Remediation of Sydney Tar Ponds and Coke Ovens Sites

December 2005

Technical Executive Summary
Remediation of Sydney Tar Ponds and Coke Ovens Sites
Environmental Impact Statement
Sydney, Nova Scotia

Technical Executive Summary

Submitted to:
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December 2005

File No. TE4109718
On May 12, 2004, the Minister of Public Works and Government Services Canada and the Premier of Nova Scotia signed a Memorandum of Agreement to jointly remediate the Tar Ponds and Coke Ovens sites, Sydney, Nova Scotia. This Project is subject to an environmental assessment pursuant to the Canadian Environmental Assessment Act and provisions of Part IV of the Nova Scotia Environment Act. A Joint Review Panel has been established by the Minister of the Environment, Canada and the Minister of Environment and Labour, Nova Scotia under the Agreement for the Joint Panel Review of the Sydney Tar Ponds and Coke Ovens sites Remediation Project (July 14, 2005).

This Environmental Impact Statement (EIS) is submitted by the Sydney Tar Ponds Agency to the Joint Review Panel and relevant regulatory authorities for the environmental assessment of the Project, Remediation of Sydney Tar Ponds and Coke Ovens sites. It has been prepared on behalf of the Sydney Tar Ponds Agency by AMEC Earth & Environmental in association with Jacques Whitford Limited and ADI Limited.

The documents comprising this EIS submission include seven Volumes and one Technical Executive Summary, as described in the following Submission Index. In case of a discrepancy, the seven Volumes of the EIS submission take precedence over the Technical Executive Summary.
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APPENDICES

APPENDIX A  Summary Table: Environmental Effects, Mitigation and Significance of Residual Effects
ACRONYMS

AAMP       Ambient Air Monitoring Program
ADI        ADI Limited
AMEC       AMEC Earth & Environmental, a Division of AMEC Americas Limited
BTEX       Benzene, Toluene, Ethylbenzene, Xylenes
CBRM       Cape Breton Regional Municipality
CCME       Canadian Council of Ministers of the Environment
CEAA       Canadian Environmental Assessment Act
CLC        Community Liaison Committee
CoCs       Chemicals of Concern
DFO        Department of Fisheries and Oceans
DNAPL      dense non-aqueous phase liquids
ECM        Environmental Compliance Monitoring
EEM        Environmental Effects Monitoring
EIS        Environmental Impact Statement
EMP        Environmental Management Plan
ERA        Ecological Risk Assessment
ESA        Environmental Site Assessment
ha         Hectares
HASP       Health and Safety Plan
HRA        Human Health Risk Assessment
HU         Hydrostratigraphic Units
JAG        Joint Action Group for the Environmental Cleanup of the Muggah Creek Watershed
JDAC       Jacques Whitford, Dillon Consulting, ADI Limited, CBCL Limited
km         kilometres
m          Metres
MAID       Municipal Ash Industrial Disposal
MEKS       Mi’kmaq Ecological Knowledge Study
mg/l       Milligrams per litre
MGC        Membertou Geomatics Consultants
MHASP      Master Health and Safety Plan
MOA        Memorandum of Agreement
NOx        Nitrous Oxides
PAH        polycyclic aromatic hydrocarbons
PCB        polychlorinated byphenyls
PM         Particulate Matter
PM10       Particulate Matter < M 10 micron
PM2.5       Particulate Matter < 2.5 micron
PWGSC      Public Works and Government Services Canada
SO2        Sulphur Dioxide
SSTL       Site Specific Target Level
STPA       Sydney Tar Ponds Agency
SVOCs      Semi-volatile organic carbons
SYSCO      Sydney Steel Corporation
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TPH                   total petroleum hydrocarbons
TSP                   Total Suspended Particulate
VEC                   Valued Environmental Components
VJ                    Victoria Junction
VOCs                  Volatile Organic Compounds
1.0 INTRODUCTION

On May 12, 2004, the Minister of Public Works and Government Services Canada (PWGSC) on behalf of Canada, and the Premier of Nova Scotia signed a Memorandum of Agreement (MOA) regarding the proposed remediation Project (the Project). This MOA provides the terms of agreement by which the Government of Canada and the Government of Nova Scotia, through the Sydney Tar Ponds Agency (STPA), have agreed to facilitate the remediation of the Tar Ponds and Coke Ovens sites located in the Muggah Creek watershed, Sydney, Nova Scotia.

A Federal/Provincial Joint Review Panel (the Panel) has been established through the Agreement for the Joint Panel Review of the Sydney Tar Ponds and Coke Ovens Sites Remediation Project, finalized on July 14, 2005 by the Federal Minister of the Environment, under the Canadian Environmental Assessment Act (CEAA), and by the Minister of Environment and Labour, Nova Scotia, under the Nova Scotia Environment Act (Joint Panel Agreement). The Panel will have the responsibility to identify, evaluate, and report on the potential environmental effects of the Project.

Pursuant to this agreement, a team of consultants, led by AMEC Earth and Environmental, in association with Jacques Whitford Limited and ADI Limited (ADI), has prepared this Environmental Impact Statement (EIS) on behalf of the STPA to facilitate evaluation of the Project through the Panel Review process. The EIS was prepared based on guidance provided by the Environmental Impact Statement Guidelines for the Sydney Tar Ponds and Coke Ovens Remediation Project, issued by the Canadian Environmental Assessment Agency on August 30th, 2005.

The focus of the EIS is to identify potential Project-related environmental and socio-economic effects. Mitigation has been proposed to address potentially significant adverse environmental effects. Monitoring and follow-up measures have also been proposed, as required, to verify environmental effects predictions and the effectiveness of mitigation measures.

The Proponent for the Project is the STPA, which has been established as a special operating agency of the government of Nova Scotia. Its mission is to focus Nova Scotia’s efforts in the Muggah Creek watershed clean up project, and to make the most effective use of provincial resources in co-operation with the Federal government (STPA 2005). The remediation of the Tar Ponds and Coke Ovens sites is currently being proposed by the STPA, to which the Federal government is contributing up to $280 million, and the Province is contributing $120 million dollars under the Federal-Provincial MOA. PWGSC will administer the federal contribution to the Project on behalf of the government of Canada. The STPA will be responsible for carrying out the Project.

Environment Canada and the STPA developed the proposed remediation plan, which consists of several components:

- control of surface- and groundwater;
- removal and destruction of selected contaminants from both sites;
- treatment in-place of selected contaminants at both sites;
The Project requires an environmental assessment pursuant to the CEAA and the provisions of Part IV of the Nova Scotia Environment Act. A Joint Review Panel, consisting of three members has been established by the Minister of the Environment, Canada (under the authority of CEAA) and by the Minister of Environment and Labour, Nova Scotia (under the authority of the Nova Scotia Environment Act). The Panel will have the responsibility to identify, evaluate and report on the potential environmental effects of the Project, as established in the EIS and the Terms of Reference of the Joint Panel Agreement. The relevant federal and provincial ministers will consider the Panel's findings and recommendations; however the ministers are solely responsible for decision making as to the acceptability of the environmental effects from the Project.

The purpose of the EIS is to describe the proposed Project, identify its potential environmental effects, and propose measures to mitigate these effects and predict the significance of the remaining residual environmental effects.
2.0 PROJECT DESCRIPTION

Overview

The proposed Project is located in the Cape Breton Regional Municipality (CBRM), Nova Scotia. It entails three principal sites, the Tar Ponds site; the Coke Ovens site; and a location for a temporary incinerator. The Tar Ponds and the Coke Ovens sites are located near Sydney harbour and centre of Sydney. The temporary incinerator is proposed for a location approximately 5 kilometres (km) north of the Tar Ponds and the Coke Ovens sites, on an abandoned industrial site (former Victoria Junction Coal Preparation Plant, referred to as VJ site). Figure 1 shows the Project location, together with a delineation of the Project site boundary. Each Project site will undergo a construction, operation and decommissioning phase. The Project schedule is shown in Figure 2.

Need for the Project

Nearly 100 years of coal and steel production have resulted in extensive environmental contamination of the Muggah Creek watershed in and around the area of former steel and coke making operations, which comprises approximately 100 hectares (ha) in the urban core of Sydney, surrounded by residential, commercial and industrial land uses. Government and community efforts towards the remediation of impacted lands and water within the watershed have focused primarily on four areas:

- the North and South Ponds of the Muggah Creek (the Tar Ponds);
- the former Coke Ovens site;
- the Coke Ovens Brook Connector (a tributary to Muggah Creek); and
- the former municipal landfill.

The contamination at the sites had created increased risks to human health and the environment. Recognition of this problem has led to numerous studies and remediation plans, beginning in the early 1980s and involved an unprecedented level of consultation with the public and government stakeholders. On the basis of the site investigations, results of human health and ecological risk assessments (ERA), and public and stakeholder preferences for clean up and re-integration of the Project sites with the urban land use, a remediation project was established.

Project Objectives

The Project has two primary objectives. The first is to reduce the current ecological and health risk from existing soil, sediments, and water contamination. The risk of human exposure to contaminated material on the site is currently being managed through fencing and access controls. The existing risk to ecological receptors associated with releases to Sydney Harbour has been, in part, addressed through ongoing clean-up activities and natural processes. The implementation of the Project will further reduce the potential health and ecological risk by removing, treating, or isolating contaminants of concern.
The second objective of the Project is to enhance the development potential and investment climate in the CBRM and to provide social benefits for CBRM as a whole. The Tar Ponds have created a stigma for Sydney which has acted as a serious impediment to the attraction of new business and opportunities to the municipality. Remediation efforts are expected to result in considerable qualitative and tangible socio-economic benefits such as the transformation of unused vacant lands near the center of Sydney to an area suitable for passive and active recreation, commercial development, or light industrial land uses. It is anticipated that the remediated lands will stimulate renewed conviction in Sydney as a place to invest and grow commercial enterprise.

**Project Cost and Labour Requirements**

Project expenditures are estimated to amount to $400 millions over an eight year period (2007 to 2014). During the construction phase, labour requirements will be highest. For this phase, the total direct peak employment has been estimated to range between approximately 280 and 540 fulltime (40 hours/week) jobs annually. Upon completion of the remediation works, i.e., during operation of the Tar Ponds and Coke Ovens sites, full time employment requirements will be very low and are estimated to be less than 5 fulltime jobs.

### 2.1 TAR PONDS AND COKE OVENS SITE

The works and activities for the Tar Ponds and Coke Ovens sites fall into three phases, (1) construction, (2) operation, and (3) decommissioning (Table 1). The construction phases for the Tar Ponds and the Coke Ovens sites encompass the actual remediation works and include activities ranging from the development of the necessary infrastructure, excavations and
removal of some of the contaminated materials, to groundwater and surface water treatment, solidification/stabilization of in-place contaminants, import of clean fill and other construction material, and the installation of final cover systems.

Materials contaminated with PCBs and PAHs will be removed and safely destroyed using high temperature incineration. The remaining sediment in the Tar Ponds will be treated using solidification and stabilization. The top 0.5 metres (m) of remaining contaminated soil at selected areas on the Coke Ovens site will be treated using landfarming, a form of bioremediation.

Both sites will then be capped using engineered containment systems designed to prevent human and environmental exposure to contaminants, and to prevent the movement of contaminants off site. Containment at the Tar Ponds and Coke Ovens sites will consist of groundwater control measures (e.g., vertical walls, interceptor trenches) installed at various locations around the site perimeters, and engineered covers consisting of semi-impervious, reinforced, multi-layered soil barriers designed to limit water penetration and facilitate future site uses.

Wastewater generated during the excavation activities of the Tar Ponds and the drying of the sediments, as well as contaminated groundwater and surface water from the excavations and the landfarming activities at the Coke Ovens site will be treated in an on-site wastewater treatment plant.

Final restoration and landscaping of both sites will be compatible with the natural surroundings and future use. Key features and activities of the construction phase are depicted for the Tar Ponds and the Coke Ovens sites in Figures 3 and 4, respectively. A cross-section through the PCB contaminated sediments at the Tar Ponds site is presented in Figure 5.

The operation phases of the Tar Ponds and the Coke Ovens sites have been defined as the ongoing operation of the remediated sites and the associated elements such as the engineered cap, and systems for surface water and groundwater control, water treatment, and monitoring. The operation is anticipated to extend over several decades.

Containment systems require long term monitoring to ensure their continued effectiveness. The remediation plan includes provisions for long term monitoring of air quality, water quality, soil, sediment, biota, and the performance of the containment system, and long-term maintenance of the sites.

Both the Tar Ponds and the Coke Ovens sites will operate indefinitely. The decommissioning phase for these sites therefore is only relevant for certain operational infrastructure features that will be phased out over time (e.g., groundwater collection and treatment systems).

The proposed remediation of the Tar Ponds and Coke Ovens sites is based on technologies that have been demonstrated to be safe and effective on similar contaminated sites.
# TABLE 1

## Key Project Works and Activities – Tar Ponds and Coke Ovens Sites

<table>
<thead>
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<th>TAR PONDS SITE</th>
<th>COKE OVENS SITE</th>
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<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
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<tr>
<td>1. Control Water</td>
<td>Construct watercourse diversion channels to redirect surface water flowing through the Tar Ponds. This will isolate brooks and streams from contaminated Tar Pond sediments.</td>
<td>Reroute groundwater and surface water flowing through the site to minimize water contact with contaminants.</td>
</tr>
<tr>
<td>2. Remove and Destroy Selected Contaminants</td>
<td>Excavate and dewater 120,000 tonnes (92,000 m$^3$) (ex situ volume) of sediment containing PCB material and destroy the dewatered sediment in an approved temporary incinerator capable of destroying PCB that will be constructed offsite on the former VJ Coal Preparation Plant site.</td>
<td>Excavate 1,300 tonnes (1,000 m$^3$) of PAH contaminated sediment from Coke Ovens Brook and 25,000 tonnes (12,500 m$^3$) of PAH contaminated material from the in-ground tar cell and destroy the excavated material in an approved temporary incinerator that will be constructed offsite on the former VJ Coal Preparation Plant site.</td>
</tr>
<tr>
<td>3. Treat Selected Contaminants In-place</td>
<td>Solidify and stabilize, in-place, the remaining sediment with a binder (such as Portland cement) using on-site mechanical mixing equipment.</td>
<td>Treat, in-place, 253,700 tonnes (128,800 m$^3$) of the remaining contaminated surface soils using bioremediation. Landfarming of the top 0.5 m of contaminated soil will be used to promote biological breakdown of contaminants in surface soils.</td>
</tr>
<tr>
<td>4. Contain Residual Contaminants</td>
<td>Install a containment system designed to reduce human and ecological exposure to contaminants and to prevent the movement of contaminants off-site. The containment system will consist of groundwater interceptor measures (e.g., barrier walls; interceptor trenches) established at various locations around the perimeter of the Tar Ponds and an engineered cap.</td>
<td>Install a containment system designed to reduce human and ecological exposure to contaminants and to prevent the movement of contaminants off-site. The containment system will consist of groundwater interceptor measures (e.g., barrier walls; interceptor trenches) established at various locations around the perimeter of the Coke Ovens site and a soil cover designed to facilitate future site use(s).</td>
</tr>
<tr>
<td>5. Site Surface Restoration and Landscaping</td>
<td>Site restoration and landscaping will be compatible with the natural surroundings and future use.</td>
<td>Site restoration and landscaping will be compatible with the natural surroundings and future use.</td>
</tr>
<tr>
<td><strong>Operation Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Treat contaminated surface and groundwater</td>
<td>Treatment of contaminated groundwater for up to 25 years or as required.</td>
<td>Treatment of contaminated groundwater for up to 25 years or as required.</td>
</tr>
<tr>
<td>3. Repair and Maintenance</td>
<td>Repair of the containment system in the event of localized erosion, drainage failure, etc.</td>
<td>Repair of containment system in the event of localized erosion, drainage failure, etc.</td>
</tr>
<tr>
<td><strong>Decommissioning Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Removal of site infrastructure</td>
<td>Removal and decommissioning of on-site water treatment system;</td>
<td>Removal and decommissioning of on-site water treatment system;</td>
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</table>
Figure 3
Tar Ponds Proposed Remediation Activities

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Figure 4
Coke Ovens Proposed Remediation Activities
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Figure 5
Tar Ponds PCB Sediments to be Excavated
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2.2 TEMPORARY INCINERATOR

Construction, operation, and decommissioning of the incinerator all occur within the construction phase of the Tar Ponds and Coke Ovens sites. The incinerator’s construction phase involves the development of the necessary site infrastructure, and the assembly and commissioning of the incinerator itself and is likely to require about one year. The subsequent operation of the incinerator will be limited to approximately three years. The entire facility and site infrastructure will be removed and decommissioned upon completion of the destruction of contaminated sediments. Once assembled, contaminated sediments from the Tar Ponds and PAH contaminated material from tar cell and Coke Ovens Brook Connector) will be removed and safely destroyed using high temperature incineration. Incinerator works and activities associated with the individual phases are summarized in Table 2.

The temporary incinerator will be located off site on the former VJ Coal Preparation Plant site, outside of Sydney. This site was identified to be the preferred site location for the temporary operation of an incinerator. An additional site located at the Phalen Mine site had been initially identified as being a secondary site to the VJ site and therefore was carried as an alternate through the effects assessment process presented in the EIS Report. The Project description, environmental characterization, and effects assessment presented in this summary focus on the preferred VJ site.

Materials to be incinerated include 120,000 tonnes (92,000 m³) (ex situ volume) of sediment containing PCB materials from the Tar Ponds and 26,300 tonnes (13,500 m³) of PAH contaminated sediment from the Coke Ovens site (Coke Ovens Brook sediment and tar cell contents). The route proposed for the rail transport of contaminated materials from the Tar Ponds and Coke Ovens sites to the temporary incinerator at the VJ site is depicted in Figure 6.

2.3 ENVIRONMENTAL AND HEALTH MANAGEMENT FEATURES

Environmental Management Features and Programs

The Project design includes a series of design features and implementation protocols to avoid, minimize and remediate adverse effects. These environmental management features are planned, pre-emptive measures developed from experience and based on good design practice and in anticipation of likely site conditions and effects.

To ensure that the protection of the environment is managed effectively, a comprehensive Environmental Management Plan (EMP) has been developed by STPA to communicate to all Project participants and stakeholders the commitment and efforts to be undertaken to prevent, manage and minimize any potential environmental impacts related to the Project.
TABLE 2  Key Project Works and Activities – Incinerator

<table>
<thead>
<tr>
<th>WORKS &amp; ACTIVITIES</th>
<th>INCINERATOR</th>
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<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
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<tr>
<td>1. Establishment of site infrastructure</td>
<td>Includes construction of entrance building, gate house, construction storage and lay down, decontamination facility, site office, staff accommodation, site services (water, power, back up power, site services building, maintenance shop)</td>
</tr>
<tr>
<td>2. Assembly and commissioning of incinerator (including)</td>
<td>waste material feed preparation area, waste feed and conveyor system, primary and secondary combustion chambers, waste heat boiler, exhaust and air pollution control systems, energy and control systems, ash handling/disposal system, fuel supply system/line)</td>
</tr>
<tr>
<td>3 Permitting and performance testing</td>
<td>Prior to initiating the operation phase the incinerator will require to be permitted. The incinerator will also undergo extensive performance testing to ensure that it will meet all Project requirements.</td>
</tr>
<tr>
<td><strong>Operation Phase</strong></td>
<td></td>
</tr>
<tr>
<td>1. Operation of Water Collection and Treatment System</td>
<td>Operation of feed storage drainage water collection system and water collection and treatment from ash storage site</td>
</tr>
<tr>
<td>2 Operation of Incinerator</td>
<td>Feed preparation and handling; incineration process</td>
</tr>
<tr>
<td>3 Ash disposal and off-site transport</td>
<td>Ash handling, on-site storage, off-site transport and disposal</td>
</tr>
<tr>
<td><strong>Decommissioning Phase</strong></td>
<td></td>
</tr>
<tr>
<td>1 Decommissioning of Site Infrastructure</td>
<td>Dismantling of utilities, site services, infrastructure and other structural components, if no longer required; incineration of all materials and equipment that cannot be cost effectively decontaminated</td>
</tr>
<tr>
<td>2 Decommissioning of Incinerator</td>
<td>Decontaminating, disassembling of incinerator, loading of components on truck,</td>
</tr>
<tr>
<td>3 Transportation</td>
<td>Transport of incinerator components and waste materials off-site;</td>
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Figure 6
Transport Route to the Temporary Incinerator Site
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The proponent is committed to elaborate on and detail the EMP prior to commencement of the construction phase based on the final Project design. The EMP is considered a dynamic “living” document that will continuously require revision due to site activities, adjustments to the approach, changes in legislation, monitoring results, etc.

The environmental management features together with the EMP and the description of the individual Project works and activities, served as the basis for the effects assessment.

**Health, Safety and Environmental Protection**

A Master Health and Safety Plan (MHASP) will be developed for the site that will cover all phases and elements of the remediation Project. The MHASP will be developed by a health and safety professional to ensure adequate precautions are taken for the protection of workers and the general public. It will include a worker-monitoring program including medical checks before, during, and after completion of the work (i.e. entry and exit level medical examination). These medical checks may include monitoring using biological markers (e.g., blood and urine), as deemed appropriate by the health and safety professional, and in consultation with the Regional Medical Officer of Health. The Plan will be modified over the life of the Project as new information becomes available for improved worker protection.

Each contractor and consultant retained for the Project will be required to submit for review, a Project-specific Health and Safety Plan (HASP) for its workforce, and will be responsible for its implementation. The HASP will meet the requirements of the MHASP. Audits will be completed to ensure compliance with the Project-specific HASP.

The MHASP will identify adequate precautions to be taken for the protection of the general public. It will include a monitoring program and communication plan for providing information to the general public. The Plan will be modified over the life of the Project as new information becomes available.

### 2.4 PROJECT ALTERNATIVES

An extensive alternatives analysis was carried out that led to the selection of the proposed “Project” as defined in the EIS. This included an analysis of the “alternatives to” the Project as well as “alternative means of carrying out” the Project as required by CEAA and the EIS Guidelines.

The analysis of alternatives to the Project established the broad concepts or remediation plans that were considered in the process of developing the Project. The history behind the development of the Project is a long one, with the development and evaluation of remediation alternatives going back to the early 1980s. Based on extensive studies, public and stakeholder consultation, representatives of STPA and Environment Canada agreed on the preferred option to approach and general configuration of the remediation project currently under review... The preferred option represents the proposed Project as described in the EIS.

The evaluation of alternative means, i.e., technically and economically feasible methods of carrying out the Project included an analysis of alternatives to components of the Project. The
process evaluated, for example, different means to control surface and groundwater, techniques
to remove and destroy contaminants, and to contain remaining contaminants. In addition,
alternative incinerator locations were evaluated and alternatives for material handling and
transportation methods and routes investigated. The selected preferred means are presented in
the Project Description of the EIS. They were determined based on technical and economic
feasibility, and environmental considerations.
3.0 PUBLIC CONSULTATION

Public, stakeholder, and First Nation consultation has been an integral component of the overall Project development and the EIS. In 1996, citizens of the Sydney community and the three levels of government formed the Joint Action Group (JAG) to seek consensus around acceptable, safe, and technically sound clean up solutions. The formation of the JAG led to comprehensive consultation with the public and government stakeholders over a seven-year period. Over that period more than 100,000 volunteer hours were spent and over 900 public meetings were held to gather public opinions on what the future remedial options should involve. The JAG activities resulted in the formulation of remedial options addressed and the definition of the Project as described in the EIS.

In addition to the JAG consultation activities, meetings were held with a number of stakeholder groups. The Community Liaison Committee (CLC) representing a wide cross-section of the community of Sydney with an interest the Project was consulted on a regular basis.

Most recently and directly related to the environmental assessment process, a series of consultation activities were undertaken, which involved the following key events:

- release of the draft scoping document to the general public (February 8, 2005);
- publication of a Notice of Commencement (February 8, 2005); and
- public open houses (February 14 to 17, 2005; and November 16th and 17th, 2005).

Communication with the public and information dissemination included media briefings, publication of Notices, the CEAA Public Registry, briefings (CBRM representatives, First Nations Unimaki Institute, non-governmental organizations), direct letter mail outs, and a Project website.

Feedback and comments received over the course of the consultation process were reviewed and used to refine the scope of the assessment and the Project design. Public input was summarized and documented in the EIS report.

Consultation with First Nations is ongoing and with an objective to identify Mi’kmaq environmental concerns and Mi’kmaq ecological knowledge and integrate the findings with the EIS. For this purpose, a Mi’kmaq Ecological Knowledge Study (MEKS) is currently in progress.

Federal and provincial officials have also regularly met with officials of the Membertou First Nation since the signing of the MOA, with an objective to assist First Nations' economic participation in the Project. A Protocol Agreement, was negotiated which will serve as a guide and consider respective interests. First Nation communities in Cape Breton have appointed Membertou as their representative in discussions with Canada and Nova Scotia.
4.0 ENVIRONMENTAL ASSESSMENT METHODOLOGY

The environmental assessment scope and methodology for the Project have been developed to satisfy regulatory requirements of a Joint Panel Review under CEAA and the provisions of Part IV of the Nova Scotia Environment Act and Environmental Assessment Regulations. In particular, the EIS is intended to comply with the Joint Agreement and EIS Guidelines developed for the Panel Review.

Key steps of the approach to the environmental assessment process include:

- assembling Project baseline information, including a clear description of the proposed Project;
- establishing the scope of the assessment; and
- assessing the potential environmental effects of the Project.

4.1 BASELINE INFORMATION

Assembling Project baseline information on the existing environment included the review of the extensive existing databases, reports, and studies directly relevant to the Project site. Where the existing data were considered inadequate for the effects assessment, the information was supplemented with the team’s own field data collection. Field data collection involved such activities as habitat, vegetation and bird surveys, fish surveys, tissue sampling, noise and air quality monitoring, and odour sampling. In addition, numerous interviews were conducted with government and municipal representatives to obtain up-to-date information on socio-economic issues, such as land use planning objectives, property value, infrastructure, and economic development. Consultation activities with the public at large and First Nations were also utilized to solicit information on the study area.

A comprehensive Project description was generated based on preliminary Project designs of STPA. Further, consultation efforts with regulators, stakeholders, the public at large, and First Nations were used to refine the Project design.

4.2 SCOPE OF THE ASSESSMENT

The scope of the assessment was established early in the process based on preliminary research on the Project area, the EIS Guidelines, regulatory requirements, consultations with regulators, stakeholders, the public at large, and First Nations.

The components of the Project to be subject of the assessment were determined to include the three Project phases (i.e., construction, operation, and decommissioning) and the associated works and activities and possible malfunctions and accidents relevant to the environment.

Potential Project-environment interactions were identified and with input from the consultation process, Valued Environmental Components (VECs) were established for the biophysical and socio-economic environments:
Biophysical VECs:

- Air Quality
- Acoustic Environment
- Groundwater Quality and Quantity
- Surface Water Quality and Quantity
- Soil and Sediment Quality
- Terrestrial Wildlife, Habitat, Vegetation
- Species at Risk
- Freshwater Habitat and Biota
- Marine Habitat and Biota

Socio-Economic VECs:

- Human Health
- Community Health and Well Being
- Public Safety
- Labour and Economy
- Property Values
- Land and Resource Use
- Aboriginal Land and Resource Use
- Infrastructure and Services
- Transportation Infrastructure
- Commercial Fisheries Resources

The VECs served to focus the inventory and effects assessment to focus on key environmental features and issues.

In addition, the scoping established other key aspects to be included in the assessment, such as the analysis of potential cumulative effects (i.e., effects that could occur as a result of the subject Project acting together with other present or future projects), effects of the environment (e.g., adverse weather) on the Project, and effects on the sustainability of natural resources.
5.0 DESCRIPTION OF THE PAST AND EXISTING ENVIRONMENT

The Sydney Tar Ponds are essentially the Muggah Creek Estuary, which empties into the South Arm of Sydney Harbour. They consist of the North and South Tar Ponds and adjacent shoreline areas. The watershed is approximately 1.8 km long from its mouth at Battery Point to the headwaters in Wash Brook. The widest points in the North and South Ponds are 200 m and 400 m, respectively.

The North Pond is bounded to the north by Sydney Harbour, the east by the East Shoreline and the Sydney Steel Corporation (SYSCO) Steel Plant, the south by the Ferry Street cofferdam, and to the west by the West Shoreline and the rail yards. It is an estuary flowing into Sydney Harbour and is susceptible to tidal action and is mainly saline. Water depths are relatively shallow, averaging less than 0.5 m below geodetic datum, and a maximum depth of 1.7 m below geodetic datum at the entrance to Sydney Harbour.

The South Pond is bounded to the north by the Ferry Street cofferdam, to the east by Coke Ovens Brook and the East and Southeast Shoreline areas, the south by Wash Brook, and the west by the West Shoreline area. The Ferry Street cofferdam is used to control water levels within the South Pond and prevent contaminated sediments from migrating into the North Pond. Coke Ovens Brook and Wash Brook are the two main freshwater sources that drain into the South Pond. Other freshwater sources include, storm water drainage, and groundwater recharge from surrounding areas. The pond is periodically influenced by tidal action when the control weir is lowered.

The Coke Ovens site is a 68 ha site, upstream of the Tar Ponds, situated in the Coke Ovens Brook watershed.

The VJ site, selected for the temporary operation of an incinerator facility, is located approximately 5 km to the east of Sydney, Nova Scotia. The site had previously included a coal preparation plant and related stacking and transfer facilities, a large waste rock pile, a lifting and banking centre, as well as various offices, coal lab, shops and warehouses in the immediate proximity of the plant. Many of these structures have now been decommissioned. There are no mine workings associated with this site.

5.1 BIOPHYSICAL ENVIRONMENT

Air Quality and Acoustic Environment

For more than 100 years, the Sydney area airshed has been impacted by air emissions from the production of steel at the former SYSCO site. Significant air emissions were generated in particular from the coking process at the Coke Ovens site. In 1988, after the closure of the coking operations significant improvements to air quality in the Sydney area were recorded. Current air quality conditions are well documented based on an ongoing ambient air monitoring program (AAMP) initiated in 2001. The program monitors total suspended particulate (TSP), metals, particulate matter (PM) (PM$_{2.5}$ (less than 2.5 microns) PM$_{10}$ (less than 10 microns)), polycyclic aromatic hydrocarbons (PAHs) and Polychlorinated byphenyls (PCBs) and volatile organic compounds (VOCs). Information on other commonly measured indictors of air quality
such as sulphur dioxide (SO₂), nitrous oxides (NOₓ), ozone and greenhouse gases were obtained for the incinerator site through the study team’s own air quality monitoring. Air quality near the Project sites is generally good. Emission standards specifically established for the site, have only been occasionally exceeded for short periods of time during demolition and other clean up activities.

A noise monitoring program was conducted which established baseline noise data around the Tar Ponds and Coke Ovens sites, and the former VJ Preparation Plant and Phalen Mine. Recorded noise levels rarely exceeded Provincial guidelines.

**Groundwater**

The Tar Ponds and Coke Ovens sites are associated with four hydrostratigraphic units (HU) which control the physical and chemical characteristics of the groundwater flow system: the Canso HU, Lower Morien HU, Upper Morien HU and Basal Till HU. Each of the Project sites has additional localized HU’s. The groundwater characteristics within the HUs have been very well document through previous studies and no additional fieldwork was undertaken as part of the EIS.

Contaminants resulting from historic industrial activities are present in various HUs and include metals (e.g., mercury, selenium, cadmium, aluminum, barium, arsenic), organics (e.g., benzene, toluene, ethylbenzene, xylenes (BTEX), PAH (naphthalene, and benzo(a)pyrene)), tar and dissolved petroleum hydrocarbons.

Groundwater flow conditions have been described based on monitoring well records and, for part of the sites, also based on numeric modelling. Chemical analyses and flow investigations identified the likelihood of Dense Non-Aqueous Phase Liquids (DNAPL) Phase Transport in several locations. The numerical model suggests much of the groundwater from the vicinity of the Coke Ovens site discharges into Coke Ovens Brook or its tributaries (Cagney, Domtar, Whitney Pier, Frederick Brooks). In the immediate vicinity of the Tar Ponds, groundwater flow is expected to be towards the Tar Ponds, which is a groundwater discharge point and away from nearby residential properties along the fringes of the Ponds. No human-caused groundwater withdrawals presently take place within the Project site boundaries other than for monitoring purposes.

Groundwater characteristics have also been described for the VJ site on the basis of monitoring well records. Bedrock groundwater flow generally follows surface gradients. The analysis of the groundwater chemistry reveals concentrations of various substances (e.g., modified total petroleum hydrocarbons (TPH), PCE, PAH, arsenic, cobalt, copper, zinc) exceeding government guidelines for groundwater resources.

**Surface Water, Sediment Quality**

The drainage area of Muggah Creek is comprised of two sub-watersheds, Coke Ovens Brook (10.3 km²) and Wash Brook (12.2 km²). The Wash Brook Watershed comprises the southern portion of the Muggah Creek Watershed and drains an urbanized portion of Sydney. Since the Wash Brook Watershed was determined to have no contaminant sources other than urban runoff, hydrological studies have been concentrated within the Coke Ovens Brook watershed.
Both Coke Ovens and Wash Brooks empty into Muggah Creek (i.e., North and South Tar Ponds), a tidal estuary, which then empties into the South Arm of Sydney Harbour. A total of seven tributaries drain into Coke Ovens Brook. As part of preventative works that will be implemented prior to the Project, Coke Ovens Brook is being re-aligned in two channels in order to accommodate the remediation of the Coke Ovens site and the existing Coke Ovens Brook bed.

Streamflow data are available from numerous monitoring stations and detailed hydrologic simulations using the HEC-1 and SWMM numerical models were undertaken for Coke Ovens Brook upstream of Victoria Road as part of the design for the re-aligned channels.

To characterize groundwater-stream interaction (GWSI) along the Coke Ovens Brook, data from several GWSI sites were reviewed. In general, there are a variety of localized gaining (effluent) and losing (influent) reaches within stream channels and underdrains over the Coke Ovens site. These conditions change with hydrological conditions.

Water chemistry is characterized through data collected at sites within the Coke Ovens Brook watershed through a Phase II/III Environmental Site Assessment (ESA) conducted prior to the EIS. Analysis included up to 124 inorganic, organic, physical and calculated parameters supported on select samples by 50 radiological parameters. The most heavily contaminated reach of Coke Ovens Brook is the central core channel between the Municipal Ash Industrial Disposal (MAID) site and Victoria Road, the section that the re-aligned channels will isolate. The analyses of Coke Ovens Brook sediments support the water analyses and reveal the highest contamination levels in the same reach.

Information from existing reports has been used to characterize the hydrology at the VJ site. The VJ site is positioned mid way down the Bridgeport Basin immediately below Grand Lake and drains northward. The basin discharges into a tidal estuarine environment some 6 km northeast of the VJ site. Contamination in Northwest Brook, below Grand Lake, is a concern due to historic contamination from coal washing activities and continuous acid drainage from an abandoned waste rock pile.

**Soil**

As part of Phase II/III ESAs conducted for the Project sites, 407 surface soil samples over the Coke Ovens site were analysed for Metals, Petroleum Hydrocarbons and PAHs. Indicator parameters included arsenic for metals and TPH for organics. The analysis identified exceedances of guideline criteria and concentrations elevated over background levels for a number of contaminants.

As part of the same studies a background surface soil sampling program was undertaken which provides a reference for the geochemistry of near surface soils outside of the Coke Ovens/Tar Ponds Project site. The sampling program was designed around assessing “surface soils” (0-5 cm) depth and “subsurface soils” (5-30 cm depth), the key geological material which local residents will be exposed to and which steel plant/coking operations will initially impact. Samples were analyzed using Canadian Council of Ministers of the Environment (CCME)
guidelines for environmentally available constituents. Soils were analyzed for 24 metals, 20 PAH compounds and five TPH compounds.

Within North Sydney the top five metals in order of decreasing average concentrations were iron (25,000 mg/kg), aluminum (12,000 mg/kg), manganese (770 mg/kg), lead (150 mg/kg) and zinc (120 mg/kg). Arsenic was also detected at 28 mg/kg. Of the average total PAH (5.4 mg/kg) the top five compounds included fluoranthene (1.3 mg/kg), phenanthrene (1.1 mg/kg), pyrene (1.0 mg/kg), chrysene (0.57 mg/kg) and benz(a)anthracene (0.52 mg/kg). Naphthalene and benz(a)pyrene were also detected at 0.18 mg/kg and 0.45 mg/kg respectively.

Terrestrial Environment and Species at Risk

Terrestrial habitats on the Coke Ovens site have been described as shrub thickets, meadows, or swales. The native species present on the site are for the most part characteristic of disturbed early successional stages. The shoreline of the Tar Ponds is vegetated with typical tidal shore vegetation including samphire (Salicornia europaea), sea-blite (Suaeda maritima) and narrow-leaved atriplex (Atriplex littoralis)

Plant surveys identified a total of 223 species identified in the study area including. Of these, a total of 77 species are characteristic of wet to damp habitat reflecting the relatively high water table in the area. Approximately 45% of species found were exotic species (non-native). This high proportion of exotics is attributed to the highly disturbed nature of the Project Site.

Twenty-four species of birds were identified at the Coke Ovens site. The most abundant were American crows and common ravens. A total of 24 species of water birds fed and rested at the Sydney Tar Ponds. The Tar Ponds provided over wintering habitat for American black ducks, gulls, and crows and summer breeding habitat for American black ducks, killdeer, and song sparrows. Species diversity was greatest in the fall (15 species) when there was an influx of migrating shorebirds.

Several species of mammals were recorded at the Project Site including such species as red fox (Vulpes vulpes), muskrat (Ondatra zibethicus), meadow vole (Microtus pennsylvanicus), norway rat (Rattus norvegicus), river otter (Lutra canadensis), coyote (Canis latrans), house mouse (Mus musculus); and white-tailed deer (Odocoileus virginianus).

Habitat and breeding bird surveys were conducted for the VJ incinerator site. The abandoned industrial site is dominated by bare ground variably vegetated by grasses, shrubs, and herbaceous plants which commonly occur in waste areas and roadsides. Terrestrial habitats within the site vicinity include shrubswamp wetland; a watercourse (Northwest Brook) including riparian marsh wetland; immature to mature mixed forest communities; and other highly disturbed or residential areas.

No species at risk, or endangered species of plants or animals or other species of special conservation status have been regularly observed in the Tar Ponds or Coke Ovens area or within the VJ incinerator site boundaries.
Freshwater Environment

Coke Ovens Brook is a small freshwater stream that has been altered by the extensive industrial development along its banks. The Sydney Landfill, which is located upstream from the Coke Ovens site, may also affect water and sediment quality in the reach located on the Coke Ovens site. Fish species observed included mummichog (*Fundulus heteroclitus*). The condition of the fish found varied from apparently healthy fish to fish with obvious tumors and black spot disease.

Spawning and rearing areas for mummichogs and brown bullhead (*Ictalurus nebulosus*) have been observed in the South Pond of Muggah Creek. It is likely that ninespine stickleback spawn in tributaries to Coke Ovens Brook. American eel (*Anguilla rostrata*) were also observed in South Pond. Due to the barrier created by the cofferdam between North and South Ponds, there is no access for diadromous fish species into South Pond and Coke Ovens Brook from Sydney Harbour.

No species at risk, or endangered species or species of special conservation status have been regularly observed in the area. A benthic macroinvertebrate survey of the Coke Ovens Brook revealed that benthic communities were dominated by species characteristic of degraded environmental conditions.

The VJ site is situated within the Bridgeport Basin Drainage Area, on the divide between the Grand Lake sub-watershed and the lower Northwest Brook sub-watershed. Surface drainage at the VJ property drains into the Northwest Brook system and Grand Lake.

The fish community in Grand Lake is expected to include such species as brook trout (*Salvelinus fontinalis*), gaspereau (*Alosa pseudoharengus*), lake whitefish (*Coregonus clupeaformis*), golden shiners (*Notemigonus crysoleycas*), blacknose shiner (*Notropis hererolepis*), lake chub (*Couesius plumbeus*) and creek chub (*Semotilus atromaculatus*).

Northwest Brook is a slow-moving, cobble and gravel watercourse. One of its tributaries drains Grand Lake, and passes around the VJ site. Contamination related to the storage of coal waste at the VJ site (acidic drainage) is evident in the water and sediment. Fish typical of slow-moving waters may be present. Gaspereau would also be present during the spring spawning run and later in the season as juveniles emigrate to sea. Fish tissue sampling and analyses conducted for Grand Lake identified exceedances of CCME tissue guidelines for mercury and indicated the presence of PCBs.

Marine Environment

Sydney Harbour receives freshwater from the Sydney River, stormwater runoff, sewer outlets, and several smaller watercourses. Sydney River, the main source of freshwater at the head of the South Arm, has an average annual flow 6.1 m³/sec. Muggah Creek is the second largest natural freshwater source, which discharges into the South Arm.

The lower reach of Muggah Creek is divided by a weir into two sections. This barrier separates the distinct marine/estuarine environment at the mouth, referred to as North Pond, from the
upstream freshwater environment referred to as South Pond. Earlier contaminant studies refer to Muggah Creek, often without distinguishing between the two.

Like many industrial ports Sydney Harbour is impacted by organic loading, metallic and organic contaminants and bacterial contamination. Pollution is quite severe due to the contaminants from the Sydney Tar Ponds, particularly PAH, PCB, metals and other chemicals. Sydney Harbour has been a receiving environment for pollutants from untreated sewage, major industries and commercial activities, and many smaller point and non-point sources.

In the North Pond sediments, the presence of a wide variety of chemical compounds have been documented through numerous studies. The PAH-impacted sediments generally appear to be co-contaminated with heavy metals, PCBs, and petroleum hydrocarbons. Analysed samples had PAH constituents that exceeded CCME Sediment Quality Guidelines by a factor of 3.3 to over $9.5 \times 10^5$ times. Concentrations of PCB exceed CCME Sediment Quality guidelines by up to a factor of 9. Metals are present in North Pond sediments at concentrations exceeding CCME Sediment Quality Guidelines at various depths by factors ranging from 1.2 to 20.3 times guideline limits.

Water quality in Sydney Harbour has been characterized based on existing studies and reports and contaminant flux from Muggah Creek to Sydney Harbour has been assessed by Jacques Whitford, Dillon Consulting, ADI Limited, CBCL Limited (JDAC) as part of Phase II/III ESA investigations. The water quality results indicated that metals were present in the water, but concentrations were generally below CCME Marine Aquatic Life Guidelines. PAHs were widely present in the water, and the concentrations reported exceeded CCME Marine Aquatic Life guidelines by factors between 1 to 404 times. Naphthalene concentrations ranged from 0.0001 mg/L (milligram per litre) to 0.01163 mg/L. PCBs were undetected.

At the North Pond, analysis results indicate that metals were present in the water at concentrations below CCME Marine Aquatic Life Guidelines. PAH parameters were detected. Of these, naphthalene was exceeded by a factor of 3. PCBs were detected at a concentration of 1.2 µg/L.

There are three basic marine habitat types in Sydney Harbour: (1) rocky shore and subtidal habitat; (2) pebble/gravel habitat; and (3) soft bottom habitat. Associated marine biota including benthic communities, marine fish, and marine mammals are described based on literature sources. Elevated concentrations of PAHs in biota have been reported for about two decades and have been confirmed through more recent studies.

Sediments in Sydney Harbour are highly toxic to biota, particularly many organisms living in sediments. Based on results from biotoxicity tests, sediments in most areas of the harbour are very likely harmful to benthic communities and biological productivity, especially in the South Arm.
5.2 SOCIO-ECONOMIC ENVIRONMENT

Community Health

Within the CBRM, numerous health and wellness facilities, services, and programs exist. The Cape Breton District Health Authority administers most of the health facilities, programs, and services and delivers services comparable to other Nova Scotia District Health Authorities.

Community health in Cape Breton when compared to Nova Scotia and the rest of Canada reveals notable differences. This includes the demographics, health status, and income. The size of the population within CBRM is continuously decreasing. The health status of the population is generally considered lower and the average income much less than reported for Nova Scotia.

Several studies have determined that there are no immediate health risks for residents near the Tar Ponds and Coke Ovens sites. Despite this fact, surveys demonstrate that local residents perceive the existing environmental conditions as posing a risk to their personal health. This is particularly the case for residents in the immediate vicinity of the Project sites.

The perception of health risks includes the proposed works and activities of the Project. A survey by Nova Scotia Public Health Services reported that 48% of respondents thought that clean up activities would pose health risks; 29% thought it would pose no risks and 22% did not know. Furthermore, 67% of the interviewed representatives of health authorities were concerned that the clean up would pose health risks. About 71% of those surveyed believe that the potential release of contaminants into the environment during clean up will cause problems. Public consultation has confirmed these concerns and demonstrated the public’s desire to minimize all health risks and maximize long term benefits to the community.

Economic Conditions (Labour, Property Values, Commercial Fisheries)

The economy of Cape Breton Island overall, and more specifically the CBRM, has historically been associated with industrial activities such as steel production and coal mining. Other major industries have included fisheries. These economic activities had a major influence on population levels and migration patterns in the region. The closure of the coal and steel industries led to economic decline and population losses, which have been more pronounced since the early 1990s, coinciding with the decline in some key sectors of the economy. Currently, there is an effort to diversify the local economy in particular in sectors such as tourism, telecommunications, and service-based industries.

About 22,500 jobs have been lost due to declines in the coal and steel industries in Cape Breton over the last three decades, in addition to an estimated 2,300 jobs lost as a result of the closure of the groundfish fishery. On the positive side, approximately 3,500 jobs have been added to the economy recently as a result of new employment in the service and retail sectors. This has lead to a transition of the economy from the secondary industry to the service industry through the emergence of other employers, for example, call centres, large box stores and software development companies.
The CBRM has the highest percentage of individuals on Cape Breton Island with a university certificate, diploma, or degree, but it is lower than for Nova Scotia as a whole. It has the second and third highest percentage of individuals, respectively, with a high school graduation certificate and/or some postsecondary, which is higher than for Nova Scotia as a whole. However a relatively low percentage of individuals in the CBRM and Victoria County have with a trades certificate or diploma.

The employment rate for the CBRM is approximately 15% less than for Nova Scotia as a whole. The CBRM has a higher employment rate than Richmond and Victoria Counties, but a lower rate than Inverness County. The unemployment rate for the CBRM is below the other three counties on Cape Breton Island, but 8.5% above that of Nova Scotia.

In the CBRM and counties, employment income constitutes a lower proportion while government transfers constitute a greater proportion of total income than in Nova Scotia as a whole. Primary industries (fishing, farming, mining) are more significant to CBRM than to both the province as a whole and Cape Breton County while the importance of secondary industries to Cape Breton and CBRM are less than the province as a whole. A high percentage of people work in business, finance and administration, health, social science, education and government, sales and service, and trades, transport and equipment operators.

**Land Use**

The Tar Ponds and Coke Ovens sites are in an area formerly used for industrial purposes. A large portion of the lands, including the Project Site is currently vacant and undergoing remediation work. Neighbouring uses are very diverse and include residences, schools, and commercial buildings, the Sydport/SYSCO Industrial Park Zone, the Battery Point sewage treatment plant, a railway yard, and a number of warehouses.

The revitalized waterfront area and the Sydney marine terminal are located to the west of the Project site. The historic residential area of North End of Sydney is situated immediately to the west of the Tar Ponds. It includes some residences and churches that date back to the founding of Sydney in the 1780s. The Sydney downtown core, located within two km of the Tar Ponds, is dominated by commercial land uses.

The Coke Ovens site has a special land-use classification, as the Coke Ovens site Reserve Zone. The Tar Ponds are designated as part of Industrial Park Zone.

The VJ site is located in a rural area. The abandoned former coal preparation plant site is currently not serviced with municipal water and sanitary sewer services. Council has designated this site for industrial business/regional utility/regional tertiary service industry uses.

**Aboriginal Land and Resource Use**

The documentation of the Aboriginal Land and Resource Use within the Project area is being conducted as part of a MEKS. The MEKS is ongoing and was commissioned by STPA to assess the potential impacts of the proposed Project on Mi'kmaq land and resource use. To ensure this study meets the interest of First Nation communities, STPA engaged the services of
Membertou Geomatics Consultants to undertake this work. Upon completion, the results of the MEKS will be made available to the public.

Infrastructure, Services, Transportation

Areas near the Tar Ponds and Coke Ovens sites are serviced by municipal water supply. An interceptor sewer line was installed in 2002-2003 to intercept sewage flowing into the Tar Ponds, Wash Brook and Coke Ovens Brook, and redirect wastewater to the new municipal treatment plant at Battery Point, in Sydney's North End.

The CBRM operates one municipal landfill site located off Grand Lake Road. The site is about to be closed and developed into a waste transfer and compost facility.

Tar Ponds, Coke Ovens and VJ incinerator site are serviced by public roads. All three sites are also accessible via existing rail spurs.
6.0 ENVIRONMENTAL EFFECTS ANALYSIS

Environmental effects were assessed for each of the identified VECs. The assessment involved a review of all relevant Project works and activities and a determination of potential adverse or beneficial effects on the VEC. The predictions were based on quantitative air dispersion modeling, contaminant flux modeling, human and ecological risk assessments, economic modeling and comparison of effects predictions against applicable guidelines or standards, where possible. Further, qualitative assessments were applied based on professional judgment, experience with similar projects, and interviews with government representatives and stakeholder groups.

Where potential for significant adverse environmental effects were identified, mitigation measures were developed to avoid or reduce the effect. Considering these mitigative measures, the significance of the residual adverse effect, if any, was determined. The assessment of the significance was based on five criteria including: (1) magnitude of the effect, (2) geographic extent, (3) duration/frequency, (4) reversibility, and (5) ecological / socio-economic context.

6.1 BIO-PHYSICAL ENVIRONMENT

Air Quality

There are several stages involved in the remedial activities of the Tar Ponds and Coke Ovens sites. These stages included excavation, solidification/stabilization, groundwater treatment systems, landfarming, cover material installation, and incineration. Each of these activities has potential to affect air quality whether by fugitive dust, VOCs, semi-volatile organic compounds (SVOCs), metals, odours, etc.; however significant impacts on air quality are not likely.

A component report has been prepared which quantifies airborne emissions and their air dispersion characteristics. Predicted maximum ground level concentrations of the contaminants at various select residential locations that represent potentially sensitive receptors were produced using air dispersion modeling. Further, maximum predicted ground level concentrations of diesel exhaust and its constituent contaminants (CO, NOx, PM$_{10}$, and SO$_2$) for 1-hour, 24-hour, and annual average intervals were generated.

Exceedances of applicable standards or guidelines were identified only for some activities during the construction phase and include contaminants emitted due to diesel exhaust, the maximum ground level concentration for the 24-hour period for naphthalene, and short-term odour thresholds for naphthalene and other VOCs.

Air dispersion modeling was conducted for the normal operating mode for the proposed incinerator. The predicted maximum ground level concentration of the criteria pollutants were determined and compared against the standards. No exceedances of any acceptable ground level concentrations are predicted once an acid control system is applied to reduce acid gas emissions during incinerator operation.
Additional mitigative measures were developed and include such measures as application of dust suppressants, covering of surfaces, the use of enclosures, paving of construction roads, and installation of dirt traps. Provided the recommended mitigative measures are executed, no significant adverse residual effects on air quality are likely to occur.

**Acoustic Environment**

The construction phase of the Project will generate noise at levels of concern in the immediate vicinity of construction activities (i.e., Tar Ponds, Coke Ovens, incinerator site). With respect to the Coke Ovens site, construction activities will require conventional moving equipment such as dozers, compactors, smooth drum rollers, excavators, dump trucks, water trucks, graders, and scrapers. Activities at the Tar Ponds will use similar heavy equipment with the addition of cranes, conveyors, pile drivers and excavation equipment to remove sediments.

The incinerator will be pre-assembled upon arrival to its site; but some heavy equipment will also be required to prepare the site and erect some of the facilities.

It is likely that construction activity will result in the detection and identification of certain noise outside of the Project construction area. Pile driving and excavation is of specific concern and mitigation by use of lower noise technology (e.g., vibratory drivers) and other measures as necessary is particularly important. Noise monitoring will be conducted during construction with response to exceedances of guidelines and/or persistent complaints.

Other noise generating activity at the site is likely to yield little or no impact beyond the site. Truck and train traffic will be monitored with mitigative measures applied (e.g., review of routing, berming) as necessary.

Recommended mitigative measures include such measures as scheduling of activities, shielding through acoustic blankets, use of a vibratory driver (as opposed to a diesel hammer), traffic management, and employment of “smart alarms”. Considering the implementation of these measures, no significant adverse residual environmental effects on the acoustic environment are likely to occur.

**Groundwater**

The principal approach to the remediation of the Tar Ponds and Coke Ovens sites relies on excavation and destruction of some of the contaminants, and the isolation and containment of remaining contaminants. This will result in reduced exposure of groundwater and surface water to contaminants. Contaminated groundwater will also be collected and treated in an engineered water treatment plant. Therefore, the Project is expected to overall have extensive and long lasting beneficial effects on the groundwater VEC within the Project sites and beyond.

Potential for adverse effects have been identified with respect to some individual Project works. In particular, the installation of linear groundwater controls systems (e.g., barrier walls) in some locations, could lead to localized mounding of groundwater and changes in the groundwater flow field. However, effective mitigation measures (e.g., purge well or French drain systems) are available to avoid and minimize any such effects. Groundwater monitoring and modeling during
the construction and the operation phase will be conducted and will trigger the implementation of mitigation measures, should the need for such measures be identified. Consequently, no significant adverse residual effects are anticipated.

For the construction, operation and decommissioning of the temporary incinerator also no significant adverse residual effects on the groundwater VEC have been identified. Construction and decommissioning phases will include standard precautionary environmental practices as defined in the Project’s EMP. The operation phase is relatively short and associated with emission levels that are too low to cause significant adverse effects on groundwater resources at or near the incinerator site. At the VJ site, the water supply will likely be from a well. Groundwater modeling will be conducted and supported by monitoring. If necessary, appropriate corrective action will be taken to ensure that effects of overlaps with dewatering cones of groundwater collection and treatment systems established at the site will be insignificant.

**Surface Water, Sediment Quality**

The effects assessment for the Surface Water VEC analyzed potential effects of the Project works and activities on:

- the North and West re-aligned Coke Ovens Brook channels, which have been designated and designed for fish habitat;
- Coke Ovens Brook downstream from the confluence with the re-aligned channels; and
- the constructed channel through the Tar Ponds.

For the Coke Ovens and Tar Ponds sites, the Project is designed to remediate and improve an existing level of contamination in surface waters. Therefore, similarly to the Groundwater VEC, the overall effects of the Project on the Surface Water VEC are positive, long lasting and affecting all surface water resources within the Project site boundaries and beyond. Potential adverse effects relate to temporary and localized effects that could be caused by individual remediation works and activities. Key concerns relate to the potential re-contamination of “clean” new channel environments from discharges of the on-site treatment plant. Also, a reduction in baseflow may occur as a result of groundwater pumping, reduced infiltration upon completion of the proposed cap and changes to the groundwater flow.

Numerous project-inherent effects management measures have been developed to address these potential effects. For example, during construction, the positioning of sheet pile cofferdams around the excavation area will reduce the opportunity for suspended contaminated sediment from being introduced into the new channels. Further, treatment systems will be designed so that discharge quality of effluent meets requirements of the *Fisheries Act*, CCME guidelines for aquatic environments, or site-specific risk based standards agreed upon by the regulators.

Reduction in groundwater-stream interaction (baseflow) is expected to be minimal. Groundwater removed will be treated and then re-introduced to the channels. In addition the primary baseflow component is derived from the upgradient watershed through the re-aligned channels.
To avoid channel contamination from surface run-off, contaminated or potentially hazardous materials will be stored in designated locations and either enclosed or equipped with drainage systems linked to the Project treatment facility. Complementary to the effect management measures built into the Project design, monitoring will be conducted to verify the effectiveness of the designs and treatment systems. Considering these measures, adverse residual effects on surface water, if any, are expected to be short lived and localized and thus not significant.

**Soil**

As part of the assessment, effects of the Project on “soil” were analysed. This assessment focused on the top 5-15 cm below the root mat, where vegetation exists. Although sampled and classified as “soil”, for most of the Project sites and surrounding urban areas the natural soil horizon has been removed and replaced with various forms of fill augmented with airborne dry fallout.

Due to the nature and purpose of the Project, its works and activities are expected to have generally large scale, long lasting beneficial effects on the Soil VEC within the Project site boundaries and beyond. Potential for adverse effects relate primarily to the potential for localized recontamination of clean surface soils of the cap material through short-term deposition of contaminants during excavation, material handling, landfarming and during the operation of the incinerator.

To identify and quantify potential adverse effects, risk calculations for human and ecological receptors were conducted. The calculation determine deposition rates for airborne contaminant and subsequently risks through exposure along pathways such as inhalation, ingestion, and dermal contact. The results of these calculations reveal that risks associated with these depositions remain below any levels of significance. To confirm the effect predictions monitoring of emissions and deposition rates and surface soil concentrations will be undertaken. With these measures in place, no significant adverse environmental effects for surface soils are predicted.

**Terrestrial Wildlife and Vegetation**

During the course of the construction phase all vegetation within the Coke Ovens site will be removed. The Tar Ponds as habitat for waterfowl will be permanently filled. The assessment analysed these effects in detail and concluded that, overall and despite the habitat removal, no significant adverse effects on wildlife and vegetation are anticipated.

At the Coke Ovens site, upon completion of the landfarming and final cap construction, the site surface will be “clean” and revegetated and will no longer represent a risk for wildlife and vegetation to contaminated soils. In the absence of final site use plan, it is unknown what amount of vegetated area will be available in the future within the Project site boundaries. Currently, much local wildlife utilizing the site is exposed to contamination from the site. Therefore, following completion of Project activities, it is expected that any revegetated areas will provide improved habitat qualities compared to the current conditions. In order to minimize adverse effects from habitat loss, it is recommended that an approach be adopted for integrating habitat development into the end use planning process. Considering the beneficial
effects overall and the potential recreation of some habitat, the overall effects of habitat loss for wildlife and vegetation is considered insignificant.

The possibility that wildlife populations may be affected by uptake of PCB’s, PAH’s, or metals during landfarming activities was considered in an ERA. Results of the ERA indicate some potential for effects on insectivorous bird species from this source. However, the ERA calculations are extremely conservative and significant effects are not likely.

The solidification /stabilization of most the Tar Ponds site affects a staging area for migratory birds (mainly waterfowl) and nesting area (along the shoreline) for some common duck species. Suitable staging area of similar quality throughout the South Arm and Sydney Harbour is abundant both locally and regionally for species that utilize the Tar Ponds site. This, together with the reduced risk of exposure to contaminated habitat and food sources, is considered to render the overall effects of the Project on migratory birds and habitat insignificant.

Given the limited existing vegetation cover at the VJ site, habitat removal and its effects on wildlife and vegetation are considered to be negligible. The possibility that wildlife or vegetation may be affected by the operation of the temporary incinerator through deposition by air emissions was analyzed with the help of an ERA. The ERA considered deposition of air borne contaminants from the incinerator near the incinerator site and subsequent exposure of wildlife and vegetation through pathways such as root uptake, leaf deposition, and ingestion. The results of the ERA indicate that there will be no significant adverse effects on vegetation or wildlife from incinerator emissions.

**Species at Risk**

Species at risk are not expected to be directly encountered during Project activities; therefore no residual adverse effects are anticipated. Based on the results of the ERA, it was concluded that there will also be no measurable residual effects on bulbous rush. This plant species of special concern was identified in close proximity to the VJ site. Consequently, mitigation measures are not required.

**Marine Environment**

The construction phase of the Project will result in two main environmental effects: loss of marine habitat due to the infilling of the North Tar Pond, and improved habitat quality and biotic diversity in Sydney Harbour due to a decrease in contaminant loading from the Tar Ponds and the Muggah Creek and Coke Ovens Brook watershed.

The loss of habitat relates to a highly degraded estuary, with a degraded habitat quality and poor fauna and flora. It is not considered critical habitat for marine biota, and there are no rare or unusual biota described in this area. During the construction phase of the Project, this heavily contaminated estuarine environment of North Tar Pond (~24 ha) will be completely replaced with a terrestrial environment. Although the North Tar Pond will no longer be a marine environment, it will be removed from being a chronic source of contamination to Sydney Harbour.
To investigate the beneficial effects of the Project, i.e., decreased contamination in Sydney Harbour, contaminant fate modelling was undertaken for selected chemicals of concern (CoCs). The modelling approach that was followed was based on results of a previously conducted mass balance model, with the aim of predicting the effects of contaminant release from Muggah Creek on the marine habitat of Sydney Harbour, prior to the Project, during construction and after remediation during the operational phase of the Project.

The model indicates that sediment, concentrations after Project completion are likely 10% to 30% of current concentrations. Overall, the loss of the North Tar Pond estuary during the construction phase of the Project will lead to a long-term improvement in the ecological health and integrity of Sydney Harbour. Given the predicted improvement in the productive capacity of fish habitat in Sydney Harbour it has been determined that the proposed Project does not require an authorization under the *Fisheries Act*. Instead, the Federal Fisheries and Oceans Canada (DFO) considers the Project as a remediation/rehabilitation project which will result in a net improvement to fish habitat. Therefore, the study team concluded that the Project will cause no significant adverse residual effects on the Marine Environment VEC.

### Freshwater Environment

One of the objectives of the Project is to remediate and improve an existing level of contamination in freshwater habitat. Therefore, the overall effects of the Project on the Freshwater Environment VEC are positive and long lasting.

By the time the Project is implemented, the current configuration of Coke Ovens Brook will have been changed. This Re-alignment of Coke Ovens Brook has undergone a separate environmental screening pursuant to CEAA. Once completed, the Coke Ovens Brook within the Coke Ovens site, will follow two new channels. This new channel configuration was taken as the baseline for the effects assessment of the subject Project. Within the Tar Ponds new freshwater channels (Muggah Creek channels) will be designed to replace the current estuary environment.

Key concerns identified in the EIS relate to the potential recontamination of these “clean” new channels as a result of the Project’s surface water and groundwater management works and activities. Further, during the construction phase of the Project, the Coke Ovens connector (between the Coke Ovens site and the South Tar Pond) will be excavated and completely channelized. This new channel together with the new Muggah Creek channels in the Tar Ponds will be engineered to prevent infiltration of contamination through an impermeable bed design resulting in a loss of physical spawning and rearing fish habitat.

Contaminants that could occur in the wastewater streams generated during the remediation include PAHs, metals, dioxins, furans, and pathogens. However, any effluent discharges into the new channel environments will be in compliance with the pollution prevention provisions of the *Fisheries Act* and will not cause an exceedance of the receiving environment water quality objectives. The discharge will meet acute lethality tests and will not cause chronic effects. Once completed, the new channels are expected to provide fish passage to upper reaches of the watershed for resident species but no spawning and rearing fish habitat.
The replacement of the South Tar Pond with a terrestrial environment and new surface water channels is not considered to cause significant adverse effect. The natural habitat is highly polluted and degraded, with poor habitat quality, a low diversity of fauna and flora, without critical habitat for freshwater biota, and no rare or unusual biota. Since the Project will lead to an improvement in the productive capacity of fish habitat in Sydney Harbour DFO has confirmed the remediation/ rehabilitation objectives of the Project and determined that the Project does not require an authorization under the *Fisheries Act*.

Extensive water quality monitoring programs will ensure effectiveness of the mitigation measures, in particular compliance with Project-specific effluent discharge objectives. Any damage to the embankments of the water courses within the Project site boundaries or erosion of the new cap system will be identified through regular site inspections and repaired.

During the operation of the incinerator, the concern for the freshwater environment is from the deposition of and subsequent uptake of PCBs, PAHs and metals. The ERA estimated that the incremental risk from the incinerator for aquatic receptors would be negligible. Runoff from the incinerator stockpiles, ash piles, and other stored material, if not adequately controlled, may contribute further contamination of North West Brook. Mitigation will include standard containment of these potential pollution sources, and strict materials handling requirements outlined in the EMP.

The assessment concludes that the Project will have long lasting, beneficial effects on the productive capacity of fish habitat in Sydney Harbour. Adverse effects on aquatic habitat and biota during the construction phase are expected to be small scale, localized and short-term. Considering the Project benefits and the implementation of mitigation measures, no significant adverse residual effects are predicted.

### 6.2 SOCIO-ECONOMIC ENVIRONMENT

#### Economic Conditions

The EIS investigated potential effects of the Project on current economic conditions within regional and local context of the Project sites. The approach to the effects assessment included a comprehensive economic model as well as numeric modeling of property values within the vicinity of the Project sites.

There are predicted to be no significant adverse environmental effects on labour and economy during the construction phase. Any negative effects on local businesses, labour, and supply of construction materials are anticipated to be of short duration and small scale. The requirements for the Project could be largely accommodated through the local and regional sources and mitigation is available in form of early coordination and communication of Project schedules and needs with business and trade organizations, unions, and the municipal economic development department. Overall, effects on local employment, incomes, economic production, demography and education and training will be positive and be greatest during construction.
The Project will have positive effects on local education, training, and skills in the environmental sector. The magnitude is potentially high and long lasting for local and regional workers during all phases of the Project.

Further, the Project can be expected to improve the business and investment climate through the removal of the perceived environmental hazard.

**Infrastructure, Services, Transportation**

With respect to services and infrastructure, key concerns relate to wastewater treatment and transportation infrastructure. However, no adverse effects are identified. As part of the Project, sufficient on-site wastewater treatment capacity will be developed. Transportation of most materials will be by rail between the Tar Ponds and Coke Ovens sites and the VJ site. Should truck traffic lead to reduced level-of-service conditions at some of the intersections along the transport route, effective mitigation measures will be implemented (e.g., signalized intersections)? Traffic conditions at key intersections will be monitored during the construction phase.

The effect on the services industry (tourism) could be adverse during the construction phase. This adverse effect is considered to be more than compensated by the expected long-term beneficial effects resulting from the improvements in the environmental conditions, aesthetics and reputation of the Sydney waterfront.

**Land Use**

No adverse effects are expected on existing land uses within the Tar Ponds and Coke Ovens site boundaries as public access and use of the sites have been prohibited since the late 1990s. No temporary or permanent displacement or restrictions in the actual land uses off site are anticipated.

The Tar Ponds and Coke Ovens sites have been identified in the municipal planning strategy as either industrial or special status sites. The intended remediation activities support the plan designations and objectives for the subject properties and do not require planning strategy amendments.

No adverse effects have been identified for the Project’s operation phase. Instead, it is expected that the “site operation” will lead to a positive effect on existing and planned land-uses at the Project sites and adjacent areas by providing development opportunities for local communities and future generations.

The temporary operation of the incinerator facility is also not expected cause any adverse effects on existing or planned land uses at or near the VJ industrial site. The decommissioned incinerator site will be returned to its original industrial land use. Therefore, no adverse effect is expected.

**Aboriginal Land and Resource Use**
The assessment of effects of the Project on this VEC is still in progress. STPA has commissioned a MEKS to assess the potential impacts of the proposed Project on Mi’kmaq land and resource use. To ensure this study meets the interest of First Nation communities, STPA engaged the services of Membertou Geomatics Consultants (MGC) to undertake this work.

Preliminary indications from the MEKS are that the overall effects of the Project are expected to be positive, as the Project will result in long-term, large scale net improvements in the health of terrestrial, aquatic, and marine ecosystems and biota. This conclusion will need to be confirmed or adjusted by the MEKS. Project implementation and effect management programs are designed to remain responsive to new information from the MEKS and the Project’s own monitoring.

**Human Health**

Human Health is of primary concern in the assessment of effects of the Project. During the construction phase of the Project at the Tar Ponds and Coke Ovens sites, there are potential carcinogenic and non-carcinogenic risks to human health associated with direct contact with contaminated materials and inhalation of volatile chemicals and dust. These exposures may affect workers on the site and residents in the surrounding area.

Contaminated material from the Tar Ponds and Coke Ovens sites will be destroyed in a temporary incinerator over a three to five year period. There is concern that deposition of CoCs in the zone of influence of the incinerator facility may negatively affect the health of people living in the area, from direct contact and indirectly through consumption of certain foods.

In order to evaluate the risk associated with the exposure of human receptors, a detailed Human Health Risk Assessment (HHRA) was conducted. The aim of the HHRA of the Tar Ponds and Coke Ovens on-site remedial activities was to quantify potential acute (short-term) and chronic (long-term) effects on people (human receptors) due to incremental exposure to chemicals from Project activities. It considered exposures to sediments, surface water, soils, groundwater, dewatering water, volatile chemicals in air, and particle-bound chemicals in air.

The HHRA of the proposed incinerator included a comprehensive evaluation of the effects of chemical emissions on human receptors. The aim of the HHRA of the proposed incinerator was to quantify potential acute (short-term) and chronic (long-term) effects on people (human receptors) due to incremental exposure to stack emissions. It considered both direct and indirect exposures to chemicals in the air, soil, surface water, and food items.

The HHRAs followed a conservative approach (i.e., an approach that overestimates potential effects) to ensure that potential risks were not underestimated for human receptors. Conservative assumptions related to exposure and toxicity were employed in the assessment.

CoCs associated with construction activities at the Tar Pond and Coke Ovens sites and addressed in the HHRA include:

- BTEX;
- metals: arsenic, beryllium, cadmium, chromium, mercury, zinc;
The HHRA identified some health risks to workers on-site. However, the STPA has stringent occupational health and safety requirements that will require site workers to wear protective gear. Specific to recommendations for protective gear from the risk assessment include:

- Workers will wear gloves and clothing that cover most exposed skin to prevent direct contact risks, and workers should exercise care to make sure that sediment does not leak in between their gloves and their hands.
- Workers will wear respirators fit with the appropriate canisters for specific work activities that require breathing protection. Fit tests will be mandatory and any breakthrough will need to be managed.

Also, controlling chemical releases from remediation activities, (e.g. application of dust suppressant) will reduce risks and control exposures. Assuming the implementation of these mitigation measures and health and safety requirements, no significant residual adverse human health effects are expected for on-site workers. For residents living within the neighborhoods of the Tar Ponds, Coke Ovens, no implementation of health and safety requirements are required and no significant adverse health effects were identified.

As for the Tar Ponds and Coke Ovens sites, the risk calculations for the operation of the temporary incinerator concluded that no significant residual adverse health effects are expected for residents living within the zone of influence of the proposed temporary incinerator.

The assessments are based on many conservative (health-protective) assumptions. Because such conservatism was included in the risk assessments, actual risks to residents living near the sites and incinerator facility would be lower than the risks estimated by the HHRA.

**Community Health and Well-Being**

Community health and well-being includes all determinants that can have an effect on physical, mental, and social well-being. The community health assessment conducted for the subject Project, therefore draws upon the results of other VEC assessments (e.g., human health risks, socio-economic conditions) and analyzes the potential overall health effects of the Project on the community.

Overall, the Project is expected to have long lasting positive effects on community health and well-being, due to the permanent removal and containment of contaminants and thus the elimination of potential exposure to these contaminants. As part of the construction activities and the Tar Ponds and Coke Ovens sites, and the operation of the temporary incinerator, some potential for short-term adverse effects were identified. These relate to temporary impairments of the quality of life for some residents, potential concerns related to the capacity of health and
social services, the health and safety of on-site workers, and perceived risks by local residents. For each of these potential adverse effects mitigation measures were developed. These include development and implementation of measures such as:

- communication strategy;
- dispute resolution policy;
- communication and coordination initiatives with the local and regional health and social services;
- MHASP;
- Work Stoppage policy; and
- risk communication activities:

The assessment concludes that if all mitigation measures are successfully implemented, community health and well-being will not be significantly adversely affected during any of the Project phases.

The Tar Ponds and Coke Ovens operation (post-remediation) will have a positive effect on community health and well-being through the rehabilitated ecological health of the Project sites.
7.0 MALFUNCTIONS AND ACCIDENTS

An assessment of possible environmental effects of malfunctions and accidents was conducted to ensure that abnormal events and/or operational upset conditions are considered and the significance of the residual effects (i.e., after mitigation) of such events is determined.

In the first step of the assessment, events were identified that have a reasonable probability of occurring. In Step 2 each event was reviewed as to whether it could reasonably be expected to result in residual environmental effects and therefore would warrant a detailed assessment by the appropriate technical disciplines. In total, 22 malfunction and accidents scenarios were identified of which 11 scenarios were forwarded for a more detailed assessment.

In the context of the assessment, the potential malfunctions and accident scenarios associated with the incinerator operation and the potential effects on human health were of particular concern. The HHRA, therefore, considered potential exposure risk from incinerator emissions on the local environment and included temporary elevated concentrations assuming that accidents and malfunctions occur from time to time. The HHRA determined that no significant residual effects on human receptors would occur from operation of the incinerator. The HHRA also assumed that the incinerator would operate for 365 days per year for 5 years, instead of the planned operation for 250 days for three years. This health-protective assumption overestimates emissions and, therefore, overestimates exposure of residents in surrounding areas. The risk assessment took this approach to provide an extra margin of safety within the analysis. Additionally, the entire risk assessment approach is very health-protective, because it assumes that people who live in the vicinity will ingest large amounts of local freshwater fish and local farm-grown beef, pork, dairy products, poultry, and eggs. The likelihood that anyone would actually consume the assumed quantities of these locally raised food products is very small. In addition, the risk assessment specifically evaluated the acute risks that would be posed by inhalation of the worst possible short-term concentrations of emitted constituents. The concentrations were well below the regulatory criteria for acute exposures, even during an assumed upset condition.

Given the design and safety features incorporated in the Project and the emergency response and contingency plans that will be in place, risks to health posed by a malfunction of the incinerator will be negligible.

The conclusion drawn for the other VECs with respect to malfunctions and accidents are similar to those of the human health VEC, i.e., any residual adverse effects are expected to be insignificant.
8.0 EFFECTS OF THE PROJECT ON RENEWABLE RESOURCES

The Project is not expected to have adverse effects on the sustainability of renewable resources. One of the objectives of the Project is to reduce the potential for exposure of ecosystem and human health receptors to contaminants within the Project site boundaries. This will be achieved by removing sources of contamination and eliminating or minimizing exposure pathways. In the long-term, this will improve the quality of the biophysical environment and will contribute to the sustainability of renewable resources for future generations.

Similarly, since no adverse Project-related effects on the capacity of any of the renewable resources have been identified, no consequential effects on socio-economic VECs are expected.
9.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

No interactions between the environment and the Project during any of the Project phases were identified to affect the Project to such a degree, that the residual adverse effects on any of the VECs would be considered significant.

The Project will be designed to avoid and/or withstand severe weather and flood events. No potential for adverse effects from seismic events have been identified due to the infrequent occurrence and limited magnitude of any such events in the Cape Breton Island.

In addition to Project features inherent to the design, the operation of the Coke Ovens and Tar Ponds sites will include routine inspection, monitoring, and maintenance. This will ensure that, damage to any of the design features or operational aspects will be identified and repaired.
10.0 CUMULATIVE EFFECTS ASSESSMENT

A series of other past, present or likely future projects and activities were identified that could interact with the Tar Ponds and Coke Ovens remediation Project and create cumulative environmental effects. In general, cumulative effects can occur if there are spatial and temporal overlaps with those of the Project reviewed. It was determined that interaction of the subject Project with 10 of the other projects may result in cumulative effects. Relevant Project-inherent effects management measures were reviewed and additional mitigation measures developed, where applicable. Considering these management and mitigation measures, the residual adverse cumulative effects were considered to be minor (i.e., non-significant).

Of the 10 projects identified as “overlapping” with the subject Project, three represent preventative works at the Tar Ponds and Coke Ovens sites. Another five projects entail site remediation or the closure and decommissioning of other industrial sites and facilities in the area. These projects are all expected to benefit the natural and socio-economic environment over the long-term. They will reduce the potential exposure of ecological and human receptors to contaminants at and near the project sites. Together, these projects are anticipated to have a positive cumulative effect on the local economy.
11.0 FOLLOW UP AND MONITORING

The Project will include the implementation of comprehensive monitoring programs. These monitoring programs are the responsibility of the proponent, and will be integrated into contractual arrangements with Contractors and site workers.

Key components of the monitoring program will be the environmental effects monitoring (EEM) and environmental compliance monitoring (ECM). EEM programs will be used to verify these effect predictions and the effectiveness of the mitigation measures. ECM will ensure that all regulatory requirements and other commitments made to regulatory agencies, (including conditions of approval and applicable permits) as well as landowners and other stakeholders, are carried out.

As Project planning continues, input received during the review process, recommendations made by the Panel, subsequent requirements made governments, as well as ongoing Project consultation, will be used to finalize the program.
12.0 CONCLUSIONS

12.1 PROJECT ADVANTAGES AND DISADVANTAGES

An overview of identified effects and mitigation measures for each of the Project VECs is presented in a Summary Table in Appendix A to this Summary. Based on the results of the effects assessment and in accordance with the EIS Guidelines, the EIS discussed the overall advantages and disadvantages of the proposed Project.

A series of disadvantages were identified. Generally, the disadvantages are considered not significant. They are localized, temporary, can be effectively mitigated, or relate to features of limited conservation value.

Disadvantages listed for groundwater, surface water and soils are for the most part related to the potential for re-contamination or ongoing contamination from existing contaminant sources. Effective management and mitigation is available to prevent or restrict these effects to small portions of the Project site.

The most visible disadvantage of the Project will be the loss of early successional vegetation at the Coke Ovens site and the coastal estuary of the Tar Ponds. The vegetation is typical of derelict industrial lands in urban centres and, in the context of Sydney, of no particular conservation importance. The loss of vegetation therefore, is not considered significant. The loss of the estuary is of low significance since current contaminant levels have impoverished the aquatic life in the estuary. Overall, the Project is expected to result in a long-term reduction in contaminant levels in the marine habitat of Sydney Harbour.

The identified advantages are substantial and match the Project objectives. The Project benefits are permanent or long-lasting, affect the entire Project site and areas beyond, and relate to significant community features and objectives. The overall key advantage relates to the permanent reduction and management of the concentrations of contaminants within the entire Project site and the reduced exposure of ecological and human receptors to these contaminants. This will render the Project site safe for a variety of land uses. Consequently, large tracks of land at the Sydney harbour front and near the city’s centre will again become publicly accessible and will provide opportunities for large scale and diverse developments in prime locations. The Project also provides for short-term employment and training opportunities during the construction phase.

12.2 OVERALL CONCLUSION OF THE PROPONENT

Following the consideration of the findings of the studies presented in the EIS Report, STPA concludes that the Project is not likely to result in any significant adverse environmental effects. The advantages of the Project clearly far outweigh the Project disadvantages, and the Project objectives will be achieved through the implementation of the Project. Follow-up programs will be implemented to confirm these conclusions.
APPENDIX A

Summary Table

Environmental Effects, Mitigation and Significance of Residual Effects
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<tr>
<th>VEC</th>
<th>Mitigation</th>
<th>Significance of Residual Adverse Effect</th>
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<tbody>
<tr>
<td>Air Quality</td>
<td></td>
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| Dust emissions (storage, material handling, landfarming, capping) | • Cleaning the area around stored materials;  
  • Covering stored materials when necessary;  
  • Apply dust suppressant when necessary;  
  • Controlled loading and unloading of material;  
  • Minimizing the working faces of material piles. | Not significant |
| Emissions from operation of heavy equipment during operation and exhaust emissions from train and truck traffic | • Maintaining vehicles and equipment in good working condition;  
  • Using vehicle enclosures where appropriate;  
  • Vehicle wash stations at site exits;  
  • Applying dust suppressant when necessary;  
  • Minimizing distance between transfer points where possible;  
  • Maintain speed restrictions on roads;  
  • Vacuum sweeping or flushing roads when necessary;  
  • Paving roads, if necessary. | Not significant |
| Volatilization of contaminants (e.g. VOCs) (Excavation) | • Modifying excavation rates or procedures, if necessary;  
  • Conducting operation during cooler periods where practical;  
  • Use of enclosures on tar cell with air filtration. | Not significant |
| Emissions from soil and cement handling (Solidification/Stabilization) | • Applying dust suppressant when necessary;  
  • Minimizing soil agitation during mixing, when practical; | Not significant |
| Particulate, VOC and odour emissions from soil tilling, emissions from material handling | • Applying dust suppressant when necessary;  
  • Soil erosion control by terracing, if necessary;  
  • Use of a surface cover for piled material;  
  • Use of activated carbon or other compounds for odour adsorption when necessary; | Not significant |
| Emissions and deposition from incinerator, emissions related to material transport (Incineration) | • Maintaining regulated operating conditions for efficient combustion;  
  • Installation and operation of proper air pollution control system;  
  • Maintaining vehicles and equipment in good working condition;  
  • Using enclosures on loaded vehicles or trains where appropriate;  
  • Applying dust suppressant where required;  
  • Maintaining speed restrictions on roads; | Not significant |
<table>
<thead>
<tr>
<th>VEC</th>
<th>Mitigation</th>
<th>Significance of Residual Adverse Effect</th>
</tr>
</thead>
</table>
| **Acoustic Environment**                                          | • Implement work scheduling controls when necessary;  
• Use well-maintained equipment having the necessary noise suppression components;  
• Strategic location of stationary construction equipment such as generators;  
• Traffic management strategies to minimize vehicle noise;  
• Using “smart” alarms on vehicles when possible; and  
• Prohibit use of engine compression for braking.                                                                                     | Not significant                        |
| Noise emissions from equipment operation, noise emissions          |                                                                                                                                                                                                          |                                        |
| from vehicle transport                                            |                                                                                                                                                                                                          |                                        |
| Noise emissions from excavation equipment                          | • Excavation equipment selection;  
• Installing acoustical shields, if practical                                                                                                   | Not significant                        |
| Noise emissions from pile driving                                 | • Employing a vibratory pile driver;                                                                                                                                                                      | Not significant                        |
| Noise emissions from train transport                              | • Performing routine rail maintenance;                                                                                                                                                                     | Not significant                        |
| **Groundwater Resources**                                         |                                                                                                                                                                                                          |                                        |
| Reduced exposure of groundwater to CoCs (Tar Ponds and Coke Ovens, | • Beneficial effect – no mitigation required                                                                                                                                                            | NA                                     |
| operation)                                                        |                                                                                                                                                                                                          |                                        |
| Groundwater contaminant migration into Project site from           | • Communication with responsible parties for adjacent properties  
other sources (operation)                                                                                                                  | Not significant                        |
| Groundwater entering upstream reach of Coke Ovens Brook           | • If required, implementation of additional groundwater controls (e.g., purge wells, interceptor drains) supported by monitoring                                                                          |                                        |
| DNAPl migration and re-contamination of groundwater (operation)   | • DNAPl collection and treatment in areas along Coke Ovens Brook Connector;  
• Installation of DNAPl trap along west wall under Coke Ovens Brook and treatment when required;                                                                                                  | Not significant                        |
<table>
<thead>
<tr>
<th>VEC</th>
<th>Mitigation</th>
<th>Significance of Residual Adverse Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Re-) contamination of surface water environments (construction and operation phases)</td>
<td>• Design water treatment to accommodate appropriate water volumes; • Ensure water treatment system is designed to be operational for 25+ years; • Cleaning bed sediments in Coke Ovens Brook (downstream of SYSCO main gate);</td>
<td>Not significant</td>
</tr>
<tr>
<td>Groundwater contamination as a result of dust deposition and groundwater withdrawal during incinerator operation</td>
<td>• Provision of alternate supplies, if supported by monitoring and comparison with existing baseline conditions.</td>
<td>Not significant</td>
</tr>
<tr>
<td><strong>Surface Water Resources</strong></td>
<td><strong>Beneficial effect – no mitigation required</strong></td>
<td>NA</td>
</tr>
<tr>
<td>Reduced inflow of CoCs into surface water (Tar Ponds and Coke Ovens site operation)</td>
<td>• Erosion and sedimentation control from waste and material piles;</td>
<td>Not significant</td>
</tr>
<tr>
<td>Increased sediment loading in new channel systems (construction phase)</td>
<td>• Water quality of discharges from the Water Treatment plant will meet requirements of the <em>Fisheries Act</em> - discharges will meet acute lethality tests and will not cause chronic effects. • All measures discussed for groundwater resources</td>
<td>Not significant</td>
</tr>
<tr>
<td>(Re-) Contamination of surface water and channel bed sediments (construction and operation phases)</td>
<td>• Only clean (uncontaminated) native soils will be used for cover material for Tar Ponds and Coke Ovens sites;</td>
<td>Not significant</td>
</tr>
<tr>
<td><strong>Soil Quality</strong></td>
<td><strong>Beneficial effect – no mitigation required</strong></td>
<td>NA</td>
</tr>
<tr>
<td>Reduced inflow of CoCs into surface water (operation)</td>
<td>• Installation and operation of proper air pollution control system supported by monitoring; • During decommissioning, remediate soils to previous baseline conditions</td>
<td>Not significant</td>
</tr>
<tr>
<td>Renewed risk of exposure to contaminants (construction)</td>
<td>• Where possible encourage habitat development in end use planning; • Linear habitat development along water courses;</td>
<td>Not significant</td>
</tr>
<tr>
<td>Soil contamination as a result of dust deposition (incinerator operation)</td>
<td>• Reduced exposure of wildlife to CoCs offsets habitat loss</td>
<td>Not significant</td>
</tr>
<tr>
<td><strong>Terrestrial Wildlife and Vegetation</strong></td>
<td><strong>Beneficial effect – no mitigation required</strong></td>
<td>NA</td>
</tr>
<tr>
<td>Reduced exposure of plant and wildlife to CoCs (Tar Ponds and Coke Ovens site operation)</td>
<td>• Clear vegetated areas at the incinerator site during winter to avoid migratory birds;</td>
<td>Not significant</td>
</tr>
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<tr>
<td>---------------------------------------------------------------------</td>
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<td>----------------------------------------</td>
</tr>
<tr>
<td>Increased exposure to CoCs (construction, incinerator operation)</td>
<td>• All mitigation measures listed under Air Quality</td>
<td>Not significant</td>
</tr>
<tr>
<td><strong>Terrestrial Species at Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No effects anticipated</td>
<td>• No mitigation required</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Marine Habitat and Biota</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of estuary habitat</td>
<td>• Reduced exposure of marine habitat and biota to CoCs offsets potential loss of contaminated marginal habitat.</td>
<td>Not significant</td>
</tr>
<tr>
<td>Increased contaminant loading during excavation</td>
<td>• Containment of Tar Ponds material during excavation and stabilization/solidification</td>
<td>Not significant</td>
</tr>
<tr>
<td><strong>Freshwater Habitat and Biota</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced exposure of aquatic biota to CoCs (Tar Ponds and Coke Ovens site operation)</td>
<td>• Beneficial effect – no mitigation required</td>
<td>NA</td>
</tr>
<tr>
<td>Increased sediment loading in channel environments</td>
<td>• Erosion and sedimentation control from waste and material piles</td>
<td>Not significant</td>
</tr>
<tr>
<td>Surface water (re-) contamination</td>
<td>• Effluent quality from treatment plants to meet Fisheries Act requirements (i.e., discharges to meet acute lethality tests; no chronic effects).</td>
<td>Not significant</td>
</tr>
<tr>
<td>(Re-) contamination of channel sediments</td>
<td>• See mitigation measures for groundwater</td>
<td>Not significant</td>
</tr>
<tr>
<td>Loss of aquatic habitat</td>
<td>• Physical habitat enhancement measures in new channel environments, where practical.</td>
<td>Not significant</td>
</tr>
<tr>
<td><strong>Land Use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved public access (operation phase of Tar Ponds and Coke Ovens sites)</td>
<td>• Beneficial effect – no mitigation required</td>
<td>NA</td>
</tr>
<tr>
<td>Opportunity for implementation of municipal planning objectives; new opportunities for development in prime locations</td>
<td>• Beneficial effect – no mitigation required</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Resource Use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential for temporary supply shortages within local and regional markets (construction)</td>
<td>• Management of Project resource requirements (e.g. materials) • Communication with supplier organizations and local economic development department</td>
<td>Not significant</td>
</tr>
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<td>-----</td>
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<td>----------------------------------------</td>
</tr>
<tr>
<td>Traditional Land and Resource Use</td>
<td>No adverse effects (to be confirmed through MEKS)</td>
<td>NA (to be confirmed through MEKS)</td>
</tr>
<tr>
<td>Archaeology and Heritage Resources</td>
<td>Reduced exposure of ecological and human receptors (to be confirmed through MEKS)</td>
<td>NA (to be confirmed through MEKS)</td>
</tr>
<tr>
<td>Disruption or loss of archaeological resources (construction)</td>
<td>Beneficial effect – no mitigation required (to be confirmed through final completion of MEKS)</td>
<td>Not significant</td>
</tr>
<tr>
<td>Property Value</td>
<td>Potential for property values increases upon completion of construction phase</td>
<td>NA</td>
</tr>
<tr>
<td>Labour and Economy</td>
<td>Employment opportunities (construction phase)</td>
<td>NA</td>
</tr>
<tr>
<td>Infrastructure and Services</td>
<td>No effects</td>
<td>NA</td>
</tr>
<tr>
<td>Transporation Infrastructure</td>
<td></td>
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</tr>
</tbody>
</table>

- **Mitigation**
  - No mitigation of adverse effects required (to be confirmed through completion of final MEKS)
  - Beneficial effect – no mitigation required (to be confirmed through final completion of MEKS)
  - Archaeological monitoring during surface disturbance in areas of elevated potential;
  - Implementation of contingency planning as required including notification of the proper authorities;
  - Conservation of archaeological resources as required.
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| Temporary reduced level-of service at intersections along transport route (construction phase) | • Installation of traffic signals at the Inglis Street at Prince Street intersection;  
• Grade crossing protection devices meet appropriate standards;  
• If required, new road construction (between Wal-Mart/Home Depot Road and Grand Lake Road);  
• If required, installation of traffic signals at Grand Lake Road/Victoria Junction Wash Plant Road.                                                                                                           | Not significant                         |
| **Human Health**                                                   |                                                                                                                                                                                                                                                                                                                                             |                                        |
| Decreased risk of (Tar Ponds and Coke Ovens, operation)           | • Beneficial effects – no mitigation required                                                                                                                                                                                                                                  | NA                                     |
| Potential for adverse effects on worker’s health through exposure to CoCs (Construction phases, incinerator operation phase) | • Implementation of Health and Safety Plan that is appropriate to the activity.  
• Mitigation as required for Air Quality VEC                                                                                                                                                                                                                                  | Not significant                         |
| Potential for personal injuries                                   | • Implementation of Health and Safety Plan that is appropriate to the activity  
• Compliance monitoring in working environments                                                                                                                                                                                                                           | Not significant                         |
| **Community Health and Well-Being**                               |                                                                                                                                                                                                                                                                                                                                             |                                        |
| Decreased risk of (Tar Ponds and Coke Ovens, operation)           | • Beneficial effects – no mitigation required                                                                                                                                                                                                                                  | NA                                     |
| Continued or increased perception of potential for health effects (construction) | • Inform citizens of project activities and progress;  
• Risk communication;  
• Dispute resolution policy;  
• Inform health authorities of COPCs found on site and type of accident that could occur;  
• Develop a reporting system to health authorities if there are exceedances of air quality guidelines during construction;  
• Health and Safety Plan;  
• Capacity to suspend activities on-site if air quality criteria exceeded;                                                                                                                                         | Not significant                         |