum. Additional testing for TCLP parameters would be required for any OHM and samples that exceed a TCLP trigger value. Based on the concentrations of certain metals such as lead, it is likely that a portion of the dredged sediment/soil would be classified as a characteristically hazardous waste (i.e., D008) that would require disposal at a RCRA hazardous waste/treatment disposal facility such as the Waste Management Facility in Model City, NY. Some of the dredged and dewatered sediment/soil may be economically disposed at a MA-lined landfill. Alternatively, it may be suitable for use as daily cover material or direct disposal at Turnkey Landfill in Rochester, NH. For the purposes of the Phase III RAP, the following quantities and disposal options have been assumed for cost estimating:

- direct disposal at a MA-lined landfill – 70% of the material;
- direct disposal at Turnkey Landfill – 20 percent of the material; and
- hazardous waste at Model City Landfill – 10% of the material.

Alternative 3 would include the demolition of the former Pump House and Valve House as these structures have not been in use since 1989 and are no longer required. Measures would be taken during the demolition of the Valve House to ensure that the outfall (Outfall #3) from the Lagoon to the Brook is permanently blocked to prevent potential discharges to the Brook.

Pre-design studies would be required to determine design parameters and remedial conditions, such as a stabilization treatability study, pilot vacuum extraction, and surface flow/hydrology in order to complete the engineering design for this alternative.

The Ecological Impact Delineation Study would also be conducted during the pre-design stage.

Similar to Alternative 2, the following permits would be required for the implementation of Alternative 3:

- MADEP BWSC – Tier 1B (in place);
- FCC Order of Conditions;
- USACOE – Section 404 Type 2 Programmatic/Individual General Permit;
- MADEP BRP Wetlands and Waterways – Section 401 WQC for Dredging Activities;
- MADEP BRP Waterways Regulation Program - Chapter 91 Waterways License; and
- MADEP MEPA - ENF/EIR.

5.2.3.1 ALTERNATIVE 3 - EFFECTIVENESS

Alternative 3 would result in a Permanent Class A-2 RAO for the Site including the Brook, Lagoon, WOA, and Wetland Soil Area as a condition of NSR to the environment would result immediately following the completion of the remedial action. The stabilization and off-Site disposal of the OHM-impacted sediments and soil would effectively remove OHM for the Site. Alternative 3 would not reduce levels of untreated and/or residual OHM in the Brook to concentrations that achieve or approach local conditions or background levels contingent upon the cleanup criteria established from the Ecological Impact Delineation Study.

5.2.3.2 ALTERNATIVE 3 – SHORT-TERM AND LONG-TERM RELIABILITY

Alternative 3 provides short-term and long-term reliability for the Brook, Lagoon, WOA, and Wetland Soil Area since it involves the removal of OHM-impacted sediment and soil to achieve the remedial objectives. It effectively reduces OHM exposure to humans and the environment to attain a level of NSR immediately following remedial action. Following the remedial action, no further remedial activities would be required for the Site.

5.2.3.3 ALTERNATIVE 3 – DIFFICULTY OF IMPLEMENTATION

The remedial action for the Site is somewhat difficult to implement due to access issues, space availability for support facilities, erosional and sedimentation control issues, extensive vegetation beside and in the Brook, and the need to minimize impacts to the upland wetland area and banks of the Brook during dredging activities. Certain Federal, State, and local permits are also required to effect implementation.

Coordination would be required with ADESA, the current owner of the Property, MADEP, and the Town of Framingham for access to work areas in the public waterway and the establishment of a temporary staging and dewatering facility on ADESA property. Work may be restricted to the spring/summer months since there is minimal available space during ADESA's busy period from September to March.

The upland wetland area, the banks of the Brook, and within the Brook in the area of the reaches of the Brook that would require dredging is heavily vegetated. Access to the Brook would necessitate the destruction/removal of substantial vegetation in these sensitive areas. Following dredging activities, these areas would have to be restored to pre-remediation conditions.

The implementation of Alternative 3 would require measures to mitigate downstream sediment migration and stream bed and bank erosion in the Brook during dredging activities. Additional protection measures would be required during significant storm events. Erosion and sediment controls would be required for the WOA and Wetland Soil Area as well.

The MCP regulatory requirements and other applicable local and State agency requirements would be met for Alternative 3. The remedial action for the Brook would require certain permits as discussed in Section 5.2.3. The permit conditions would include erosion and sediment controls, monitoring, water treatment/discharge requirements, restoration, public communication, notifications, and documentation of remedial activities.

5.2.3.4 ALTERNATIVE 3 - COSTS

A detailed cost breakdown for Alternative 3 is presented in Table 5.2. The total capital cost is estimated to range from $3,195,000 to $4,869,000. There are no annual OMM costs associated with Alternative 3.

The construction costs for Alternative 3 are sensitive to the volumes of sediment and soil that would require removal and off-Site disposal. The costs estimate for Alternative 3 is based on a reasonable range of volumes of sediment and soil requiring remediation based on the results of the Phase II CSA. The specific extent and volumes of these materials requiring remediation and the Site-specific soil and sediment cleanup criteria would be determined by the Ecological Impact Delineation Study to be completed during pre-design activities.

5.2.3.5 ALTERNATIVE 3 - RISKS

Alternative 3 has short-term on-Site and off-Site risks associated with remedial activities for the Brook, Lagoon, WOA, and Wetland Soil Area. There is a risk of discharge of OHM from these areas during dredging, excavation, material handling, and stabilization activities. Control measures that would be required include erosion and sediment controls, stormwater management, and protection of the adjacent wetlands, [Riverfront Areas], and the Brook downstream of the work areas. Since OHM would be removed from the Site to a level that achieves sediment and soil cleanup criteria, there would be no long-term risk to human health and the environment associated with the Site.

5.2.3.6 ALTERNATIVE 3 - BENEFITS

The remedial action for the Site would restore the natural resources associated with the Brook, WOA, and Wetland Soil Area by removing OHM-impacted sediment and soil above the Site-specific soil and sediment cleanup objectives. The remedial action would result in temporary damage to vegetation and disruption of ecological habitat as a result of clearing and grubbing, dredging, excavation, and hauling activities.

5.2.3.7 ALTERNATIVE 3 – TIMELINESS

Alternative 3 would achieve a level of NSR within a reasonable timeframe (i.e., approximately one year) for the entire Site including the Brook Lagoon, WOA, and Wetland Soil Area as the dredging and excavation and off-Site disposal of impacted sediment and soil would eliminate the source of OHM for the Site.

5.2.3.8 ALTERNATIVE 3 - RELATIVE EFFECTS

Alternative 3 would not affect non-pecuniary factors for the Site as the Site would be restored to its pre-remedial action condition.

5.2.4 ALTERNATIVE 4 - BROOK: SEDIMENT REMOVAL/ON-SITE CONSOLIDATION LAGOON/WOA/WETLAND SOIL AREA: SEDIMENT AND SOIL REMOVAL/ON-SITE CONSOLIDATION

Alternative 4 includes the removal of impacted sediment from the Brook, Lagoon, and WOA, and impacted soil from the Wetland Soil Area, consolidation within the Lagoon, and capping. An AUL and long-term OMM would also be required for Alternative 4. The primary remedial areas for Alternative 4 are shown on Figure 5.4.

The remedial action that would be conducted for Alternative 4 would result in a Permanent Solution (Class A-2 RAO) for the entire Site including the Brook, Lagoon, WOA, and Wetland Soil Area.

As discussed in Section 3.0, the specific extent and volumes of material requiring remediation will be determined based on the ecological-based cleanup criteria established from the pre-design Ecological Impact Delineation Study.

As discussed for Alternative 3, the volumes of OHM-impacted sediment and soil are estimated to range from:

- approximately 1,000 to 3,900 cubic yards for the Brook;
- approximately 700 to 1,250 cubic yards for the banks of the Brook;
- approximately 1,600 to 3,200 cubic yards for the Lagoon; and
- approximately 1,500 to 3,000 cubic yards for the combined WOA and Wetland Soil Area.

Sediments and soil would be excavated from the Brook, Lagoon, WOA, and Wetland Soil Area and stockpiled in the on-Site staging area prior to consolidation within the Lagoon. The sediment and soil would be dewatered and stabilized with the addition of a stabilizing agent such as kiln dust, fly ash, and/or Portland cement (approximately 25% by volume). After the Lagoon has been dewatered and excavated of all OHM-impacted sediment at concentrations above sediment cleanup criteria, a compacted grading layer would be placed at the base of the excavation to a thickness that extends above the groundwater table elevation. Stabilized sediments and soil would then be placed and compacted on top of the grading layer and capped with a cover system. The purpose of the cap or cover system is to prevent direct contact and reduce infiltration of precipitation through the stabilized OHM-impacted sediments and soil and subsequent leaching of OHM to groundwater. In addition, the cover system would provide long-term protection against erosion, degradation of the fixated sediment and soil, and potential migration of the OHM-impacted material and human health and environmental exposures. With the existing low permeability soils in the sidewalls and base of the Lagoon, the cover system would provide an impoundment that would essentially isolate OHM-impacted material from the environment and from human exposure.

The cover system would consist of a composite cap with a vegetated surface. The proposed cap is a modified version of a Subtitle C RCRA landfill cap. The proposed containment unit within the Lagoon and cover system cross-section is as follows (bottom to top):

- grading layer (depth varies as necessary);
- stabilized sediments (approximately 2 to 6 ft);
- soil barrier layer – clay (12 inches);
- Geocomposite Clay Liner;
- Geonet drainage layer;
- common fill (12 inches); and
- vegetative cover (6 inches).

The purpose of the grading layer is to bring the bottom of the impacted sediment and soil layer above the groundwater elevation, thus preventing it from coming into direct contact with groundwater. The grading layer would be constructed of compacted clean fill from an appropriate off-Site source and would be free of unsuitable materials. The stabilized sediments and soil would be placed and compacted on the grading layer above the groundwater elevation. The cover system would then be constructed over the stabilized sediment/soil.

The bottom layer of the cover system would consist of an one-ft thick layer of compacted low-permeability soil directly overlying the stabilized sediment and soil to reduce infiltration to the impacted sediments/soil layer. The barrier layer would be covered with a GCL to provide additional reduction in infiltration and also significantly reduce the hauling necessary to import additional low-permeability barrier materials. GCL is also generally easier to install than-low-permeability soil, less susceptible to differential settlement, and more forgiving of freeze/thaw damage.

A Geonet drainage layer would be placed over the GCL to facilitate efficient lateral drainage. This layer typically consists of a drainage net and geotextile filter fabric. The use of a Geonet drainage layer effectively reduces infiltration, and significantly reduces the hauling and construction equipment necessary to import and install sand drainage materials.

The drainage layer would be covered with 12 inches of common fill to provide protection to the lower cap layers from intrusion by plant roots or burrowing animals. The common fill layer would be constructed using imported soil from an approved source and would be free of unsuitable materials.

A 6-inch topsoil and vegetative cover layer would be placed over the common fill layer to prevent wind and water erosion, provide storage for vegetation, maximize evapotranspiration, and significantly reduce the volume of infiltrating stormwater that would migrate to the drainage layer or potentially come in contact with the impacted sediment/soil. The vegetative layer also functions to enhance aesthetics and to promote a self-sustaining ecosystem on top of the cover system. The cover system and surrounding areas would be seeded and a temporary erosion control blanket would be installed to prevent soil erosion. Topsoil material used as part of the cover system would be imported from an approved source and would be free of unsuitable materials.

An AUL would be prepared and registered on the Property, in the area of the Lagoon to support the Class A RAO. The AUL would require soil management plans, including health and safety measures, for any construction or excavation activities that would be required in the future. The AUL would also require the long-term monitoring of groundwater at the Site to monitor potential degradation of fixated OHM-impacted material and migration from the impoundment.

For the purposes of the Phase III RAP, the OMM program is assumed to include regular inspection and routine and unscheduled maintenance of the cover system. The program also would include the collection of groundwater samples from the five previously installed monitoring wells in the area of the Lagoon. Groundwater sampling would be conducted quarterly for the first year, semi-annually for 4 years, and annually thereafter. The samples would be analyzed for SVOCs, VOCs, and metals for the first year, and

SVOCs and metals thereafter. OMM Reports would be submitted to the MADEP every 6 months.

Alternative 4 would include the demolition of the former Pump House and Valve House as these structures have not been in use since 1989 and are no longer required. Additional measures also would be implemented during the demolition of the Valve House to ensure that the outfall (Outfall #3) from the Lagoon to the Brook is permanently blocked to prevent potential erosion/degradation and releases to the environment.

Pre-design studies would be required to determine design parameters and remedial conditions, such as a stabilization treatability study, pilot vacuum extraction, and surface flow/hydrology in order to complete the engineering design for this alternative. The Ecological Impact Delineation Study also would be conducted during the pre-design stage.

The following permits would be required for the implementation of Alternative 4:

- MADEP BWSC – Tier 1B (in place);
- FCC Order of Conditions;
- USACOE – Section 404 Type 2 Programmatic/Individual General Permit;
- MADEP - BRP Wetlands and Waterways – Section 401 WQC for Dredging Activities;
- MADEP - BRP Waterways Regulation Program-Chapter 91 Waterways License; and
- MADEP – MEPA - ENF/EIR.

5.2.4.1 ALTERNATIVE 4 - EFFECTIVENESS

Alternative 4 would result in a Permanent Class A-2 RAO for the Site including the Brook, Lagoon, WOA, and Wetland Soil Area as a condition of NSR to the environment would result immediately following the completion of the remedial action. The stabilization and on-Site consolidation and capping of the OHM-impacted sediment and soil would effectively and permanently immobilize OHM. Alternative 4 would provide some reduction in OHM concentrations but not overall mass. Alternative 4 also would not reduce levels of untreated and/or residual OHM to concentrations that achieve or approach local conditions or background levels contingent upon the cleanup criteria established from the Ecological Impact Delineation Study.

The OMM and AUL for the Lagoon would provide for the maintenance of the cap and would require appropriate soil management plans, including health and safety measures, which may allow certain authorized future construction activities to be conducted. The AUL would also provide certain controls over permitted uses and restricted activities in the area of the Lagoon to ensure that disturbance, exposures, degradation, and subsequent migration of OHM-impacted material would be managed in the future.

5.2.4.2 ALTERNATIVE 4 – SHORT-TERM AND LONG-TERM RELIABILITY

Alternative 4 provides short and long-term reliability by restricting use, access, and development of the Lagoon property. This alternative also includes measures (i.e., consolidation, stabilization, and capping) to prevent potential OHM discharge or migration to the environment. It effectively eliminates OHM exposure to humans and the environment over the long-term by the attainment of a level of NSR immediately following remedial construction and AUL activities. Following the remedial construction activities ongoing OMM associated with the cap inspection and maintenance and environmental monitoring would provide long-term reliability.

5.2.4.3 ALTERNATIVE 4 – DIFFICULTY OF IMPLEMENTATION

The remedial action for the Site is somewhat difficult to implement due to access issues, space availability for support facilities, erosional and sedimentation control issues, extensive vegetation beside and in the Brook, and the need to minimize impacts to the upland wetland area and banks of the Brook during dredging activities. A number of Federal, State, and local permits are also required to effect implementation. In addition, Alternative 4 may be difficult to implement from a regulatory perspective as the inadvertent wetlands within the Lagoon would be eliminated.

Coordination would be required with ADESA, the current owner of the Property, MADEP, and the Town of Framingham for access to work areas in the public waterway and the establishment of a temporary staging and dewatering facility on ADESA property. Work may be restricted to the spring/summer months since there is minimal available space during ADESA's busy period from September to March.

The upland wetland area, the banks of the Brook and within the Brook in the area of the reaches of the Brook that would require dredging is heavily vegetated. Access to the Brook, Wetland Soil Area, and WOA would necessitate the destruction/removal of substantial vegetation in these sensitive areas. Following dredging activities, these areas would have to be restored to pre-remediation conditions.

The implementation of Alternative 4 would require measures to mitigate downstream sediment migration and stream bed and bank erosion in the Brook during dredging activities. Additional protection measures would be required during significant storm events. Erosion and sediment controls would be required for the WOA and Wetland Soil Area as well.

The MCP regulatory requirements and other applicable local and State agency requirements would be met for Alternative 4. The remedial action for the Brook would require certain permits as discussed in Section 5.2.4. The permit conditions would include erosion and sediment controls, monitoring, water treatment/discharge requirements, restoration, public communication, notifications, and documentation of remedial activities.

The long-term OMM program for the Lagoon is easily implemented. However, the AUL would require the cooperation of the current land owner, ADESA, and the long-term commitment for the OMM program, regular reporting and review, and maintenance of the cap.

5.2.4.4 ALTERNATIVE 4 - COSTS

A detailed cost breakdown for Alternative 4 is presented in Table 5.3. The total capital cost is estimated to be \$72,000 and the estimated annual OMM cost is estimated to be \$72,000. The total present worth of this alternative is estimated to range from \$4,557,000 to \$5,780,000 based upon a 5 percent discount rate over a 30-year period.

The construction costs for Alternative 4 are sensitive to the volumes of sediment and soil that would require removal and off-Site disposal. The costs estimate for Alternative 4 is based on a reasonable range of volumes of sediment and soil requiring remediation based on the Phase II CSA. The specific extent and volumes of these materials requiring remediation and the Site-specific soil and sediment cleanup criteria would be determined by the Ecological Impact Delineation Study to be completed during pre-design activities.

5.2.4.5 ALTERNATIVE 4 - RISKS

Alternative 4 has short-term on-Site and off-Site risks associated with remedial activities for the Brook, Lagoon, WOA, and Wetland Soil Area. There is a risk of discharge of OHM from these areas during dredging, excavation, material handling, and stabilization activities. Control measures would include erosion and sediment controls and stormwater management to protect adjacent wetlands, Riverfront Areas, and the Brook downstream of the work areas. Since OHM would be removed from the Site to a level that achieves sediment and soil cleanup criteria consistent with MCP requirements, there would be no long-term risk to human health and the environment associated with the Site.

The AUL for the Lagoon would control access and activities thereby minimizing risks to human health and the environment associated with the disturbance of the Lagoon impoundment.

5.2.4.6 ALTERNATIVE 4 - BENEFITS

The remedial action for the Site would restore the natural resources associated with the Brook, WOA, and Wetland Soil Area by removing OHM-impacted sediment and soil above the Site-specific soil and sediment cleanup objectives. The remedial action would result in temporary damage to vegetation and disruption of ecological habitat as a result of clearing and grubbing, dredging, excavation, and hauling activities. The elimination of the inadvertent wetland associated with the Lagoon would not be a benefit.

The wetland areas are currently zoned industrial/commercial, except the Brook which is a public waterway. The remedial actions would not change the Lagoon, WOA, and Wetland Soil Area land use classification or assist in allowing development so no benefit would result.

5.2.4.7 ALTERNATIVE 4 – TIMELINESS

Alternative 4 would achieve a level of NSR within a reasonable timeframe (i.e., approximately one year) for the entire Site including the Brook, Lagoon, WOA, and Wetland Soil Area as the dredging, excavation, stabilization, consolidation, and on-Site disposal and capping of impacted sediment and soil would eliminate the source of OHM for the Site.

5.2.4.8 ALTERNATIVE 4 - RELATIVE EFFECTS

Alternative 4 would not affect non-pecuniary factors for the Site as the Site would be restored to its pre-remedial action condition with the exception of the Lagoon. The inadvertent wetlands associated with the Lagoon would be eliminated by the consolidation of sediment and soil within the Lagoon and the placement of a vegetated cap. Certain permit conditions may be required to address this condition, although it is essentially restoring the area to pre-Lagoon conditions.

6.0 SELECTION OF REMEDIAL ACTION ALTERNATIVE

The following is a summary of the comparative evaluation of the remedial action alternatives.

Effectiveness

Alternative 1 (No Action) does not eliminate a Substantial Hazard, achieve a condition of NSR, or achieve a Temporary or Permanent Solution and, therefore, is not effective.

Alternative 2 would result in a Permanent Class A-2 RAO for the Brook and a Temporary Class C-1 RAO for the Lagoon, WOA, and Wetland Soil Area to ensure that a condition of No Substantial Hazard is maintained in these areas for ecological receptors.

Alternative 3 would result in a Permanent Class A-2 RAO for the entire Site including the Brook, Lagoon, WOA, and Wetland Soil Area as a condition of NSR to the environment would result immediately following the completion of the remedial action.

Alternative 4 would result in a Permanent Class A-2 RAO for the entire Site including the Brook, Lagoon, WOA, and Wetland Soil Area. The AUL, long-term monitoring program, and cap maintenance for the Lagoon would ensure that OHM does not migrate from the Lagoon impoundment to the environment.

Therefore, Alternative 3 is the most overall effective alternative as it permanently removes all OHM-impacted sediment and soil from the Site above cleanup criteria and achieves a condition of NSR without the need for an ongoing AUL and OMM as is the case for Alternatives 2 and 4. Alternative 4 is more effective than Alternative 2 as it achieves a condition of NSR and is a Permanent Solution.

Short-Term and Long-Term Reliability

There is no short-term or long-term reliability provided by the No Action alternative.

Alternative 2 provides short-term and long-term reliability for the Brook. Following the remedial action, no further remedial activities would be required for the Brook. Alternative 2 does not provide long-term reliability for the Lagoon, WOA, and Wetland Soil Area since monitoring for potential OHM discharges to the environment from these areas are required to ensure a condition of No Substantial Hazard is maintained for the Site. Alternative 2 does not include physical remedial measures to prevent potential

OHM discharge or migration to the environment from the Lagoon, WOA, and Wetland Soil Area and, therefore, does not manage or control potential environmental impacts or exposures to human receptors that may occur. Therefore, Alternative 2 is less reliable than Alternatives 3 and 4.

Alternatives 3 and 4 provide short-term and long-term reliability for the Brook, Lagoon, WOA, and Wetland Soil Area. These alternatives effectively reduce OHM exposure to humans and the environment to attain a level of NSR immediately following remedial action. Following the remedial construction activities, ongoing OMM associated with the cap and long-term monitoring for Alternative 4, would be required for the Site.

Alternative 3, therefore, has the highest short-term and long-term reliability as additional measures such as an AUL and ongoing OMM, including long-term monitoring are not required.

Difficulty of Implementation

The No Action alternative has no associated technical implementability difficulties. However, the No Action alternative is difficult to implement since it does not comply with Federal, State, and local environmental, stormwater, and wetland protection regulations.

The remedial action for Alternatives 2, 3, and 4 is somewhat difficult to implement due to access issues, permitting requirements, coordination and/or commitment by ADESA for access and AUL/OMM, space availability for support facilities, erosion and sedimentation control issues, and the need to minimize impacts to the Site during dredging, stabilization, water treatment activities, and rehabilitation requirements. Erosion and sediment controls would also be required for the WOA and Wetland Soil Area for Alternatives 3 and 4.

For Alternatives 2 and 4, the long-term OMM program is easily implemented. However, the AUL required for these alternatives would require the cooperation of the current land owner, ADESA, and the long-term commitment for the OMM program. In addition, there is the need to evaluate and possibly implement a Permanent Solution in the future for Alternative 2.

In addition, Alternative 4 may be difficult to implement from a regulatory perspective as the inadvertent wetlands within the Lagoon would be eliminated.

Therefore, of the alternatives that meet the remedial action objectives (Alternatives 2, 3, and 4), Alternative 3 is the least difficult alternative to implement.

Costs

The costs associated with the alternatives are summarized as follows:

Alternative	*Capital Cost*	*Annual OMM Cost*	*Total Present Worth Cost*
1	--	--	--
2	$2,048,000-$3,051,000	$74,000	$3,185,000-$4,188,000
3	$3,195,000- $4,869,000	--	$3,195,000-$4,869,000
4	$3,454,000-$4,677,000	$72,000	$4,557,000-$5,780,000

The most cost-effective alternatives that meet the MCP and other regulatory requirements are Alternatives 2 and 3. However, Alternative 3 is also more cost-sensitive to increases in volumes of sediment and/or soil due to transportation and off-Site disposal costs.

Risks

The No Action Alternative would not reduce short or long-term risks to the environment associated with OHM in Site sediment and soils and would not achieve a condition of NSR.

Alternatives 2, 3, and 4 have short-term on-Site and off-Site risks associated with remedial activities for the Brook and other areas due to damage to natural resources during remedial construction activities. There is a risk of releases of OHM from the Brook during dredging activities. Control measures that would be required include erosion and sediment controls, stormwater management, and protection of the adjacent wetlands, Riverfront Areas, and the Brook downstream of the work areas. Since OHM would be removed from the Site to a level that achieves sediment and soil cleanup criteria, there would be no long-term risk to human health and the environment associated with the Brook for Alternatives 2, 3, and 4. Alternatives 3 and 4 also have short-term risks associated with remedial construction activities for the Lagoon, WOA, and Wetland Soil Area.

Alternative 2 does not prevent potential OHM releases and migration; therefore, there is a potential risk of future exposures by humans and environmental receptors to OHM associated with the Lagoon, WOA, and Wetland Soil Area.

For Alternative 4, since stabilized OHM remains in the Lagoon impoundment there is still some risk associated with potential future degradation, releases, and exposure to human health and environmental receptors.

Alternative 3 would, therefore, have the least long-term risks for the Site.

<u>Benefits</u>

The No Action Alternative does not provide any benefits to the environment as there would be no changes to Site conditions and there would be no remedial action, except no short-term damage would occur due to remedial construction activities.

For Alternatives 2, 3, and 4, the remedial action for the Brook would restore the natural resources associated with the Brook by removing OHM-impacted sediment and soil above the Site-specific soil and sediment cleanup criteria. The remedial action for the Brook would result in temporary damage to vegetation and disruption of ecological habitat as a result of clearing and grubbing, and dredging and hauling activities.

For Alternatives 3 and 4, in addition to the Brook, the remedial action for the Site would restore the natural resources associated with the WOA and Wetland Soil Area by removing OHM-impacted sediment and soil above the Site-specific soil and sediment cleanup criteria.

Alternative 2 would avoid loss of value to the Site by minimizing the damage and disruption to the wetlands and Riverfront areas as the wetlands in the Lagoon, WOA, and Wetland Soil Area would not be subject to remedial construction activities.

For Alternative 4, the inadvertent wetlands at the Lagoon would be eliminated by the construction of the Lagoon impoundment.

Alternative 3 would, therefore, have the highest level of benefit to the environment.

Timeliness

The No Action Alternative does not achieve a level of NSR for the exposure of ecological receptors to Site-related OHM within a reasonable timeframe. Alternative 2 would achieve a level of NSR within a reasonable timeframe (i.e., approximately one year) for the Brook. However, Alternative 2 does not eliminate uncontrolled sources of OHM or achieve a level of NSR for the exposure of ecological receptors to Site-related OHM within a reasonable timeframe for the Lagoon, WOA, and Wetland Soil Area.

Alternatives 3 and 4 would achieve a level of NSR within a reasonable timeframe (i.e., approximately one year) for the entire Site including the Brook Lagoon, WOA, and Wetland Soil Area. However, Alternative 4 would require an AUL and long-term OMM associated with the OHM-impacted sediment and soil left in the Lagoon impoundment.

Alternative 3 would, therefore, have the highest level of timeliness to achieve remedial action objectives.

Relative Effects

None of the Alternatives would affect non-pecuniary factors with the exception of Alternative 4. The inadvertent wetlands associated with the Lagoon would be eliminated by the consolidation of sediment and soil within the Lagoon and the cap construction. The incremental benefit of removing OHM from the Site with the implementation of remedial construction activities for Alternatives 3 and 4 exceeds the reduction in short-term damage to the Site in comparison to Alternatives 1 and 2.

6.1 PREFERRED ALTERNATIVE

Based on the detailed evaluation, the preferred and recommended alternative is Alternative 3.

Alternative 3 meets MCP and other regulatory requirements. The implementation of this alternative is readily achievable and it provides appropriate management of OHM-containing sediment and soil to achieve a condition of NSR in a reasonable timeframe. This alternative is a Permanent Solution and is also as or more cost-effective and provides less potential future risk to human health, the environment, and public safety than the other alternatives.

7.0 FEASIBILITY EVALUATION

Feasibility Evaluations are conducted to evaluate the feasibility of the following:

- implementing a Permanent Solution;
- reducing the concentrations of OHM in the environment to levels that achieve or approach background;
- reducing the concentrations of OHM in soil to levels at or below applicable soil UCLs; and
- eliminating, preventing or mitigating Critical Exposure Pathway(s).

The evaluation of the feasibility of implementing a Permanent Solution is required when the selected Comprehensive Remedial Action alternative is a Temporary Solution.

The evaluation of the feasibility of reducing the concentrations of OHM in the environment at the Site or a portion of the Site to levels that achieve or approach background is required in all cases where a Permanent Solution is selected as the Comprehensive Remedial Action alternative, unless the Permanent Solution selected is designed to achieve background and a Class A-1 Response Action Outcome pursuant to 310 CMR 40.1000.

An evaluation of the feasibility of reducing the concentrations of OHM in soil at the Site to levels at or below the applicable soil UCLs is required before a Comprehensive Remedial Action alternative is selected as a Permanent Solution which would leave OHM in soil at concentrations above the soil UCLs at a depth greater than 15 ft below the ground surface or beneath an engineered barrier.

A remedial action alternative that would achieve a Permanent Solution, reducing the concentrations of OHM in the environment at the Site or a portion of the Site to levels that achieve or approach background, or reducing the concentrations of OHM in soil to levels at or below applicable soil UCLs is considered feasible unless:

- the alternative is not technologically feasible, as specified in 310 CMR 40.0860(6);
- the costs of conducting, or the risks resulting from the alternative would not be justified by the benefits, considering such factors as potential damage to human health or the environment, cost of environmental restoration, long-term OMM costs, and non-pecuniary values;

- individuals with the expertise needed to effectively implement the alternative would not be available;
- the alternative would necessitate off-Site land disposal and no off-Site facility is available in the Commonwealth or in other states that is in full compliance with all applicable federal and State regulatory requirements; or
- an alternative is selected for a portion of a disposal site for which the source of the OHM is not located thereon, and the elimination or control of such source cannot currently be achieved at that portion of the disposal site.

A remedial action alternative is considered technologically feasible unless:

- existing technology or reasonable modifications of existing technology cannot remediate the OHM present at the disposal site to the extent necessary to attain a level of NSR or, when required to be considered, to levels that approach or achieve background;
- the reliability of the identified alternative has not been sufficiently proven at other sites or through pilot tests and a substantial uncertainty exists as to whether it will effectively reduce risk; or
- the identified alternative cannot comply with or be modified to comply with applicable regulatory requirements.

The benefits of implementing a remedial action alternative to achieve a Permanent Solution or Temporary Solution and the benefits, when performing a Permanent Solution, of reducing the concentrations of OHM in the environment at the Site to levels which achieve or approach background or reducing the concentrations of OHM in soil at to levels at or below applicable soil UCLs will justify the related costs unless:

- the incremental cost of conducting the remedial action alternative is substantial and disproportionate to the incremental benefit of risk reduction, environmental restoration, and monetary and non-pecuniary values;
- the risk of harm to health, safety, public welfare or the environment posed by the implementation of the alternative cannot be adequately controlled; or
- the alternative would destroy more than 5,000 square ft of wetlands or wildlife habitat, or would otherwise result in a substantial deleterious impact to the environment and other feasible Temporary or Permanent Solutions exist; the OHM, if any, that have come to be located in such resources do not bioaccumulate and are

not likely to migrate; and the damage to such resources resulting from the implementation of the alternative would be permanent and irreparable.

The selected Alternative 3 – Sediment and Soil Removal and Off-Site Disposal is considered a Class A-2 RAO Permanent Solution and, therefore, a feasibility evaluation of reducing the concentrations of OHM in soil and sediment to levels approaching or achieving background was conducted. Based on the results of the Phase II CSA, there are no Site-related OHM present in soil at the Site at concentrations which exceed applicable UCLs. The average concentration of lead present in Lagoon sediment currently exceeds its UCL if the sediment is managed as "soil" by dredging and remains on-site. However, for Alternative 3, depending on the final volumes to be consolidated from the Lagoon, Brook, WOA, and Wetland Soil Area, the final concentration of lead in the soil and sediment to be placed within the Lagoon may be less than the UCL. In addition, the OHM-impacted sediment and soil would be dewatered and stabilized/solidified prior to placement in the Lagoon to ensure that on-Site containment is effective and permanent in the long-term. Stabilization/solidification would fixate OHM present in soil and sediment and would also reduce the concentration of lead in the stabilized/solidified mass.

7.1 FEASIBILITY OF REDUCING OHM CONCENTRATIONS TO LEVELS APPROACHING OR ACHIEVING BACKGROUND

For Beaverdam Brook, a significant length of the Brook would require dredging to remove all sediment with OHM concentrations greater than the upstream background sediment concentrations. To remove all impacted sediment with OHM concentrations above background, the Brook would require dredging from the upstream Property boundary to the downstream Property boundary and off-Property downstream for a total distance of at least 3,000 ft or more. In addition, the downstream off-Property OHM sediment concentrations are generally significantly lower than on-Property source area concentrations and approach upstream background but are, generally, somewhat higher than those concentrations. There are also numerous point and non-point discharge sources downstream off-Property that would contribute OHM to the Brook but are not related to the Site. Based on the HHRA and ERA conducted during the Phase II CSA, there are currently no unacceptable human health risks and no significant ecological risks associated with the Site, downstream of the Property boundary. In addition, there would be little benefit to the environment as the selected alternative would fully address the impact to ecological receptors associated with OHM in sediment and soil at the Site.

For the Wetland Soil Area and banks of the Brook, it is expected that a significantly larger area and volume of soil would require removal and off-Site disposal to achieve or approach a level of OHM consistent with MADEP background soil concentrations or local conditions for soil based on the developed urban areas around the Site. As there are no unacceptable human health risks associated with the soil in this area and the selected alternative would address the impact to ecological receptors associated with OHM in soil, there would be little additional risk reduction. In addition, a significant portion of the wetlands would be temporarily destroyed during the excavation of the Wetland Soil Area to achieve background and would require significant restoration.

For the Lagoon and WOA, it is expected that a significantly larger volume of sediment would require removal and off-Site disposal to achieve or approach a level of OHM consistent with either local background sediment or soil concentrations or MADEP background concentrations. As there are no unacceptable human health risks associated with the sediment in these areas and the selected alternative would address the impact to ecological receptors associated with OHM in sediment, there would be no incremental additional risk reduction and there would be an increased risk due to short-term impacts during remedial activities.

The feasibility of reducing OHM concentrations to background or approaching background is cost prohibitive in comparison to achieving the ecologically-derived sediment and soil cleanup criteria to be determined by the Ecological Impact Delineation Study.

In addition, there are considerable concerns regarding potential risks to the environment and other impacts during the implementation of a remedy to achieve or approach background. These potential risks include the following:

- soil erosion and sediment migration;
- surface water impacts;
- stormwater management;
- potential impacts to groundwater;
- wetlands impacts; and
- significant Site restoration requirements.

It is, therefore, not considered feasible to achieve or approach background OHM concentrations for the sediment in Beaverdam Brook, the Lagoon, and the WOA; and soil in the Wetland Soil Area and banks of the Brook as the incremental cost of conducting the remedial action alternative is substantial and disproportionate to the incremental benefit of risk reduction, environmental restoration, and monetary and non-pecuniary values.

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