Newfoundland and Labrador Refinery Project

Amendments to the Environmental Impact Statement (EIS)

Submitted to:
The Minister of Environment and Conservation
Government of Newfoundland and Labrador

Submitted by:
Newfoundland and Labrador Refining Corporation

November 2007

NLRC's Response To Comments on the EIS

Introduction

This document was prepared by the Newfoundland and Labrador Refining Corporation (NLRC) in response to the Newfoundland and Labrador Minister of Environment and Conservation letter of October 5, 2007 regarding an amendment to the Environmental Impact Statement (EIS) of the Newfoundland and Labrador Refinery Project.

The EIS amendment represents NLRC response to all reviewed comments from various government departments, agencies and public as provided by the Environmental Assessment Committee on behalf of the Minister of Environmental Conservation.

The NLRC's response is organized by department or organization, where questions or comments from each group is provided first followed by NLRC's response to each question or comment.

NEWFOUNDLAND & LABRADOR
DEPARTMENT OF NATURAL RESOURCES
ENERGY BRANCH

In general the Environmental Impact Statement (EIS) is very comprehensive and either adequately addresses the main points of the EIS guidelines or identifies future work that will be performed.

Some areas of the EIS that should be further elaborated on or where more clarification is required are as follows:

The Federal Government has announced plans for a new Regulatory Framework for Air Emissions that will require new industrial facilities to adopt a continuous annual improvement in air emissions intensity. The EIS outlines a GHG Management Plan, but there is a need for a more specific in-depth discussion regarding how the refinery will meet these new air emissions guidelines.

NLRC Response:

NLRC is participating in the Refinery Industry - Environment Canada discussions regarding emission caps for the refining sector under the new Regulatory Framework for Air Emissions and fully supports the goals of the Framework. NLRC will meet the new air emissions guidelines by installing Best Available Control Technology and complying with the requirement for clean fuels as mandated by the Regulatory Framework.

The GHG Management Plan in the EIS identifies several potential means to reduce GHG emissions; NLRC will investigate all of these measures during the Front End Engineering and Design (FEED) work for the refinery in order to determine which best meet BATEA and the commitments of NLRC under the Framework. Once this work is completed, NLRC will update the GHG Management Plan, which will be part of the overall Environment, Health and Safety Management System for the project.

NLRC proposes to build a 300,000 bpd refinery, expandable to 600,000 bpd. The EIS is based on 300,000 bpd refinery design. What would be the next steps in the environmental assessment process if this expansion occurred at some point in the future? What would be the anticipated environmental effects of this expansion? How would this expansion impact potential future cumulative effects given the other proposed industrial developments in this region.

NLRC Response:

An expansion of the refinery to 600 000 bpd would require environmental assessment as a new project under both provincial and federal legislation and the potential environmental effects would be considered at that time. At this time, NLRC has ensured that the overall refinery footprint and property boundaries can accommodate the potential expansion.

As a part of the Environmental Management Program it is advisable to implement an energy production/consumption management program for the entire refinery and to ensure that the consumption of combustibles used for production is kept to appropriate levels.

NLRC Response:

An energy production/consumption management program will be developed and implemented for the refinery project. The program will be an integral part of the detailed design work. NLRC recognizes the environmental and economic importance of effective energy management.

It is also recommended that a monitoring program be implemented as a part of the Environmental Management Program to check underground water for any spill-over. This program should also define the necessary measures, in the event of water table pollution, to contain this pollution within the boundaries of the site.

NLRC Response:

NLRC will conduct extensive geotechnical and hydrological surveys in the project area as part of finalizing refinery layout and design and providing input to the Environmental Protection Plan. A network of groundwater monitoring wells will be established on the site.

While not yet developed, there will be an Environmental Protection Plan and emergency response plans in place for the site for all phases of the project, construction through operations and decommissioning. Infrastructure, equipment, structures and procedures will meet all necessary regulations for protection of both personnel and the environment. Spill containment structures will be provided in the Tank Farm and other hazardous material storage areas (HAZMAT areas).

NEWFOUNDLAND & LABRADOR
DEPARTMENT OF ENVIRONMENT & CONSERVATION
WATER RESOURCES DIVISION

The EIS and relevant documents for Newfoundland and Labrador Refinery Project were reviewed. They were found to meet the guidelines prepared by EC. The proponent covered all impacts and issues related water resources protection and their extent as well as mitigation measures.

In addition to the baseline information on water quality and other water resources information that were presented in the components studies as required by the Water Resources Management Division, the EIS and relevant documents confirmed the proponent commitments for the protection of water resources in the project areas that may impacted or affected by the project. Also, the proponent reiterated its commitments for real water quality monitoring agreed to by MOU and other water resources issues.

Therefore, the EIS is acceptable subject to obtaining all licenses, permits or approvals required under the *Water Resources Act*, and our regulations, policies and guidelines that are presently in effect or enacted in the future.

NLRC Response:

NLRC acknowledges the expectations of the Water Resources Divisions and will work to ensure that mitigation measures, water quality monitoring and other commitments are implemented and honoured during each stage of the proposed project, in accordance with all applicable licenses, permits or approvals.

NEWFOUNDLAND & LABRADOR
DEPARTMENT OF TOURISM, CULTURE & RECREATION
PROVINCIAL ARCHAEOLOGY OFFICE

In the Socio-Economic Assessment Volume, Section 12.1.4, page 12-5 "The site, that at one time consisted of two buildings constructed as a Trans-Atlantic cable station, was apparently used briefly during the 1850s" is to be changed to "The site, Bay Bulls Arm Telegraph Station, consisted of two buildings and was used briefly as the landing location for the first Trans-Atlantic cable".

NLRC Response:

Text in Section 12.1.4 in Volume 4, sentence two should read:
"The site, Bay Bulls Arm Telegraph Station, consisted of two buildings and was used briefly as the landing location for the first Trans-Atlantic cable".

NLRC Note:

Please note that the following two comments were made in the Socio-Economic Component Study comments, however NLRC believes it is more appropriate to address these within this document.

In the Historic Resources Component study, Section 5.3, Conclusions and Recommendations, it is indicated that "if for any reason the Project needs to be relocated closer to the shoreline of North Harbour or Come By Chance Harbour, or within 20 metres of the registered archaeological or ethnographic sites (including the 19th century telegraph station), details should be forwarded to the PAO for review." The PAO would like to see the same information added to the Socio-Economic Assessment Volume under section 12.0 Historic Resources.

NLRC Response:

NLRC agrees with this request. The following paragraph should be inserted under Section 12.5 of Volume 4:

"If for any reason the Project needs to be relocated closer to the shoreline of North Harbour or Come By Chance Harbour, or within 20 metres of the registered archaeological or ethnographic sites (including the 19th century telegraph station), details should be forwarded to the PAO for review."

In the Socio-Economic Assessment Volume, Section 12.1.4, page 12-5 - the same information in #3 above should be changed here as well.

NLRC Response:

The following paragraph should be inserted under Section 12.1.4 of Volume 4:

"If for any reason the Project needs to be relocated closer to the shoreline of North Harbour or Come By Chance Harbour, or within 20 metres of the registered archaeological or ethnographic sites (including the 19th century telegraph station), details should be forwarded to the PAO for review."

NEWFOUNDLAND & LABRADOR
DEPARTMENT OF ENVIRONMENT & CONSERVATION
PARKS AND NATURAL AREAS DIVISION

After reviewing the Environmental Impact Statement, Parks and Natural Areas Division has the following comments and suggestions as related to requirements in the EIS Guidelines for the project:

3.5 General Project Description: Shipping and Marine Traffic and
3.7 Operation and Maintenance: Traffic by Cape St. Mary's Ecological Reserve with map

In Vol 2, Figure 6.3 (p. 6.28), it would be useful to depict the boundaries of Cape St. Mary's Ecological Reserve, which include a marine component. The text on p. 6.29 discusses the importance of Cape St. Mary's Ecological Reserve as a sensitive environmental area, but should also include a reference to the fact that Seabird Ecological Reserve Regulations (section 6.3 (a)) prohibit the operation of a vessel longer than 20 meters within the marine component of the reserve. As well, under section 5(a) of the same regulations, it is prohibited to pollute any body of water within a Seabird Ecological Reserve.

NLRC Response:

Additional text is added to the last paragraph of Section 6.2.5 on page 6-29 in Volume 2 so that the paragraph reads

Cape St. Mary's has been identified as a sensitive environmental area and the configuration of the existing traffic lanes takes this into account. Traffic lanes are positioned in deep water at the centre of Placentia Bay with extensive buffer zones to either shore. Traffic lanes in the outer part of the bay are 2.5 nautical miles wide and have a 3-nautical mile separation. All tanker traffic will avoid landfall and keep to the established deepwater traffic lanes in the centre of the bay. The closest that tanker traffic should approach to Cape St. Mary's is approximately 12 nautical miles as vessels enter the traffic lanes and transit up Placentia Bay. The Marine Terminal Regulations and Information book to be prepared and issued by NLRC will include a chart of the marine component of the Cape St. Mary's Seabird Ecological Reserve and refer to the associated Regulations and specifically to clause 6.3 (a) that prohibits vessel larger than 20 feet length in the marine area of the reserve and clause 5 (a) that prohibits pollution of water bodies within a Seabird Ecological Reserve.

3.7 Operation and Maintenance: Anchorage plans and frequencies

Since the planned anchorages are close to Cape St. Mary's Ecological Reserve, Parks and Natural Areas would appreciate if the results of discussions on this topic through the TERMPOL process could be communicated back to the Division.

NLRC Response:

Existing anchorages in Placentia Bay are at the far (north) end of the Bay from Cape St. Mary's, close to Arnold's Cove and Come By Chance. No new anchorages are planned by NLRC. However, it can be expected that anchorages will be fully examined during the TERMPOL Review. The Department of Environment and Conservation is represented on the TERMPOL Review Committee and, as well, the results of the TERMPOL Review will be available to the public.

6.2. Emergency Response/Contingency Planning: Marine and terrestrial spills

Given the size of tankers will range from product tankers at a capacity of 80,000 DWT to crude carriers (VLCC) of 300,000 DWT, a spill response capacity by the Eastern Canada Response Corporation of 2500 tonnes in the Mount Pearl location and a total of 10,000 tonnes appears to be inadequate to protect the ecologically important Placentia Bay, and the seabirds at Cape St. Mary's Ecological Reserve. Additional infrastructure, equipment and trained personnel would appear to be critical. This is a comment for consideration through the TERMPOL review process as described in Vol 2. section 12.9.1, and Vol. 3, section 5.5.2, and in development of the proponent's Oil Pollution Emergency Plan.

NLRC Response:

NLRC has indicated that the marine terminal will be designated as an Oil Handling Facility under the Canada Shipping Act. As such, there will be spill response capability at the marine terminal which will increase the overall response capacity in Placentia Bay. NLRC has also indicated in the discussion regarding cumulative effects in the EIS that they are aware of the concern outlined above and that it is under discussion in the Placentia Bay Traffic Committee. As pointed out in the comment above, the issue of spill prevention and response will be part of the TERMPOL Review. This issue has also been raised by the recently released report entitles "Quantitative Assessment of Oil Spill risk for the South Coast of Newfoundland" and is under review by Transport Canada.

6.3 Environmental Monitoring: Air quality monitoring program

Under section 10.1.2 (vol 3) describing Environmental Effects Monitoring and Follow-up, reference is made to development of a sampling program to analyze lichens for chemical uptake of contaminants, and to monitor lichen response to potential air pollution. Under the subsection, Potential Opportunities for Follow-on Environmental Initiatives (p. 10-8), Parks and Natural Areas would also be interested in a joint lichen-monitoring program in some of our nearby parks and ecological reserves in combination with NLRC and Terra Nova National Park.

NLRC Response:

NLRC will participate in the planned consultations by the Canadian Wildlife Service on an Erioderma pedicellatum management plan. NLRC and Parks and Natural Areas (Natural Areas Biologist) have initiated discussions on a joint monitoring program.

NEWFOUNDLAND & LABRADOR DEPARTEMENT OF HUMAN RESOURCES, LABOUR & EMPLOYMENT

Specific Technical Deficiencies, Concerns, Issues and Suggestions:

The marine fish habitat component study noted that the near shore areas of the proposed refinery were known to contain lobster habitat. This lobster habitat was mainly evidenced by the large numbers of lobster pots observed during the surveys and the long timeline of the traditional lobster fishery in the area. Special consideration should be given to the displacement of any lobster fisherpersons who may lose employment or income as a result of the refinery's development in the study area.

NLRC Response:

NLRC is in negotiations with the FFAW regarding actions required for displaced fishers.

This document outlines the Department of Human Resources, Labour and Employment (HRLE) comments and feedback on the Socio-Economic Impact Study for the proposed Newfoundland and Labrador Refinery project by Newfoundland and Labrador Refining Corporation.

The Department acknowledges that the proponent has successfully identified the socio-economic issues for this project. The Department offers the following comments for the proponent's consideration.

General Technical Points:

Census data is referenced multiple times in this report. It should be noted, however, that Census data is subject to a confidentiality procedure known as "random rounding" to prevent the possibility of associating statistical data with any identifiable individual. When examining this data at the regional level, all figures, including totals and margins, are randomly rounded either up or down to a multiple of "5", and in some cases "10".

For further information on what to include in the Component Study document as an explanation of this process, please visit the following website:
http://www.communityaccounts.ca/communityaccounts/onlinedata/Confidentiality%20and%20Random%20Rounding.htm

The proponent could include a clarification that regional data from Statistics Canada are covered by the above confidentiality procedure and therefore that no individuals are identifiable from the data.

NLRC Response:

Your suggestion regarding census data and confidentiality now forms part of the "Data Limitations" section and is worded as follows:

Census data is subject to a confidentiality procedure known as "random rounding" to prevent the possibility of associating statistical data with any identifiable individual. When examining this data at the regional level, all figures, including totals and margins, should be randomly rounded either up or down to a multiple of "5", and in some case, "10". Further information on the process of confidentiality can be found at: http://www.communityaccounts.ca/communityaccounts/onlinedata/Confidentiality%20and%20Random%20Rounding.htm.

Specific Technical Deficiencies, Concerns, Issues and Suggestions:

Biophysical Impacts

Placentia Bay is frequented by bird and whale watchers, as this area is seasonally abundant in certain species. Special consideration should be given to the effects on local bird sanctuaries and marine tourist areas since these locations play a large part in the tourism industry, which ultimately affects the local labour market.

NLRC Response:

Eco-tourism is increasing throughout the province, including in Placentia Bay. The Project itself, by virtue of increasing employment in the area, will increase tourism in the area.

Cape St. Mary's Seabird Ecological Reserve at the mouth of Placentia Bay is a world-recognized ecological attraction. Annual migrations of capelin, herring and other species attract several species of whales as well as seabirds to the area. In addition to tourism, there is increasing use of the islands and coasts of Placentia Bay for recreation and seasonal residences.

NLRC's research and preparation for environmental protection in association with the proposed project has identified areas of importance to birds, such as the lagoon near Arnold's Cove and the come By Chance River estuary and wetlands. Spill response plans will incorporate specific protection measures for areas such as these.

NLRC has met with the Placentia Bay Integrated management Committee to ensure that they are familiar with the proposed project and continue to make project information available. The tourism and hospitality industry is represented on this Committee.

It should also be noted that there is no bird sanctuaries or marine tourist areas in the immediate footprint of the proposed refinery and its access roads.

It is noted within the Environmental Impact Statement that the proposed refinery footprint will affect the local lobster fishery, as there were many lobster pots observed during surveys of the proposed refinery site. The displacement of these lobster pots and the local lobster fisherpersons should be given special consideration, due to the risk of reduced income and employment from the displacement. Also, during construction and while Construction Safety Zones (CSZ) are in place, consideration should be given to

the fisherpersons, fish processing businesses, and fish vessel transits that will be disrupted through the closing of this area.

NLRC Response:

Early in this process, fishers were identified as an important stakeholder in the project. NLRC has established a sub-committee with the FFAW and fishers from communities around Placentia Bay, including St. Bride's, Red Harbour, Marystown, North Harbour, Come by Chance, Southern Harbour, and Fairhaven. NLRC has worked closely with the sub-committee to schedule and organize joint meetings with fishers around Placentia Bay to discuss their concerns regarding how the proposed refinery will affect the fisheries in the Placentia Bay area. Discussions will continue with these groups until all outstanding issues are resolved.

Socio-economic Impacts

(3.3.5 and 3.3.6) Adverse residual effects on medium to low income households are predicted in the EIS during the construction and operation phases of the project. This means that, while many individuals may benefit from the project, others may end up becoming even more disadvantaged. Additional information could be gathered on the specific number of people who would be affected in this manner. Such information can then be used to assess the provisions needed to minimize negative impacts on these people.

NLRC Response:

Regarding the possible adverse residual affect on a specific number of low to medium income earners with housing needs (3.3.5 and 3.3.6), it would be challenging to accurately gather this information because of:

- *the number of data sources (e.g. retirees, social assistance, handicapped, etc.);*
- *some of this information is not yet available from the 2006 Statistics Canada census;*
- *some communities would have such small numbers that it would not appear statistically due to random rounding to prevent the possibility of associating statistical data with any identifiable individual.*

The Socio-Economic Component Study (3.5.3.2) lists the number of low income rental housing units sponsored by the Newfoundland and Labrador Housing Corporation (NLHC) as well as the amount of funding available for low income home owners and the amount of new housing made available throughout the province during 2006 (200 units) through the joint Federal/Provincial Affordable Housing Program. The Study also indicates that additional low income housing units will be made available throughout 2007. Further, the current government announced as part of its mid-campaign policy strategy to increase low-income subsidies by 30% over the next four years. Thus, NLHC in conjunction with the Department of HRLE and rental housing agencies would be in the best position to jointly monitor the need for additional rental units or to increase or supplement

financial support systems if the cost of, or demand for, low income rental and housing increases in the region.

(8.3, 13.4.9) It is agreed that human resource strategies to ensure the sufficiency of the local labour pool must incorporate efforts from many different stakeholders (e.g., unions, post-secondary institutions, government, etc.). However, it is noted that there are some areas which the proponent would find advantageous to consider from its own perspective.

(4.1.1) The proponent cites in several places the labour problems/ lack of skilled worker in the province and refers to the work of government's "Skill Task Force' (2006) as a means to remedy this problem. While government has a role to play here, there are some considerations which need to be addressed largely on the part of the proponent. For example, there is not a great amount of attention given in the EIS to strategies or incentives which might attract and retain skilled workers – an important consideration given the anticipated competition for skilled labour and the limited labour supply.

(5.3.2 Conflict with Fish Harvesting) There is some concern that the proposed project may have a negative impact on the Placentia Bay fishing industry as a result of the increased marine traffic (tankers). While some interference may be unavoidable, the proponent should take every effort to avoid displacing fisherpersons from their existing fishing grounds. This is all the more important given that a significant number of projects will make use of this water system (13.4.5)

NLRC Response:

Early in this process, fishers were identified as an important stakeholder in the project. NLRC has established a sub-committee with the FFAW and fishers from communities around Placentia Bay, including St. Bride's, Red Harbour, Marystown, North Harbour, Come by Chance, Southern Harbour, and Fairhaven. NLRC has worked closely with the sub-committee to schedule and organize joint meetings with fishers around Placentia Bay to discuss their concerns regarding how the proposed refinery will affect the fisheries in the Placentia Bay area. Discussions will continue with these groups until all outstanding issues are resolved.

There is an assumption in the EIS that a large proportion of the required workers will be recruited from the employment catchment area population (approximately 50 per cent - page 13-9). There is no data given in the EIS, however, to support this assumption and it seems to be based largely on anecdotal evidence. It also runs counter to earlier statements that much of the skilled labour has left due to the absence of large-scale projects in the area (8.2). Given the negative implications of insufficient labour supply for the completion of this project, the proponent should research carefully what proportion of skilled workers can in fact be procured in the region.

The proponent should also determine the proportion of skilled workers outside the province which would move to the region to work, what incentives would be required to achieve this, and whether this level of recruitment, combined with in-province labour supply, will be sufficient to meet all project demands.

NLRC Response:

Regarding human resource strategies to ensure sufficiency of the local labour pool and concern by HRLE that sections 8.3 and 13.4.9 do not adequately address strategies or incentives that might attract and retain skilled workers, the Department should refer to Sections 4.3.1, "Labour Market Mitigation Measures" and 13.4.2, "Predicted Cumulative Effect on Labour" where specific mitigation measures are listed that address recruitment, retention of a diverse workforce and wages and benefits.

Regarding the assumption that approximately 50% of the workforce would be recruited from the Employment Catchment Area page 13-9), this is largely anecdotally based and could be plus or minus 10-20%. However, it is founded on a number of sources and assumptions including the following:

- *the trades' union survey which indicates that the trades' unions can supply the required labour from the Province;*
- *the majority of union members are from the Employment Catchment Area;*
- *many of the potential employees from the Area are currently commuting to places such as Alberta, but have not moved their families there, and, therefore, are still "residing" in the Area; and*
- *the number of written and verbal expressions of interest in Project employment that were given at the educational and community meetings as well as at the public information centre from individuals working both away and in the Area, recent and future high school graduates and families whose children or partners were commuting or working outside the Province. In addition, 116 resumes were received despite the Project not having received the required environmental approvals or financing.*

Discussions with the trades' unions and the educational institutions are ongoing.

After NLRC finalizes its project financing and begins the next phase, the Front End Engineering and Design (FEED) including completion of its detailed construction plans, it will have a better opportunity to refine its construction employment needs. Identification of employment sources will also be part of the project management and sub-contractor bid packages including refined estimates of the proportion of skilled workers from outside the Province.

NLRC understands the concern over the need to maximize local employment opportunities as well as the need to accurately estimate the number of out-of-province workers during the construction phase. These two factors alone will influence the majority of other socio-economic impacts. NLRC is in agreement to continue meeting regularly with HRLE and appropriate provincial committees to update and plan with them on how to both estimate/maximize local employment and estimate the number of out-of-province workers.

(9.1.4) There is some concern that light and noise associated with project activity will be disruptive to one of the largest fox farms in North America located in North Harbour. The proponent has suggested consultations with the owner of the fox farm to ensure this doesn't happen (9.3.3). It is recommended by the Department that regular consultations with the owner take place during the construction life of the project, and at the beginning

of the operations stage, to ensure that new project developments do not negatively impact this industry.

NLRC Response:

Regarding potential light and noise that may be disruptive to one of the largest fox farms in North America which is located in North Harbour (9.1.4), NLRC commits to undertaking the mitigation measures discussed in 9.3.3 as they affect the fox farm.

The Department notes that the influx of new workers will lead to greater demand in a number of service areas including: highway upgrading (10.1.1), ambulance services (11.1.4), policing (11.2.1), firefighting (11.2.2), and Search and Rescue (11.2.3). This requirement should be cited somewhere in the proponent's assessment of labour demand.

NLRC Response:

NLRC agrees that new workers to the region will lead to greater demand for a number or services (e.g. highway upgrading, ambulance, policing, firefighting and Search and Rescue – Sections 10.1.1, 11.1.4, 11.2.1, 11.1.1, 11.2.3 respectively), which will cause an indirect demand for Project-related labour. As assessment of capacity for ambulance, policing, fire fighting and Search and Rescue and the ability to increase labour supply to meet demand for each of these services was discussed in Section 3.6 of the Component Study. An assessment of future road networks was made in Section 3.4.1.2 of the Component Study and each of the major roads that would be affected by the Project are currently under consideration for upgrading by the Department of Transportation. Therefore, labour demand for these upgrades will most likely be part of any future upgrading work scope and budget.

Likewise, some mitigation measures will necessitate additional labour, such as in the areas of: wastewater treatment and waste removal (10.2.4), high-speed Internet connectivity (10.2.5), power line transmission (10.4), childcare (8.1.1), commuter bus service (13.4.17), emergency services (13.4.22), and health care (13.4.6). Such additional labour should be mentioned somewhere in the proponent's labour demand assessments particular where the proponent plans to have services available on site.

NLRC Response:

NLRC agrees that additional labour may be required for wastewater treatment and waste removal, high speed Internet connectivity, power line transmissions, childcare, commuter bus service, emergency service and health care Sections 10.2.4, 10.2.5, 10.4, 8.1.1, 13.4.17, 13.4.22, 13.4.6 respectively). On-site wastewater treatment and waste removal are addressed as part of overall Project labour requirements. Power line transmission will be required and is part of NL Power's regular commitment to supply power to industrial, commercial and residential developments within the Province and are considered as part of NL Power's ongoing planning process. As a result of the Project, new childcare services will likely be required which represents an employment opportunity within the Employment Catchment area.

In addition, as part of the mid-campaign policy of the recently re-elected government, childcare spaces will increase by 30% within the Province, and since the Employment Catchment Area represents a major source of future employment, it is likely that many of the spaces will be added there. Commuter bus services already exist, but increased frequency may be required which represents either rescheduling or a small employment opportunity. Cumulative effects on labour emergency services (13.4.22) can be partially met through advanced technology (e.g. Placentia Bay traffic management) or the redeployment of RCMP from other areas for short time periods or through staff planning. Employment in health has already been cited as an issue without this or other projects and recruitment of trained health personnel will be an ongoing challenge for the Eastern Health Corporation. However, through the cumulative effects management suggested in 13.4.6, the impact on the need for additional health care personnel should be minimized.

The Department notes that many of the above concerns will be exacerbated by the large number of projects – both ongoing and proposed – occurring in the area which will place heavy demands on the labour supply and dramatically increase the need for support services (13.0).

*(*3.0 Competition for Labour*)* The study mentions competing projects but does not go into detail regarding all the proposed projects taking place in the study area that could potentially draw on the already strained local labour force. These projects would include:

- Hebron (Offshore)
- Voisey's Bay Nickel Processing Plant (Long Harbour)
- Liquid Natural Gas (Grassy Point)
- Increased activity at Kiewit Offshore Services (Marystown Shipyard)
- NFLD Refinery (Southern head)
- Construction of a long term care centre (Clarenville 5 yr. construction phase, $46.6 million)
- Clarenville Events Centre (Fall 2008).

(13.4.2) It is stated that, should all projects proceed concurrently, significant labour shortages are likely to occur since all projects will be competing for the same labour pool and amenities. Furthermore, if all these projects finish up in the same time period, there is risk of repeating the "boom and bust" scenario wherein skilled labour will once again have no local jobs and will have to leave to find work outside the province. Given these potentially negative implications, it is suggested that the proponent explore along with other proponents how individual projects might be spaced apart through careful project timing of work components.

NLRC Response:

In response to the concern over the possibility of a 'boom-bust" scenario (13.4.2), NLRC is willing to work with other successful project proponents to address this issue. NLRC will likely be the first of the proposed major projects (e.g. Voisey's Bay Processing Plant, Kiewitt Offshore Services, Lower Churchill Generation Project, Hebron oil field development) to receive environmental approval under the provincial Environmental Assessment Act. After these other projects receive environmental approvals, NLRC will be willing to work with the other project proponents to coordinate planning and management of regional impacts. In many cases, timing alone will become a mitigation measure (e.g. some projects have yet to start the environmental assessment process; others may be delayed due to financing, markets, or other corporate priorities).

(4.24) This competition for workers will affect some trade areas more than others, as well as earlier. For example, representatives of the province's welders and iron makers indicated that they anticipate a shortage of labour due to competing projects. While unions reported large numbers of unemployed skilled trade's workers, they must also be cognizant of the labour environment they are in.

NLRC Response:

Regarding competition for workers among the skilled trades (4.24), NLRC cannot comment about the union's position on this subject.

(13.4.1) It is stated that labour demands that cannot be addressed through the provincial workforce may foster temporary unionized in-migration of workers from other provinces and other countries. On this note, every attempt should be made to not only hire local labour but also to provide services and assistance (e.g., training, lodging, etc.) that will maximize local residents' opportunities for obtaining such project employment.

NLRC Response:

Regarding the potential need to hire from outside the province (13.4.1), NLRC agrees that every attempt should be made to not only hire local labour but also to provide services and assistance (e.g. training and accommodations, etc.) that will maximize local residents' opportunities for obtaining such project employment. Hiring locally is always in the best interest of NLRC because it is the most cost effective method of doing business. Further, the Corporation's majority owners have as their corporate philosophy "a deeply rooted commitment to the pursuit of opportunities within its home province of Newfoundland and Labrador" (Altius

Minerals Corporation, Annual Repot 2007), which means the hiring of Newfoundlanders and Labradoreans wherever possible.

Specific Editorial Points and Errors:

Biophysical (Volume 3)

Within the first paragraph of the Introduction on page 1-1, the Newfoundland and Labrador Department of Environment and Conservation is referred to as the Newfoundland Department of Environment and Conservation. Labrador should be inserted.

NLRC Response:

Please replace the 1st paragraph of Section 1.0, page 1-1 with the following text:

"The five volume Environmental Impact Statement for the Newfoundland and Labrador Refining Corporation (NLRC) Refinery Project at the head of Placentia Bay (The Project) has been prepared to meet the requirements of both the provincial and federal environmental assessment processes (as described in the Guidelines for Environmental Impact Statement/Comprehensive Study Report (EIS/CSR) by the Newfoundland and Labrador Department of Environment and Conservation) and to respond to the ideas, suggestions, questions and concerns of the residents of Placentia Bay and nearby communities."

On page 2-1, in the second paragraph from the bottom, the word 'design' is misspelled as "desigh".

NLRC Response:

Please replace the 5th paragraph of Section 2.1, page 2-1 with the following text:

"Effects of the environment on the project include such aspects as site selection and route planning to avoid sensitive habitat, seasonal restrictions on construction activities, design criteria for infrastructure and buildings to accommodate severe storms or potential changes in sea level due to global warming, climatology and physical oceanography in the biophysical assessment and aspects such as work schedules, commuting distance and procurement policies in the socio-economic assessment."

There is a typing error on page 4-41 in the last sentence; there should be a hyphen added to Come-By-Chance, to read as Come-By-Chance.

NLRC Response:

Please replace the 1st paragraph on page 4-41 with the following text:

"Annual average predicted concentrations of benzene in ambient air are presented in Figure 4.14 and are summarized for communities and at the property line in Table 4.15. There is no local air quality standard for benzene in

ambient air. These results will be used in the health impact assessment since benzene is a known carcinogenic substance. The highest concentrations are predicted at the property line (at 0.42 mg/m³). In communities, the highest concentrations are predicted in Come-By-Chance (0.026 mg/m³) and North Harbour (0.0173 mg/m³)."

The last sentence of page 4-86 should be clarified, as its content is grammatically incorrect and ambiguous.

NLRC Response:

Please replace the last paragraph on page 4-86 with the following text:

"Large numbers of birds breed in northern biomes with extended daylight, where it is relatively free of artificial lighting, and migrate annually through highly industrialized areas with substantial artificial lights. Species breeding at high latitudes (especially juveniles such as shorebirds) might suffer higher mortality during migration due to short daylight periods as they have never experienced nighttime and artificial light before undertaking the southward movements (Bevanger 1994)."

Socio-Economic (Volume 4)

Table 4.23 (pg. 4-24) this table reports numbers that show large and unrealistic amounts of unemployment amongst all skill trades (province-wide). These numbers should be verified with the source for accuracy.

NLRC Response:

Table 4.23 figures were supplied to AMEC Earth & Environmental by the respective unions and have been verified. These high numbers can be partially explained by "residing" referring to place of residence. Many union workers are working in such places as Alberta but still maintain their place of residence as Newfoundland and Labrador. The unions cannot say with any degree of certainty who is currently working inside or temporally outside of the Province.

Additional Comments:

The study area of Placentia Bay will play a large role in the now approved Hebron project due to its proximity, water depth of bay, ice free water, relevant existing infrastructure, and pre-existing ocean related industries. As a result, there will be many new direct and indirect impacts on the factors listed in this Environmental Impact Statement (EIS). It is the suggested that the proponent re-work the existing EIS to include the new economic impacts that will result from the Hebron project.

NLRC Response:

Regarding the suggestion that the existing EIS be re-worked to include new economic impacts that would result from the Hebron project, the following information should be noted. The Hebron oil field was discovered in 1981, talks on its development were shelved in 2002 and an agreement was reached on the royalty regime on August 22, 2007. At the time of the submission of NLRC EIS in July 2007 to the Department of Environment after more than six months of work, there was no way of knowing when or if talks on Hebron would be successful. Hebron is still a long way from receiving approval under the Environmental Assessment Act and NLRC cannot take responsibility for reworking its EIS to include a project that had an uncertain future when NLRC submitted its EIS. NLRC feels that the appropriate way to review these issues is for the Hebron Project to include the data from the NLRC Project into its Environmental Assessment.

(2.3) The Department notes that, in the Socio-economic Component study, the proponent addressed quality of life issues in considerable detail and emphasized them as an important contributing factor to sustainable development. It is questioned why quality of life issues are not similarly addressed in the Environmental Impact Study.

NLRC Response:

The approach to addressing quality of life taken in the overall Socio-economic Assessment was to consider the various factors that affect quality of life. These factors were identified in the EIS Guidelines and through discussions and consultations with the communities in the project area. The Conclusion of the Socio-economic Assessment draws together the individual considerations and outlines the intent and specific measures that NLRC will use to maintain or enhance the way of life (i.e. quality of life) within the Study Area. It should also be noted that the Component Study complements the EIS.

From the perspective of this Department, there are no issues of significance attached to this particular Environmental Impact Study.

NLRC Response:

NLRC acknowledges this response from the Dept. of Human Resources, Labour and Employment.

EASTERN HEALTH

Given the parameters' natural nature, the low level exceedance, and the parameters not being a normal effluent constituent, no risk to human health is anticipated from facility operations.

An assessment of potential human exposure pathways: hunting, berry picking, recreation, for emission constituents should be well handled in terrestrial effects monitoring which the proponent has committed to in their registration document.

Planned effects mitigation measures especially as they relate to housing, public health and acute care, and community and family social services are considered effective measures.

Planned establishment of regional industry and community services agencies, industry and community services, and community liaison committees are deemed essential to meeting the needs of the communities, the proponent, and the service providers including community and acute care services. Committees should be set up early to ensure effective cumulative effects monitoring, to ensure service providers are able to meet projected needs, and to ensure ongoing issues are addressed in a timely manner. Plans to address some of the employee medical needs on-site should help reduce the burden on local medical services.

NLRC Response:

Regarding planned establishment of regional industry and community services agencies, industry and community services and community liaisons committees, NLRC agrees they are important and will take the lead in ensuring that cumulative effects monitoring is undertaken and that project plans that affect service deliverers are provided in a timely manner.

It's recommended that the proponent work with local communities in emergency response development and plan testing.

NLRC Response:

NLRC agrees that it should work with local communities in emergency response development and plan testing.

With regard to recreation, it's recognized that the proponent plans to provide on-site facilities, it is recommended that the proponent, through the various committees, seek ways to assist communities in meeting community recreation needs; e.g.; existing facility maintenance and upgrades.

NLRC Response:

NLRC agrees that it will provide on-site recreation facilities at the work camp and that it will seek ways through regional committees to assist communities in meeting community their recreation needs.

Water, sewer, and general waste handling is well documented, food handling provision however during the construction and operation phases is not discussed. What is the proponent's plan regarding food preparation and handling?

NLRC Response:

Regarding food preparation, NLRC will ensure that all food preparation and handling at the Project site meets the Province's Food Premises Regulations (1996) that were recently consolidated (2006). NLRC will ensure all permitting requirements for catering/cooking facilities are met.

It's recommended this study be repeated every 5 years when data is available. This study covers the period 1999 to 2004, the next study could be considered for 2009.

NLRC Response:

Regarding the request that this study to be repeated every five years when data is available, it is assumed that "this Study" refers to the EIS. Under the Environmental Assessment Act, an EIS is only required once. However, NLRC agrees to undertake a socio-economic management plan as stated in Chapter 15. If this is a reference to the Health Study, it will be considered under the Socio-economic Management Plan.

NEWFOUNDLAND & LABRADOR
DEPARTMENT OF FISHERIES AND AQUACULTURE

The DFA - Aquaculture Branch Comments (NLRP - EIS)
Volume 4, Socio-Economic Assessment

The EIS is acceptable from an Aquaculture stand point after the following comments have been addressed. Overall it is believed that the quantifiable parameters respecting socio-economics in the baseline work have been noted in the EIS.

Section 2.2. Consultations

Fisheries and Aquaculture is not listed? Consultation with DFA on Aquaculture matters is a significant reference in the baseline study. Although DFA is identified in the Appendix, it is believed that it should be listed in (2.2.) with the other Departments.

NLRC Response:

NLRC itself and consultants working on the environmental assessment consulted with the Department of Fisheries and Aquaculture on several occasions for key information regarding commercial fisheries and aquaculture. These consultations are referenced in Volume 4, Appendix A: Agencies and Persons Consulted and Sections 5.1, 5.2 and 5.3 of the Commercial Fisheries and Aquaculture section; in Volume 5 Public Consultations, Appendix A: Meetings and Discussions with Government Agencies; and in the Canning and Pitt Background Report (which is appended to this Addendum as Appendix B). Please note the amended list of provincial government agencies in Section 2.2, volume 4 reads:

"Provincial

- *Environment and Conservation*
- *Human Resources, Labour and Employment*
- *Fisheries and Aquaculture*
- *Women's Policy Office*
- *Rural Secretariat*
- *Business*
- *Municipal Affairs*
- *Transportations and Works*
- *Health and Community Services*
- *Finance*
- *NL Housing Corporation*
- *Eastern Health"*

Section 5.4.6. Accidental: Oil Spill

The section is accurate when it implies that a near shoreline oil spill does present a risk to aquaculture farmers when it states, "Depending on the level and extent of the shoreline impacted, the greatest effects (on a per enterprise basis) may be felt by the aquaculture sector." As well the section on effects and mitigation appear to be accurate.

However, in consideration of the baseline information provided on aquaculture development it is clear that despite some challenges in the finfish sector overall the aquaculture industry is undergoing annual grow/expansion in Placentia Bay, and this should be clear in the EIS text on aquaculture.

This is notable for blue mussels.

NLRC Response:

Information on aquaculture operations in Placentia Bay was provided by DFA in 2006 when the project was registered for environmental assessment and updated in April 2007 and is presented in Volume 4, Section 5.0 Commercial Fisheries and Aquaculture. Sub-Section 5.3.4 outlines the current situation for aquaculture: there are 13 DFA-licensed aquaculture operations in the bay with five presently in commercial production, all for blue mussels. DFA also indicated that eight additional license applications for blue mussel aquaculture were under consideration.

It should also be considered that the strategic focus on salmonids and cod in recent years by the Government of NL will spur development in these sectors. The Bay d'Espoir and Fortune Bay areas are only a starting point for industry expansion, and should not be looked on as the end all region for development, as was somewhat implied on (pg 5-34) in a statement that is 7 years dated (i.e., this is a significant period of time in consideration of the rate at which aquaculture is developing in NL).

In fact much will depend on Placentia Bay for cod expansion in the near future (i.e., a projected target made in Feb 2007 was ~2500 MT by 2011) and salmonids expansion in the mid to long-term expansion.

Thus, the statements (pg 5-61, and 5-62), "Currently underutilized species may have new and lucrative markets." and "The aquaculture sector may have expanded into many new areas with many new species in production.", can be more specific and strengthened by incorporating the trends noted and implied in the baseline and my comments.

NLRC Response:

The discussion in the EIS on the existing environment for aquaculture includes reference to the optimism for future finfish aquaculture (cod, salmon, steelhead) in Placentia Bay (commencing on page 5-34). The statements on pages 5-61 and 5-62 regarding the potential for aquaculture species in addition to blue mussels in Placentia Bay are drawn, in part, from recent (April 2007) discussions with DFA personnel and are meant to acknowledge that the economic considerations associated with aquaculture (in the event of a spill affecting operations) may differ in the future. Information on aquaculture operations will kept current in NLRC's spill response plans.

NEWFOUNDLAND & LABRADOR
DEPARTMENT OF ENVIRONMENT & CONSERVATION
WILDLIFE DIVISION

Volume 3, Biophysical Assessment

Page 3-108 Big Game:

The population estimate for woodland caribou is currently at approximately 60,000 and the population is declining.

NLRC Response:

The Wildlife Division was contacted to ascertain more details about the revised population estimate for woodland caribou. Based upon more recent surveying results for the south coast and Middle Ridge caribou populations (and subsequent modeling) the following changes should be made to the EIS. In the paragraph describing woodland caribou on page 3-108 replace the following sentence: "Newfoundland supports large and relatively healthy herds of woodland caribou estimated at over 100,000 and increasing, and they are considered not at risk by COSEWIC (Thomas and Gray 2002)." with "The population estimate for woodland caribou in Newfoundland is currently estimated at approximately 40,000 and the population is declining (C. Callahan, Big Game Management Biologist, Provincial Wildlife Division, pers. comm., 2007). It should be noted that this population estimate is considered preliminary and is based upon new and limited survey and modeling results. Woodland caribou are not currently considered at risk in Newfoundland (Thomas and Gray 2002)."

Page 3-110 Birds:

Additional surveys or information on breeding bird abundances must be provided before an accurate assessment can be made about potential impacts of the development on songbirds, waterfowl and birds species listed under endangered species legislation. Additional information should be provided to indicate how survey protocols were modified.

NLRC Response:

There is a large database on birds that frequent Placentia Bay including the Project location. NLRC undertook additional, site-specific surveys that were needed to provide the required information for accurate assessment of the impact of the Project on relevant birds.

The NLRC surveys have provided a list of the common breeding species and their relative abundances at the project site and a general picture of the breeding bird community. Further field study is planned during the 2008 breeding season (5 June to 5 July) using approved protocols to confirm the presence, or not, of Species at Risk and obtain accurate densities of breeding species. NLRC is confident that the studies carried out to date and the existing literatures and database are sufficient for the assessment and the additional surveys will provide added confirmation.

Page 4-3 Waterbodies:

The riparian zone surrounding waterbodies is a highly productive and sensitive zone for wildlife. A 50m naturally vegetated buffer should be maintained between the development and undisturbed waterbodies wherever possible.

NLRC Response:

Water bodies within 500 m of the proposed refinery site development that will not be directly impacted by the footprint of the proposed oil refinery and its access roads will be identified and zoned for maintenance of a minimum of 50 m buffers whenever possible.

Page 4-13 Table 4.2.

Otter should be included under the Marine Mammals & Sea Turtles heading.

NLRC Response:

Delete the river otter column from Table 4.1 and Table 4.3 and insert columns for river otter under the Marine Mammal and Sea Turtle heading in Table 4.2 and Table 4.4.

Page 4-67 Potential Adverse Effects due to Gaseous Air Pollutants:

Terrestrial plants may not be considered at risk but there should be some mention of terrestrial lichens here. Lichens are extremely sensitive to air quality and plant emissions may change the lichen community in the area.

NLRC Response:

Insert the following sentence at the end of the section: An assessment of potential effects of air pollutants on lichens is provided on pages 4-284 to 4-289.

Page 4-88 Habitat Loss:

Sampling for terrestrial birds was insufficient to determine if any national, regional or locally significant bird populations or bird habitats would be impacted by the development. One point count survey between 8:30 am and 3:30 pm in June is not sufficient to identify either bird densities or the presence of rare bird species in the area. Additional sampling is required to determine if rare birds or bird habitat will be impacted.

Appropriate mitigation must be developed to ensure that invasive plants are not introduced to the area. Mitigation measures might include washing of equipment being brought into the area to ensure no seeds are transported on equipment (particularly on tires), ensuring that materials being brought on site do not contain non-native insects or small mammals which might become established in the area etc.

NLRC Response:

The survey provided a relative abundance of the common breeding species and a general impression of the habitat and corresponding songbird breeding community in the project area. The habitat is typical of eastern Newfoundland and thus no unusual concentrations of any birds considered at risk are expected. A follow up survey using established protocols to confirm presence/absence of species, including Species at Risk, and for determining breeding bird densities will be conducted on the proposed refinery site during the peak singing period for songbirds between 5 June and 5 July 2008. However, NLRC is confident that the studies carried out to date as part of the EIS are sufficient for the assessment and the additional surveys will provide additional confirmation.

NLRC will consult with the Provincial Wildlife Division to develop mitigation measures to minimize the potential for introducing non-native terrestrial plant species into the project site.

Page 4-93,94 Loss of Rare Habitats:

Additional surveys for rare plants both within the project footprint area and in adjacent areas that will not be disturbed could provide additional insight into the impacts of the development on rare plants and rare habitats within the footprint area.

Survey methodologies and effort were inadequate to make any conclusion with respect to densities of terrestrial birds in the area and the potential impacts of the development on rare bird species and habitat. Additional survey effort is recommended.

NLRC Response:

Additional surveys for rare plants and lichens are currently underway in and near the refinery and access road footprints in an effort to complete baseline coverage of that area. This information will be provided to provincial and federal government agencies and mitigation and monitoring programs will be implemented to minimize impacts as required.

As discussed above, further study during the breeding season using established protocols will determine densities of breeding birds on the project site, including the location of species considered at risk.

Page 4-242 Otters:

The Wildlife Division supports the suggestion that additional monitoring be conducted to assess the potential impacts of the development on the Placentia Bay otter population. In order to assess the potential impacts of the development and any accidental oil spill on otter populations in Placentia Bay, a program to determine a population estimate and other relevant population demographics parameters must be developed in consultation with the Wildlife Division.

NLRC Response:

NLRC is committed to monitoring river otters in the Study Area. An appropriate monitoring program will be developed in consultation with the Provincial Wildlife Division.

Page 4-266 Species at Risk:

The survey effort for landbirds was insufficient to determine if any species at risk are within the project footprint area. Under the provincial Endangered Species Act, cabinet approval is required if the residence of a threatened or endangered species will be disturbed or destroyed by development activities. Additional survey effort is required to ensure that no listed species are nesting within the project footprint area.

NLRC Response:

As discussed above, the landbird survey provided a relative abundance of the common breeding species and a general impression of the habitat and corresponding songbird breeding community in the project area. The habitat is typical of eastern Newfoundland and thus no unusual concentrations of any birds considered at risk are expected. However, species considered at risk such as Rusty Blackbird and Gray-cheeked Thrush could be breeding on the project site. A follow up survey using established protocols to confirm presence/absence of Species at Risk, and for determining breeding bird densities will be conducted on the proposed refinery site during the peak singing period for songbirds between 5 June and 5 July 2008. Again, NLRC is confident that the studies carried out are sufficient for the assessment and the additional surveys will provide additional confirmation.

Page 4-269-288 Cyanolichens in the Project Area:

Additions lichen surveys must be conducted prior to the commencement of construction activities. The Wildlife Division has developed survey protocols. Surveys should be conducted within the footprint area, along proposed roads, in areas where prevailing winds will tend to produce the highest concentration of airborne pollutants and in areas where airborne contaminants will be lowest.

The Wildlife Division is willing to assist with the development of appropriate research projects to better assess the potential impacts of airborne contaminants from the refinery on lichen populations in general and *Erioderma* in particular.

NLRC Response:

As discussed above, additional surveys are underway for cyanolichens in the project area. Also, a depositional monitoring program that would allow assessment predictions related to effects on lichens including the boreal felt lichen will be developed in consultation with the Provincial Wildlife Division (and EC).

Page 10-1 Environmental Monitoring and Follow-up Plan

The Wildlife Division will require survey and/or monitoring programs for the following species:

Erioderma and other lichen species
Wetlands
Terrestrial birds
Otters
Eagles
Caribou

The Wildlife Division is willing to assist the proponent in the development of appropriate survey and monitoring programs to assess the impacts of the development on these species.

NLRC Response:

Monitoring programs will be developed, where required, for Erioderma and other lichen species, wetlands, terrestrial birds, otters, eagles and caribou. Such monitoring plans will be developed in consultation with the Wildlife Division.

Volume 1: Summary and Conclusions

Page 6 Emissions Reduction:

A lichenologist should be a member of the Air Quality Advisory Group to provide input and expertise with respect to the effects of air quality on lichens.

NLRC Response:

Monitoring programs will be developed, where required, for Erioderma and other lichen species, wetlands, terrestrial birds, otters, eagles and caribou. Such monitoring plans will be developed in consultation with the Wildlife Division. NLRC welcomes the opportunity to include a representative from the Wildlife Division (e.g. a Lichenologist) on the Air Quality Advisory Group.

Page 6-9 Terrestrial Birds:

Survey effort was insufficient to make conclusions with respect to landbird and nesting waterfowl densities and habitat.

Appropriate monitoring programs must be developed for the species and habitat as outlined in comments on Volume 3.

NLRC Note:

Although not requested in the comments on the EIS, the following table (Table C) provides the results of boat-based surveys of Placentia Bay for marine-associated birds conducted after preparation and submission of the EIS.

Table C. Average densities of marine-associated birds (per km^2) during 10-minute counts in Placentia Bay, June and August 2007. [*n* = the number of 10-minute counts conducted along the survey route.]

	Survey Route A (*n* = 25 counts)	Survey Route A (*n* = 42 counts)	Survey Route B (*n* = 40 counts)	Survey Route C (*n* = 37 counts)
Species	**18-Jun-07**	**24-Aug-07**	**23-Aug-07**	**28-Aug-07**
Common Loon	0	0	0	X
Northern Fulmar	0.03	0	0	0
Greater Shearwater	0.96	0	0	0
Sooty Shearwater	0.64	0	0	0
Manx Shearwater	0.13	0	0	0
unidentified shearwater	1.76	0	0	0
Northern Gannet	3.78	0.47	0.1	X
Double-crested Cormorant	0.03	0	0.02	0.03
Great Cormorant	0.10	X	0.26	X
unidentified cormorant	0.74	X	0	0.27
Bald Eagle	0	0	0	X
Semipalmated Plover	0	0	X	0
Ring-billed Gull	0.13	0	0	X
Herring Gull	0.77	2.37	1.86	3.7
Great Black-	0.06	0.08	0.1	0.1

	Survey Route A (*n* = 25 counts)	Survey Route A (*n* = 42 counts)	Survey Route B (*n* = 40 counts)	Survey Route C (*n* = 37 counts)
Species	**18-Jun-07**	**24-Aug-07**	**23-Aug-07**	**28-Aug-07**
backed Gull				
Black-legged Kittiwake	0.61	0.02	0.02	0
Common Tern	0.03	X	0	X
unidentified tern	0	0	X	0
South Polar Skua	X	0	0	0

NLRC Note:

In addition, coastal bird surveys were continued after April 2007 and surveys were conducted at each of the four sampling sites (Arnold's Cove, Southern Harbour, North Harbour, and Come By Chance) on 30 August and 14 September 2007. The results are presented in Table D Information gained from these surveys reinforces observations made during the August and September 2006 period; the barrier beaches and associated lagoons at Arnold's Cove and Come By Chance are important feeding areas for migratory shorebirds. A total of 17 species of shorebird were observed at these locations during the August and September 2007 surveys. Two species, Whimbrel and Pectoral Sandpiper, were recorded during the August/September 2007 surveys but not in 2006. Semipalmated Plover was the only species recorded in August/September 2007 in numbers noticeably different from the 2006 surveys. There were high counts of 138 at Come By Chance and 84 at Arnold's Cove in 2007 versus 4 and 39, respectively, in the same time period in 2006.

Based on existing literature, databases, previous EIA's, typical bird habitat in eastern Newfoundland and Placentia Bay, as well as, the site-specific surveys that have been carried out by NLRC during the preparation of the EIS and after the submission of EIS and the experience of the assessment team, NLRC is confident that the above studies/databases, etc. are sufficient for the assessment of the project effects on birds and its conclusion regarding such effects.

The planned future surveys will provide additional confirmation.

Table D. Numbers of birds observed in inner Placentia Bay by LGL Limited during coastal surveys on 30 August and 14 September 2007.

	30-Aug-07					14-Sep-07				
Group/Species	Southern Harbour	Arnold's Cove	Come By Chance	North Harbour	**Totals**	Southern Harbour	Arnold's Cove	Come By Chance	North Harbour	**Totals**
Waterfowl										
Canada Goose	0	0	0	0	**0**	0	0	12	0	**12**
American Black Duck	0	76	0	0	**76**	0	60	0	0	**60**
Common Loon	0	0	2	0	**2**	0	0	0	0	**0**
Birds of Prey										
Osprey	0	0	2	0	**2**	0	1	1	0	**2**
Bald Eagle	1	0	0	0	**1**	1	0	0	0	**1**
Sharp-shinned Hawk	0	1	0	0	**1**	0	0	0	0	**0**
Merlin	0	0	1	0	**1**	0	0	0	0	**0**
Shorebirds										
Black-bellied Plover	0	0	29	0	**29**	0	3	12	0	**15**
American Golden-Plover	0	0	1	0	**1**	0	0	0	0	**0**
Semipalmated Plover	0	36	138	0	**174**	0	84	10	17	**111**
Spotted Sandpiper	0	0	0	0	**0**	1	0	0	0	**1**
Greater Yellowlegs	0	40	39	2	**81**	0	7	29	2	**38**
Lesser Yellowlegs	0	5	5	0	**10**	0	0	1	0	**1**
Whimbrel	0	0	1	0	**1**	0	0	0	0	**0**
Ruddy Turnstone	0	2	5	0	**7**	0	9	0	0	**9**
Red Knot	0	1	4	0	**5**	0	0	8	0	**8**
Sanderling	0	1	8	0	**9**	0	0	1	0	**1**
Least Sandpiper	0	2	7	0	**9**	0	0	0	0	**0**
Semipalmated Sandpiper	0	6	43	0	**49**	0	2	0	3	**5**
White-rumped Sandpiper	0	0	12	0	**12**	0	1	1	0	**2**
Baird's Sandpiper	0	1	0	0	**1**	0	0	0	0	**0**
Pectoral Sandpiper	0	0	0	0	**0**	0	1	0	0	**1**
Dunlin	0	0	0	0	**0**	0	0	0	0	**0**
Short-billed Dowitcher	0	7	0	0	**7**	0	2	2	0	**4**
Gulls and Terns										
Black-headed Gull	0	2	0	0	**2**	0	1	0	0	**1**
Bonaparte's Gull	0	0	0	0	**0**	0	1	0	0	**1**
Ring-billed Gull	0	22	18	0	**40**	0	8	17	0	**25**
Herring Gull	12	54	5	3	**74**	11	598	8	3	**620**
Great-black Backed Gull	15	30	2	0	**47**	1	70	3	5	**79**
Common Tern	1	29	14	0	**44**	0	1	0	0	**1**
Other										
Black Guillemot	2	3	0	0	**5**	0	3	0	0	**3**
Belted Kingfisher	0	0	0	0	**0**	1	0	0	0	**1**
American Pipit	0	0	0	0	**0**	0	2	0	0	**2**
Totals	31	318	336	5	**690**	15	854	105	30	**1004**

NEWFOUNDLAND & LABRADOR
DEPARTMENT ENVIRONMENT & CONSERVATION
POLLUTION PREVENTION DIVISION

The Pollution Prevention Division (PPD) has reviewed the 5-volume EIS for the Newfoundland & Labrador Refinery Project, and now wish to provide the following comments:

1. It is stated in several locations in the EIS that best available technology economically achievable (BATEA) will be implemented to control air emissions. The commitment to apply best available control technology (BACT), as defined in section 6 of the *Air Pollution Control Regulations*, to each emission source within the refinery should be included by the proponent in the EIS.

   NLRC Response

   It should be noted that the use of BATEA and BACT as related to air emissions are interchangeable and mean the same in the context of the EIS. Emissions from the proposed NLRC refinery will meet the requirements of the Provincial Guidelines for Air Quality, satisfying the Air Pollution Control Regulations, 2004. The preliminary air quality assessment has provided conservative air quality emissions data, and the next phase of the project will look at each source within the plant and apply BACT either to the fuel source, burner technology or post-combustion control technology.

   NLRC is committed to assessing BACT on each point source as per the above-mentioned guidelines and regulations, and as described in the Air Pollution Control Regulations regarding BACT.

   Best available control technology (Excerpt from Air Pollution Control Regulations)

   6. (1) An owner or operator who installs a new or modified emission source shall employ the best available control technology.
      (4) Best available control technology shall be acceptable to the department and shall, in that particular circumstance, be:
      (a) the most effective emission control device or technique;
      (b) the most stringent emission control device or technique;
      (c) proven reliable in comparable processes; and
      (d) economically feasible as determined by the minister in light of industry standards after consultation with the particular owner or operator.

2. Vol. 2, pages 3-22 and 3-23: The proponent lists several of the common contaminants and streams associated with refinery wastewater, and numerous treatment methods that may be employed. Additional information on the wastewater characterization (influent and effluent) and treatment systems should be provided, so as to demonstrate that the refinery effluent can comply with the constituent limits specified in the *Environment Control Water and Sewage Regulations* and any applicable guidelines. The specific details of effluent treatment may be addressed upon application to the PPD for Approval to construct and operate the facility.

NLRC Response

All discharged treated effluent will meet all applicable federal and provincial regulations. The wastewater effluent will consist of the refinery's process water, cooling tower circulation water (heated water), the desalination discharge (heated and high brine water) and contaminated stormwater runoff from the plant site, the tank farm, etc. The wastewater will be directed to the marine outfall, where a sampling control point will be installed on land (a manhole or chamber) just before entering the marine outfall pipe, which is connected to a diffuser at its end.

The diffuser is designed to provide the required mixing, to minimize the zone of influence of the effluent discharges into the marine environment (to less than 100 m radius from the diffuser). This point will provide "the last control point" to ensure effectiveness of the wastewater treatment system and the characterization of both the influent and the effluent in relation to the ability of the treatment system to meet the requirements (concentration limits) of both federal and provincial legislations. The details of the type of sampling (on-line automated or manual), sampling frequency, substances, etc. will be determined at the detailed design stage and permitting and approvals process.

The seawater intake will consist of two (2) 1.2 m diameter high-density polyethylene pipes that will extend from the intake wet well at the shoreline to the seawater collection point approximately 985 m from shore. The pipe will be installed such that it is buried in the inter-tidal zone at the shoreline for protection from erosion and land-fast sea ice. It will be anchored with concrete bocks over the entire exposed length to prevent floating. The depth of the end of the intake will be at 18 m below low normal tide.

Wastewater treatment system effluent will be designed and monitored to ensure compliance with all applicable regulations, both provincial and federal. Sampling of water quality at the outfall location will be conducted to ensure parameters meet the provincial Environmental Control Water and Sewage Regulations under the Water Resources Act, the federal Petroleum Refinery Liquid Effluent Regulations *under the* Fisheries Act*, and the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life. These regulations and guidelines do not cover all of the parameters identified as wastewater contaminants; however, they are covered under sections 34 and 35 of the Fisheries Act.*

The proponent is also committed to monitoring within the effluent discharge "zone of influence" (e.g., within 100 m radius from the diffuser). This effects/compliance monitoring program (sampling locations, frequency and substance to be sampled) will be detailed as part of permitting and approvals. Due to the diverse nature of crude supply and the processing required, precise effluent parameters and concentrations will not be determined until the selection of the feedstock and the design of the process is complete.

3. The temperature and total dissolved solids concentration of the combined effluent from the proposed refinery, as estimated in the EIS, fall just within the acceptable limits for discharge specified in the *Environmental Control Water & Sewage Regulations*. Care must therefore be taken by the proponent during the detailed

design stage to ensure that the values of these parameters remain at or below the levels estimated in the EIS. This matter may be addressed upon application to the PPD for Approval to construct and operate the facility.

NLRC Response

NLRC recognizes that the temperature and total dissolved solids contained in wastewater effluent fall just below acceptable limits specified in the *Environmental Control Water & Sewage Regulations*. *Although these concentrations are only at the immediate location of the diffuser and within few meters from the discharge ports,* NLRC *commits to taking all necessary steps to ensure that these parameters will fall within acceptable ranges for marine discharge, including preparing site-specific models during the detailed engineering phase, as well as following a detailed water quality monitoring program. It should be noted however, all concentrations of deleterious substance within the zone of influence (100m diameter) are well below regulations.*

4. Vol. 2, page 3-18: With respect to stormwater management, it is indicated that "water that is released will meet provincial water quality guidelines. Contaminated water will be treated to meet Provincial quality guidelines prior to release to the environment." It should be noted that these releases will be subject to the *Environmental Control Water & Sewage Regulations*, which contain enforceable regulatory limits rather than 'guidelines'.

NLRC Response

On page 3-18, Volume 2 of the NLRC EIS, please replace the second paragraph with the following text, to read as follows:

"Storm water management practices will be in place to contain and release water in a controlled fashion. Water that is released will meet the provincial Environmental Control Water and Sewage Regulations. Contaminated water will be treated to meet these provincial quality regulations prior to release into the environment."

5. Vol. 3, page 4-52: It is stated that "all discharges will be in compliance with the Newfoundland & Labrador Environmental Control Water and Sewage Control Regulations and Associated Guidelines." The correct document reference here is the "*Environmental Control Water and Sewage Regulations*".

NLRC Response

On page 4-52, Volume 3 of the NLRC EIS, please replace the second paragraph with the following text, to read as follows:

"There will be one outfall pipe approximately 400m with a 100m diffuser at its end, located west of the Southern Head point. It should be noted that the actual concentration of various substances in the treated effluent is not known at present and will be determined as detailed engineering progresses. However, all discharges will be in compliance with the Newfoundland & Labrador

Environmental Control Water and Sewage Regulations (Government of Newfoundland and Labrador, 2003). Where specific substances are not addressed in these regulations, permissible levels have been supplement with those listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life."

6. It is stated in several locations in the EIS that temporary power generators (diesel) may be required during the initial stages of construction, which would later be used as an emergency/standby power source. The proponent will be required to evaluate emissions from any diesel generators prior to their usage at the site. Specific evaluation requirements, including atmospheric dispersion modeling, may be addressed upon application to the PPD for Approval to construct and operate the facility.

NLRC Response

Modeling of the construction phase was not undertaken because the details of project execution are not well enough defined at this point. The schedule of the construction contracts will determine the amounts and types of equipment on site at any one time and depending on the schedule there may be higher concentrations of equipment at some times.

NLRC is committed to conducting construction phase emissions modeling when the construction plans are defined. Past experience has shown that construction emissions are not normally significant and with the isolation of the site from the existing communities an exceedance of air quality standards during the construction phase is not anticipated. NLRC also acknowledges that the use of diesel generators on site will require permitting approval, which will in turn require dispersion modeling.

7. Vol. 2, page 8-23: It is stated that "there are currently no regulations regarding environmental noise in the province of Newfoundland and Labrador." This statement is not entirely accurate, as noise may be regulated as a nuisance issue under section 11(2) of the *Air Pollution Control Regulations*.

NLRC Response

NLRC recognizes that noise may be regulated as a nuisance issue under the Air Pollution Control Regulations and will meet the requirements of these regulations under consideration during all phases of the project. In addition, the effects of noise on workers also falls under the Occupational Health and Safety Regulations, which will also be implemented by NLRC during construction, operations and decommissioning.

8. Vol. 2, Appendix A (Relevant Legislation and Associated Permits): *The Air Pollution Control Regulations* are listed with sections 4, 12 and 13 specifically mentioned. Several other relevant sections of the regulations have not been cited here, including:
   Section 3: Ambient standards
   Section 5: Good engineering stack height
   Section 6: BACT

Section 9: Opacity monitors
Section 10: Sampling platforms
Section 17: Aboveground storage tanks
Section 18: Gasoline distribution networks
Section 19: NOx emissions

***NLRC Response*:**

Each of the above-mentioned Sections will be consulted to ensure full compliance of the Air Pollution Control Regulations during all phases of the Project.

ENVIRONMENT CANADA

Effects Of the Environment On the Project

General

Section 4.1 of the Environmental Impact Statement ("EIS") Guidelines indicates that a description of the existing environment, including meteorological conditions, must be provided by the proponent. Section 5.1 of the EIS Guidelines indicates that the proponent must assess the effects of the environment on the project, and in particular, the vulnerability of the project to climatic elements and provisions for minimizing risk. Important climatological factors to be considered in such an assessment include wind, precipitation, fog, wave action, and storm surge. The extremes and variability of these factors, and the influence of climate change, merit particular attention in evaluating and addressing risks that could have consequences for valued ecosystem components (e.g., system upsets and spills which impact wildlife and environmental quality).

In the EIS, the proponent should describe how climatological factors and best available data has been taken into account in designing structures, and identify steps that would help ensure built structures remain effective during and after storm events. When applying meteorological information to design parameters for infrastructure, the proponent is encouraged to consider the report, *Water Sector: Vulnerability and Adaptation to Climate Change* (GSCI and MSC, 2000). For example, when accounting for the effect of climate change on extreme events, such as particularly heavy precipitation, it should be recognized that the return periods for these events could reduce by at least a factor of 2 by the end of the century.

NLRC Response:

General:

We have stated in section 1.4.6 of Volume 2 that the effects of climate change on the design of the facility will be minimal. The one area stated that may have an effect is sea level rise and this will be designed into the marine facilities. The best available data will be used for the design of the facility included latest information on the prediction of climate change during the life of the facility. We have carried out a conceptual level design to date to give enough information for the EIS. More detailed studies will be carried out during detailed design stage. This will include site-specific wind &wave hindcast studies (including severe storm hindcast) and extremal analysis. The structures are designed for 100 year return period estimate (for wind, waves and current) as described in Volume 3, Section 3.5 and supplemented by the additional information provided below. Best design practices, risk assessment, HAZOP review, application of safety factors to design parameters applications of most recent building codes and other design standards will all be part of the final design which will ensure the project infrastructures, including Marine facilities will be built to withstand all extreme climatological factors, including severe storms, sea level rise, wave action, precipitation, storm surge, seismic etc.

NLRC will consider the report, Water Sector: Vulnerability and Adaptation to Climate Change (CSCI and MSC, 2000) to help ensure built structures remain effective during and after storm events.

Wave Climate

It would be helpful if the EIS included a description of the wave climate in terms of the joint frequency distributions of significant wave heights and peak wave periods (e.g. analyses by Oceans Ltd. (2007)) as well as information on the types and climatology of storms that produce extreme conditions along the south coast of Newfoundland. These storm systems include intense extratropical cyclones as well as tropical or transitioning cyclones as described in Bowyer and MacAfee (2005), Hart and Evans (2001), and Meteorological Services of Canada - Atlantic (2005). As its stands, some of the information used to characterize the wave climate in the EIS (Volume 3, Sections 3.5.6 and 7.2.5) could be updated based on improved hindcast models and more comprehensive marine data (Volume 3, Section 3.5.6).

The SmartBay buoy recorded 9.1 m during only 8 months of observations, and would not be expected to have observed the full range of extreme conditions possible over the length of time used to establish the climate of an area. The proponent identifies the highest significant wave height (Hs) in outer Placentia Bay as 9.5 m based on historical observations. The highest Hs at the mouth of Placentia Bay from the 50-yr hindcast period of the AES40 was comparable. However, extreme value analysis of the AES40 and MSC50 datasets (described below) suggest extreme values could be somewhat higher. Estimates of the 100 year return period significant wave height at the mouth of Placentia Bay are 10 and 12 m, from the AES40 and MSC50, respectively. The MSC50 extremal analysis shows a 100-year return period Hs of 10 m for most of outer Placentia Bay.

It would be helpful for the assessment of high impact scenarios to include examples of extreme storms that have affected Placentia Bay, especially any that affected the inner bay, by describing their impacts and the highest observed values of relevant coincident marine parameters.

A 30-year hindcast wave dataset was used for the inner parts of Placentia Bay. The EIS should include at least a brief description of the hindcast model and its validation. It may be worth examining short-term waverider data for locations within inner Placentia Bay, from the early 1970s and early 1990s, archived by the Department of Fisheries and Oceans Marine Environmental Data Service.

Additional long-term climatological wave hindcast data and marine observations for Placentia Bay and approaches are available, but are not used or mentioned in the EIS. These datasets would be useful for any further studies of the marine climate undertaken for this project, and are described briefly below.

- AES40 and MSC50: The AES40 50-year wave hindcast dataset (Swail *et al.* 2000) is freely available and has been employed in recent environmental assessments for marine projects in the area and in the offshore. In addition, the MSC50 wave hindcast (Swail *et al.* 2006) would be a valuable addition to any further analysis of the wave climate. The MSC50 hindcast improves upon the AES40 dataset in a number of ways including higher temporal and spatial resolution (thus more output

points within Placentia Bay), a larger model domain, inclusion of shallow water wave physics, and inclusion of additional wind information in the development of the wind fields. The MSC50 Wave Atlas, available online at http://www.oceanweather.net/MSC50WaveAtlas, includes wave climate maps, comparisons with observations, and extremal analysis maps and individual grid point data. MSC50 data for individual grid points are available from Environment Canada's Atlantic Climate Centre in Fredericton.

- The ICOADS (International Comprehensive Ocean-Atmosphere Dataset), available online at http://dss.ucar.edu/pub/coads/ , is a source of marine observations and monthly climatological statistics that includes more recent observations than the MAST dataset. It provides monthly statistics on 2° grid boxes of winds, temperatures, and visibility. It also includes archived individual marine reports of weather and sea state from ships and buoys, from which climatological sea state statistics may be derived.

NLRC Response;

Wind/Wave Database used:

The available wind & wave data used in this study are:

1) *Meteorological Data from weather stations around Placentia Bay including:*
   - *St. Lawrence (on the Burin Peninsula at the western entrance of Placentia Bay (1966-1995)*
   - *Argentia (1976-1996)*
   - *Arnolds Cove (1971-1993)*
   - *Come By Chance (1971-1993)*
   - *SmartBay Buoy #1 (46º58.9378'N, 54º41.1746'W) started in August 2006 (wind & waves)*
   - *SmartBay Buoy #2 (near the marine terminal jetty at: 47º47.7'N, 54º02.3'W) it is also fitted with ADCP for current measurements.*

2) *Wave Measured Data*
   - *Mobil Oil Canada Hibernia GBS wave measurement program in Placentia Bay (Dec. 1, 1985 to Dec 31, 1986). This presents the best and most applicable measured data for the Project Marine Terminal. It represents a full year data at three locations simultaneously. Locations are:*
     (i) 47º46.95'N, 54º02.30'W
     (ii) 47º45.40'N, 54º07.93'W
     (iii) 47º42.28'N, 54º04.70'W
   - *Marine Environment Data Service (MEDS) buoy data at different locations in the Bay (see attached map).*
   - *SmartBay Buoy, two buoys one at the entrance of the bay and the second is near the proposed Marine Terminal (see above). The data collection from the SmartBay buoys is on-going and will provide the most recent wind and wave data for the project (mainly for operations and future wave hindcasting studies model verification).*

3) *Long Term (wind & wave) Hindcast Data*

- *MacLaren Plansearch Limited (1991) Wind and Wave Climate Atlas – Volume 1: East Coast of Canada (provides wind and wave statistics and extremes for the East Coast including the Grand Banks and the approached to Placentia Bay (excellent reference for offshore Placentia Bay and entrance).*
- *SNC-Lavalin 30 years site-specific Wave Hindcast (at Come By Chance Bay & Arnolds Cove Transshipment Terminal). This provides the only long-term wave climate at the proposed marine terminal. It also provides extreme wave analysis for the site. (SNC-Lavalin Inc./BAE Newplan, 1996).*
- *Canadian Climate Centre (1991) Wind/Wave Hindcast Extremes for the East Coast of Canada. Provides contour maps for wind and wave extremes of 50 and 100 year return periods for the East Coast including the Grand Banks and the south coast of Newfoundland including the entrance of Placentia Bay. It used 68 most severe storms in the period of 1957-1988.*
- *AES40 which modeled initially the entire 40-year time period from 1858 to 1997 and was updated to cover the period from July 1955 to June 30, 2004. It utilized global reanalysis of wind fields as input to third generation spectral wave model (ODGP 3G by Oceanweather Inc. (Swail et. Al., 2006).*
- *MSC50 was to improve the AES40 database by modeling the Canadian East Coast at significantly higher resolution (0.1 degree grid) and to incorporate shallow water physics using the same 3G model used in AES40. This database provides the best and latest long term wind and wave Hindcast data for the East Coast including most of Placentia Bay, (50 years from 1954-2004). This database also provides extreme wind and wave prediction (for 1,5,10,25,50,75,100 and 200 year return periods), thus applicable to the development proposal. It provides excellent data set for the Placentia Bay area south of the island (i.e. offshore the project location). This data can be used to provide input to a site-specific wave propagation (wave refraction and shoaling) at the site.*

  The above sources were used to provide full description of the wind and wave climate (both normal and extremes) for the Project area.

4) *Site-Specific Wave Hindcast (30 year hindcast)*
   In order to provide accurate prediction of the wave climate at the proposed marine terminal, long-term measured data is required. This is not a problem with wind data as there are enough long-term wind measurements in the study area. However, very limited measured wave data are available at or near the site (with the exception of the full Mobil wave data shown above), which although excellent data set, it only cover one year. It provides three hourly values of significant wave height, peak wave period and maximum wave height. Long-term wave hindcast is required to provide the design data for the marine facility. Since the site is protected from the south by the islands in Placentia Bay, the locally generated sea is by wind (fetch limited seastate) plus swell propagation from the open water south of the islands. The data from MSC50 hindcast or other sources can be used as input a shallow water wave propagation model (refraction and shoaling).

   A simplified wind driven wave hindcast model was developed by SNC-Lavalin (1996) for the Newfoundland Transshipment Terminal site selection study. The model used SMB method (U.S. Army Corps of Engineers, Sore Protection

Manual, 1986). The measured winds from Argentina and St. Lawrence weather stations were used as input to the wave prediction model. The swell component was estimated using refraction/shoaling co-efficients, which were determined from SNC-Lavalin Shallow Water Wave Propagation Analysis Program.

The combined significant wind wave (sea) and swell wave (swell) height was calculated as follows:

$$Hs = \sqrt{H\text{^}2_{sea} + H\text{^}2_{swell}}$$

The above model results were first validated by comparison with wave measurements (Mobil 1965-86 data). Excellent agreement was found between measured and hindcast values (see SNC-Lavalin 1986 for details).
The wave hindcast was then carried out for 30 years (from 1966 to 1986).

EXTREME ANALYSIS

Wind and wave extremes were determined from long-term hindcast database for the study area and analysis of the most severe storms that hit the southern coast of Newfoundland and the Grand banks. MSC50 database also provides extreme wind and wave prediction (for 1,5,10,25,50,75, 100 and 200 year return periods), It provides excellent data set for the Placentia Bay area south of the island (i.e. offshore the project location). This data can be used to provide input to site-specific wave propagation (wave refraction and shoaling) at the site. This will provide required data for the design and operation of the marine facilities, which accounts for the most severe storms in the study area.

For the purpose of this assessment, a long-term wave prediction data were obtained from a previous 30-year hindcast study (see SNC-Lavalin, 1996), which presents the best long-term site-specific wave climate at the head of Placentia Bay. The 30 year model hindcast in the vicinity of the project area indicated that the mean significant wave height is less than 1.0 m, and maximum significant wave height is 3.0 m. The estimated 100 year return period design significant wave height (H_s) is 3.75 m (upper 90% confidence), with associated maximum wave height (H_{max}) is in the order of 7.0 m.

The extreme analysis results at the entrance of Placentia Bay for 5, 10, 25, 50 and 100 year return periods (source: MSC50 extreme analysis at grid point # 11170, located at 46.875^o N,55.0^o W) are presented below:

Return Period (Years)	*Maximum Wind Speed (Ws) (m/s)*	*Sig. Wave Height (H_s) (m)*	*Maximum wave height (H_{max}) (m)*	*Peak Period (Tp)s)*
5	*25.94*	*9.71*	*17.65*	*13.5*
10	*26.75*	*10.29*	*18.63*	*13.8*
25	*27.76*	*11.03*	*19.87*	*14.2*
50	*28.51*	*11.57*	*20.79*	*14.5*
100	*29.26*	*11.57*	*20.79*	*14.8*

It should be noted that the MSC50 grid pont # 12169 at 47.30° N, 54.100°W at depth 216m offshore Argentia may provide the best model grid point for the propagation of swell to the site however, the archived wave spectral data does not exist at this location. Therefore, we selected other locations listed above to provide such data, which present more conservative design conditions. The 100 year significant wave height at this grid point is 8.4m versus 12.11m. Note that due to refraction and shoaling this value will be significantly reduced at the proposed marine terminal site.

Editorials

The following statement is offered in Volume 3, Section 3.0, p. 3-8: "The monthly precipitation data obtained from the Arnold's Cove climatic station covers a time period from 1968 – 1994 and is presented in Figure 3.8. The mean annual total of precipitation in the form of rain at the Come By Chance station is 1195.5 mm, whereas the mean annual snowfall amount is 124.5 cm." The reference to the Come By Chance station is in error – the correct source of data is the Arnold's Cove station.

NLRC Response:

EC is correct in this observation. This will be corrected in future reference to this data.

The hindcast locations for the inner parts of Placentia Bay were given as Come by Chance and Argentia in Section 3.5.2, but the actual results presented in Sections 3.5.6 and 7.2.5 gave hindcast statistics for Come by Chance and Whiffen Head, near Arnold Cove, not Argentia.

NLRC Response:

Wind data from Argentina and Come by Chance weather stations were used as input to the wave hindcast model, which provided the (30 year) wave climate in the inner Placentia Bay, which best represent the site conditions. Naturally the results are provided for the site and its approaches (Come by Chance Bay and Arnold's Cove).

Wave data were obtained from MAST statistics based on marine data up to 1989 (largely from ship observations). The area for which the MAST statistics were calculated (footnote of Table 7.12, Wave Heights for Locations on Placentia Bay) is the area of Placentia Bay bounded by 46.7N, 47.5N, 60.0W, and 58.0W. This appears to contain an error, as the longitudes would place the area west of Placentia Bay.

NLRC Response

Correct coordinates are:

46.7^{o}N, 54.0^{o}W and 46.7^{o}N, 55.3^{o}W
47.5^{o}N, 54.0^{o}W and 47.5^{o}N, 55.3^{o}W
NOTE: MAST was one of several databases, which was used to provide complete description of the marine climate. It provided good basis for separating swell and sea waves. As noted Placentia Bay can be divided into two main

areas, the open offshore outer area south of the Islands (which is similar to the wind and wave climate of the southern shore and northern Grand Bank of Newfoundland , and the inner bay which is sheltered by the several islands, thus different wave climate.

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Oceans Ltd. 2007. Climate and Oceanography. In *Marine Environment Component Study of Long Harbour, Placentia Bay and Vicinity*, prepared by LGL Ltd, for Voisey's Bay Nickel Company Ltd, 24 April 2007.

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Swail, V.R., Cardone, V.J., Fertguson, M., Gummerz, D.J., Harris, E.L., Orelup, E.A., Cox, A.T. 2006. The MSC50 Wind and Wave Reanalysis. *Proceedings of the 9th International Workshop on Wave Hindcasting and Forecasting*, September 25-29, 2006, Victoria, BC. [available online at: http://www.waveworkshop.org/9thWaves/]

NLRC Additional References

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SNC-Lavalin Inc. (1996). Newfoundland Transshipment Terminal Site Selection Study – Marine Physical Environment Component Report

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AIR EMISSIONS

Regulatory Framework for Industrial Air Emissions

As the proponent is no doubt aware, the federal government announced its Regulatory Framework for Air Emissions on April 26, 2007. This framework includes mandatory reductions in emissions of greenhouse gases and air pollution. The greenhouse gas regulations will come into force in 2010 and air pollutant regulations will take effect in the 2012 to 2015 timeframe. The petroleum refining sector is one of the sectors included in the framework.

Although the regulations are under development and are not yet in force, the direction for industrial facilities in Canada is laid out in the framework; namely, that Canada "*will have one of the most stringent sets of regulated targets for the emissions of greenhouse gases and air pollutants in the world*." The proponent should describe how the proposed new facility would be designed to meet such an objective.

NLRC Response:

The Regulatory Framework recently published by the federal Government for Air Emissions specifically references new facilities (defined as those whose first year of operation is 2004 or later). Newfoundland and Labrador Refining Corporation would fall under this category.

The new Regulatory Framework for Air Emissions (RFAE) sets a flexible approach to functioning, in particular when technology or special equipment is used in a plant for carbon capture and storage to offer significant emissions reduction. Firms would be able to use different options in order to meet their legal obligations for greenhouse gas regulations. In accordance with the Regulatory Framework for Air Emissions, greenhouse gas reduction will be implemented various approaches, such as:

- *Energy efficiency measures,*
- *Improved energy management systems,*
- *Carbon capture and storage, and*
- *Other emission-reducing technologies.*

NLRC has stated their intention to implement a selection of the above viable options in order to achieve and reach targets for greenhouse gas mitigation within the refining process.

To transition Canada from a position of high-level greenhouse gas emissions to one with steadily declining emissions, the government will set regulations for short-term emission-intensity reduction targets, which will come into force in 2010. The short-term targets would support initiatives such as increased development and use of renewable energy, energy efficiency, and cleaner transportation

According to RFAE there would be also various flexible options companies could take part in to meet their legal obligations with minimum economic impact, such

as emissions trading and contributing to a technology fund. In addition, when the international carbon market becomes more developed, the government will consider further emissions trading worldwide.

The emission trading system will be part of the regulatory framework for greenhouse gases and will have several components. The main component would be inter-firm trading, through which firms may buy and sell emission credits among themselves. A domestic offset system would allow regulated firms to invest in verified emission reductions outside the regulated system without restrains on firms' access to domestic emissions trading.

The technology fund would be used mainly to subsidize technology development and to finance investments that have a high probability of yielding greenhouse gas emission reductions in the long-term. Firms could contribute to the fund at a rate of $15 per tonne of CO2e from 2010 to 2012 and $20 per tonne in 2013.

This framework has also established an approach to setting facility level annual caps, based on recommendations and the methodology developed through the Canadian Council of Ministers of the Environment (CCME) refinery framework, for a range of air pollutants such as SOx, NOx, and volatile organic compounds (VOC's) for the refining sector.

NLRC has reviewed the federal Regulatory Framework for Air Emissions and has provided EC with emissions estimates. As a new facility, NLRC has an advantage from the perspective of being able to make use of the most modern technology from the start, as well as choosing to utilize cleaner fuel sources.

The NLRC refinery will be constructed and operated in such a manner that will serve to minimize air emissions of CACs, particularly greenhouse gases, and maintain standards within the regulated levels. NLRC is committed to meet the future requirements and is planning to use BAT and best fuels available in the detailed engineering phase of the project. As well, NLRC plans to support research for the development of modern methods to curb air emissions.

NLRC generic action plans for CO2 management will cover strategies associated with the following areas:

- *The process heaters and utility fuel system in the refinery,*
- *Energy efficiency,*
- *Hydrogen (pinch management),*
- *Advanced processing options,*
- *Process/ utility/ plant integration*
- *Alternate uses for waste heat,*
- *Carbon Capture and storage if available.*
- *Products produced by the refinery that reduce CO2 emissions by the end user.*

NLRC's air quality monitoring plan will be frequently evaluated and updated in order to ensure compliance with the upcoming targets and timelines. When

necessary, modeling exercises will be incorporated into the design and processes refinery components.

The proponent is encouraged to review the regulatory framework and participate in consultations as the regulations are developed. Information on the framework and the consultations can be found at www.ecoaction.gc.ca.

NLRC Response:

NLRC has participated in this process. The NLRC contact on this file at Environment Canada is Ms Helen Ryan.

Process Description/Use of Best Available Technologies/Economically Achievable

The proponent has committed to the use of Best Available Technologies/Economically Achievable ("BATEA"), but has not described how BATEA will be determined in this case. As no new refineries have been built in North America in a number of years, the proponent should describe how the BATEA determination would take into account engineering expertise, achieved emissions rates from existing refineries that have been modernized, and the European Commission's Integrated Pollution Prevention and Control Reference Document on Best Available Techniques for Mineral Oil and Gas Refineries.

NLRC Response:

As a new installation, NLRC will adhere to the highest of environmental standards and will obtain all the necessary permitting based on the intended use of BATEA (or BACT). By making use of the most effective and advanced stage techniques in the development of activities and their methods of operation, NLRC will ensure that no significant air pollution is caused, during each stage of the Project.

Preliminary and estimation of air emissions analysis was done to give conservative results for the assessment with the knowledge that the final plant configuration will provide much better results. The next phase of the project will look at each source within the plant and apply BACT either to the fuel source, burner technology or post combustion control technology to satisfy the requirements of the Air Pollution Control Regulations. NLRC is committed to assessing BACT on each point source as per these regulations and as described below.

Best available control technology (Excerpt from Air Pollution Control Regulations*)*

6. (1) An owner or operator who installs a new or modified emission source shall employ the best available control technology.
(4) Best available control technology shall be acceptable to the department and shall, in that particular circumstance, be:
(a) the most effective emission control device or technique;
(b) the most stringent emission control device or technique;
(c) proven reliable in comparable processes; and

(d) economically feasible as determined by the minister in light of industry standards after consultation with the particular owner or operator.

NLRC does not anticipate any exceedances of any air emission components outside the Project boundaries and will be additionally regulated via the permitting process.

Fugitive Emissions

Differential Absorption Lidar ("DIAL") studies, which measure the actual releases of volatile organic compounds ("VOCs") from refineries, have shown that emissions have often been greatly underestimated in the past. The proponent should describe and explain the confidence level for its emission estimates.

NLRC Response:

Air emissions modeling for NLRC has been done using very conservative assumptions, i.e. modeling has incorporated input parameters that represent higher concentrations of contaminants. As well, modeling was performed based on the most stringent guidelines in Canada. Based on the reliability of the model and expertise used, coupled with background research, NLRC has a high level of confidence that predicted air emissions will meet all applicable standards.

With regard to fugitive emission, we will implement a Leak Detection and Repair program to control process fugitive emissions and we will also proceed to the inspection of internal floating roof tanks to validate the good condition of the floating roof. CCME codes PN 1180, 1106 and EPC-72 will be implemented to reduce VOCs emissions at the source.

The estimation of emissions from various process units in Table 8.4 (Volume 2) does not include all of the emissions of organic compounds listed in the last paragraph on p. 8-10. Many of the listed compounds are of concern. Therefore, the proponent should either present emission estimates for all listed organic compounds and assess potential impacts, or provide reasons for why that is not deemed necessary. Schedule 1 of the *Canadian Environmental Protection Act* ("CEPA") and the Ontario Ministry of the Environment Point of Impingement Standards could be used to identify which compounds merit particular attention.

NLRC Response:

Air quality assessment studies performed in the past by SNC-Lavalin Environment Limited have shown that, typically, BTEX (benzene, toluene, ethylbenzene, and xylene) and in some occasions, 1.3-butadiene are the main chemical substances of interest for a refinery. For the air dispersion study, the assessment focused on benzene because it is by far the main substance that constitutes a health issue (i.e. of all the toxic substances produced by a refinery there are normally higher quantities of benzene emitted and it also has a very low allowable concentration criteria in the local air shed). Based on this comparative analysis, health issues with other toxic substances are not anticipated. However, to address possible concerns, the project will address other toxic substances

emissions in the detailed engineering phase and communicate the results to the stakeholders.

The following are specific observations on the emission estimates presented in the EIS and requests for clarification:

It is understood that the proponent has derived emissions estimates for the tail gas recovery and thermal oxidation unit from Chapter 8 of the United States Environmental Protection Agency AP-42 ("AP-42"). Based on an estimated 1000 tonnes/day of sulphur associated with a 300,000 barrels/day production rate (Volume 2, Section 6.1.6, p. 6-12), and the emissions factors in AP-42, EC's calculations yield much greater sulphur dioxide ("SO_2") emissions than those presented in Table 8.4 for the tail gas recovery and thermal oxidation unit. The proponent should provide further details on how it has calculated SO_2 emissions attributable to the tail gas recovery and thermal oxidation unit.

NLRC Response:

NLRC is committed to implementing BACT for the sulphur recovery systems. To support the emissions estimation for the EIS, NLRC consultants developed a detailed process simulation of the entire sulphur recovery train using Sulsim 6.0, which is an industry standard simulation tool specifically developed to simulate sulphur recovery facilities. This facility was simulated as a 3 stage Claus unit followed by a SCOT type tail gas recovery unit. This configuration provides the current best available recovery efficiency for sulphur recovery units.

The actual tail gas composition generated by Sulsim for the overall sulphur recovery efficiency on a molar basis is 99.98% based on the proposed plant configuration.

The calculations that were used to predict the annual average fugitive emissions from a number of sources (Volume 2, Table 8.5) cannot be validated without further information on the Screening Values used (denoted as "SV" in the Canadian Petroleum Products Institute Code of Practice and as "C" in Table 8.5). The identity of the Screening Values together with a rationale of why they were used should be provided.

NLRC Response:

The screening values used in calculations to estimate process fugitive emissions are as follows:

- *93 % C = 100 ppm*
- *5 % C = 1,000 ppm*
- *2 % C = 10,000 ppm*

Based on experience and because NLRC will be a new facility using low or no emissions design, process fugitive emissions are expected to be lower than those estimated in the air quality assessment.

Estimates of total flare emissions (Volume 2, Table 8.10) appear to have been derived based on industrial flares emission factors from AP-42. While refining is noted as one of the sectors employing industrial flares, the petroleum refining section of AP-42 also provides emission factors for vapour recovery and flaring. The proponent should confirm that the correct emissions factors have been used, given that the emission factors for vapour recovery and flaring are greater than those for industrial flares.

NLRC Response:

There will be no flaring of vapor recovery at the proposed NLRC refinery, therefore, flaring is not included in modeling as this is an accidental release and modeling has only been performed for steady state operations.

Normally, vapor recovery is not flared but recycled to the process. Flaring was not estimated, as the predicted emissions (including SO_2) are negligible in the overall atmospheric emissions. Detailed flaring scenarios must be performed during the detailed engineering phase.

The total emissions of nitrogen oxides ("NO_x") from flaring reported in Table 8.10 could not be reproduced based on low-NO_x burners as the sole control technology. The proponent should provide further details on additional tailpipe technologies that are being considered to reduce emissions, in order to confirm the validity of the estimated emissions.

NLRC Response:

NO_x emissions are based on factors provided by the Department of Environment and Conservation based on BACT. Final emissions will be confirmed at detailed engineering phase

Modeling/Ambient Concentrations

It is stated in Section 4.10.2 (Volume 3, p. 4-287) that emissions from the Come By Chance Refinery were once over 2.5 times greater than they are now. The proponent should clarify whether the background concentrations presented in Table 4.5 (Volume 3, p. 4-28) relate to historical or contemporary emissions levels.

NLRC Response:

Background ambient air quality concentrations are actual values (i.e. 2007). Also, as NLRC refinery start-up is planned for 2012, these background values (provided by NL DEC) are expected to be lower in 2012 due to a requirement of NARL to reduce its atmospheric emissions on a yearly basis.

A discussion of the stack heights required for modeling purposes is presented in Section 4.2.4 (Volume 3, p. 4-29). The proponent should discuss how these heights will

compare with the actual facility stack heights and provide a qualitative discussion of how this may affect the modeling results.

NLRC Response:

Stack heights used in the modeling height have been established to avoid plume down-draft. During the detailed engineering phase, stacks' height will have to be validated (i.e. higher or equal to proposed height) depending on the final and detailed description of the plant structures.

Specific stack heights will be confirmed during the detailed engineering design phase of the project, upon which time further air dispersion modeling will take place.

The fuel mix used in developing the emissions scenario is identified in Section 4.2.4 (Volume 3, p. 4-30). It is not clear, however, whether that fuel mix represents a long term average or the likely fuel mix at any point in time. It is important that the emission rates used in the modeling be consistent with the time frame of the regulatory requirements. For example, if the fuel mix is presented as an annual average, although residual fuel oil is likely to be used during a particular 24-hour period, then the emission rates employed for estimating the annual and 24-hour concentrations would have to be adjusted accordingly. The proponent should clarify how the emission rates were used relative to the time frames of the regulatory requirements.

NLRC Response:

The fuel mix is the worst-case scenario expected during the preliminary engineering phase of the project. It is expected that this fuel mix is realistic during winter, however more refinery gas could be available during other seasons. For the atmospheric dispersion study, we have simulated the worst case fuel mix all year long to be conservative.

The sulphur content for marine fuels is assumed to be 1.5% (Volume 3, p. 4-30), although the use of fuel with a higher sulphur content is currently permitted. If ships servicing the refinery are likely to be using fuel with a sulphur content greater than 1.5%, a more conservative emissions rate should be chosen (note that if the tankers are carrying high sulphur crude, they will likely be coming from a place where high sulphur marine bunker will be available).

NLRC Response:

Review of the shipping industry has indicated that the trend in marine fuels is moving towards lower percentage sulphur fuels. As well, Canada and the US are also working together to reduce the sulphur content of marine diesel fuel. The International Maritime Organization (IMO), a United Nations agency which governs shipping regulations in international waters, currently requires heavy ocean-going vessels to use diesel with a sulphur content of less than 4.5 percent.

Canada and the United States are planning to apply under an exception of an IMO agreement to have North America declared a Sulphur Emission Control

Area (SECA), which would limit sulphur content to 1.5 percent. In order to make the application, both countries must first ratify the agreement, and hope to do so within 6-10 months; Environment Canada and other government agencies are conducting research to build the case for creating an SECA.

Ships that are loading will be using shore power and gravity flow from the tank farm and will not be running onboard engines to run pumps. Only crude carriers that are offloading will be required to run onboard pumps to pump the crude from the vessel up to the elevation of the tank farm. NLRC has chosen to model two ships offloading at the dock, which is very conservative. This would be similar to having one vessel at the dock loading which is burning 3% sulphur fuel, therefore it is felt that the modeling is still adequately conservative.

The proponent concludes in Section 4.2.5 (Volume 3, p. 4-42) that predicted ambient air concentrations will be near or below the World Health Organization ("WHO") guidelines. However, the data presented in Table 4.8 do not justify this conclusion for the 3-hour and 24-hour SO_2 standards, which show that the maximum concentrations from the proposed refinery alone will be well above the WHO guidelines. This should be clarified.

NLRC Response:

Short-term hazard quotients based on predicted gaseous air pollutants concentrations from the proposed refinery at the property boundary are show in Table 1. short-term background concentrations were not available for the property boundary. This represents the maximum concentration that a receptor would be exposed from emissions from the proposed refinery in the short-term at the maximum concentration location anywhere off-site. It is acknowledged thet there may temporarily be elevated levels at the property boundary from already existing facilities (Lawrence 2007), however, it is expected that the climatic conditions that result in the maximum short-term concentration from the proposed refinery are such that other sources can be neglected. It should be noted that conservation from the proposed refinery are such that other sources can be neglected. It should be noted that conservation assumptions were used in the derivation of emission estimates (as discussed in the Air Quality Component Study) therefore, the predicted concentrations are considered to be conservative over-estimates.

TABLE 1

MAXIMUM SHORT-TERM HAZARD QUOTIENTS FOR GASWOUS AIR POLLUTANTS EMITTED FROM THE NLRC REFINERY

Gaseous Air Pollutants		*Predicted Maximum Concentration (µg/M^3)*	*Health Based Criteria (µg/M^3)*	*Hazard Quotient*
CO	*1 hour*	*80*	*30,000*	*<0.01*
NO_2	*1 hour*	*458*	*200*	***2.3***
SO_2	*1 hour*	*824*	*350*	***2.4***

Note: All health0based criteria obtained from WHO.
*Values in **bold** exceed a hazard quotient value of 1*

As seen from Table 1, short-term hazard quotient from CO concentrations fro the proposed refinery is below 1 and represents less than 1% of the health based criteria. In contrast, short-term, 1 hour hazard quotients fro NO_2 and SO_2 are 2.3 and 2.4, respectively. Examination of the contour diagrams as provided as part of the air dispersion modeling indicates that fro both NO_2 and SO_2, the maximum predicted concentration along the property boundary is located offshore, southeast of the proposed refinery. On land maximum 1-hour concentration is approximately 300 µg/M^3 for SO_2 and 150 µg/M^3 for NO_2, both below the health based criteria. The short-term maximum concentration off-site for NO_2 and SO_2 is above the health based criteria, however, the location of the maximum is over water. Potential fishing in this area is likely to be limited given the use of this portion of the bay as a shipping channel for the proposed refinery as well as the already existing North Atlantic Refinery. There are no existing aquaculture sites at this location with Placentia Bay. It should be noted that the short-term TRVs for NO_2 and SO_2 are based on protection of sensitive individuals within the general public (asthmatics) and are thus conservative for the expected receptors. In addition, conservation assumptions were used in the derivation of emission estimates. For example, it was assumed ship unloading would occur 365 days/year, 24h/day where as it is expected that there would be 66 crude oil deliveries during a year. In addition, the short-term values are exceeded for less that 3% of this year. Based on all of these considerations, it is expected that the potential for a human health effect from short-term exposure is considered to be low.

At specific sites over water near the marine terminal, the short-term maximum concentration for NO_2 and SO_2 is above the health-based criteria specified by the WHO for 1 hour and 24 hour as a result of ship emissions. The modeling of ships engines is somewhat conservative because two ships are modeled when in reality if there are two ships at the berth only the ship that is unloading will have engines running in order to power pumps and associated systems. Ships that are loading will have gravity assist or onshore pumps to load. Also the short durations are one hour out of the whole year. From table 13 on page 22 of the air Quality Component Study it can be seen that the worst hour is 82% of the provincial value while the next worst hour is 60% of the provincial value and closer to the WHO value.

The potential for a human health effect from short-term (24-hour) exposure to refinery emissions is considered to be low, based on the results of the human health risk assessment by SENES Consultants Limited.

The long-term exposure (annual values) to NO_2, CO and PM2.5 are well below health-based guidelines and therefore not expected to be a concern. Annual SO_2 concentrations as well as other contaminants are expected to remain well below the WHO guideline.

The health risk assessment concluded that no measurable adverse health effects would be expected to occur in the communities near the proposed refinery based on the emissions from the new refinery when combined with the existing background concentrations.

As indicated in the August 31st EC review of the air quality component study, further air quality work using revised emission estimates may be appropriate depending on the clarifications offered by the proponent.

NLRC Response:

NLRC agrees and commits to complete further air quality work during the detailed engineering phase.

Greenhouse Gases

Greenhouse gas ("GHG") emissions are a cumulative, global issue. The total worldwide emissions from millions of individual GHG sources are expect to result in significant adverse environmental effects. Therefore, reducing GHG emissions from all sources, both large and small, is encouraged so that the total, worldwide GHG emissions are minimized. The EC report, *2005 Facility GHG Reporting*, identifies industrial GHG emitters in Newfoundland and Labrador. Based on predicted emissions of 3,581,383 carbon dioxide equivalent ("CO_2 eq") tonnes/year, the proposed refinery would be the largest single source industrial emitter in the province and will make attainment of GHG reduction targets more difficult.

NLRC Response:

NLRC will implement the "Clean Fuels" requirements as required by the Regulatory Framework for Air Emissions to reduce GHG. NLRC has also participated in the process to establish refinery sector caps for air pollutants and GHG. It should be noted that the new facility will be included in the national refinery sector cap for GHG's.

As GHG is a global issue, the important criteria to reduce climate change issues is to use best fuels available and best technologies available. NLRC is committed to reduce GHG as much as possible and to be among the cleanest refineries in the world.

It is stated in Section 8.1 (Volume 2, p. 8-1) that an inventory of all significant emissions has been prepared for both construction and operational phases. However, the inventory of atmospheric emissions in Table 8.11 lists only CO_2 eq resulting from operations (stacks) and ship maneuvering. The proponent should include a complete inventory from all project phases (e.g. construction, commissioning, operations, maintenance, malfunctions and accidental releases). Key assumptions used to estimate GHG emissions, as well as the methods that will be used for verifying actual GHG emissions once project construction and operation start, should be discussed in more detail.

NLRC Response:

The second sentence in the first paragraph should be changed to read:

"An inventory of all significant emissions and discharges has been prepared for the operations phase."

The following sentence should be added to the end of the first paragraph:

"The operations phase of the project will have orders of magnitude higher emissions of contaminants and green house gases than from all other phases of the project combined, therefore for the purpose of the assessment, it was determined that if the air quality assessment provides good results for operations then the other phases of the project will be acceptable from an air quality perspective. NLRC has committed to carry out additional modeling to confirm the emissions quantities for all phases of the Project and present these results to stakeholders during the detailed design phase of the project."

With regard to green house gas emissions the primary source of emissions during operations are process heaters and other process operations, the remaining sources represent a small fraction of additional gasses. The Department of Environment are developing protocols to establish key assumptions used to estimate GHG emissions, as well as the methods that will be used for verifying actual GHG emissions for refineries in Canada as part of industry consultations that are ongoing. NLRC are in discussions with Environment Canada and are fully involved in this process.

Given the predicted emission quantities, all potential reduction strategies should be investigated and analyzed during the early project planning and design stages when BATEA options are easier and more economical to address. Several GHG reduction technologies and strategies are most likely to be feasible if incorporated when the project is constructed. While the proponent has raised the "the possibility of utilizing **cogeneration units**…at **later** stages in the project development" (Volume 2, p. 6-9), a full analysis of the possibility of utilizing cogeneration units should be included, together with BATEA and best management practices, as part of a detailed GHG Management Plan included with the EIS.

NLRC Response:

A detailed GHG Management Plan will be developed as part of the detail design for the facility. NLRC will implement the "Clean Fuels" requirements as required by the Regulatory Framework for Air Emissions to reduce GHG. NLRC is committed to evaluating all available options to reduce emissions in the detailed phase of the project.

An outline of the green house management plan is given is section 8.4. This plan will be fully developed during the detailed design phase had which point all options to reduce green house gases will be explored. At that time NLRC will evaluate if and how a cogeneration plant could be beneficial to issues as GHG global emissions and local air quality, especially in the context of local source of electricity (hydro vs. thermal).

Environment Canada has still not defined what the requirements of the "Clean Fuels" will be so it is difficult to complete a detailed GHG Management Plan at this time. Also NLRC has participated in the process to establish refinery sector caps for air pollutants and GHG the new facility in included in the refinery sector cap.

Editorials

It is mentioned in Section 8.4 (Volume 2, p. 8-21) that production of ultra-low sulphur diesel will have "…a tremendous impact on end-user emissions ….for greenhouse gases…". The reference to GHGs in this context is inaccurate and should be removed.

NLRC Response:

The reference to GHGs here is presented to support the fact that diesel is at least 20% more efficient as a fuel source. This means that diesel per kilometer of travel produces less GHG, especially as new diesel engines with lower emission rates (CO_2 as well as SO_2, particulates, etc.) are available on the market (personal cars and commercial vehicles).

The following statements are included in the EIS: *"Air quality and greenhouse gas levels will remain consistent with current baseline information and data. Local short-term changes in air quality and greenhouse gas levels may be triggered in the event of fire"* (Section 3.10, Volume 3, p. 3-205). It is implied that since local concentrations of GHGs will not be elevated under normal operations, the GHG emissions from the project will not be an issue. This is not correct. The three principal GHGs emitted from the project (i.e. carbon dioxide, methane, nitrous oxide) are all long lived gases in the atmosphere, with lifetimes in the approximate range of a decade to a century. As such, these gases become globally distributed and well mixed with the atmosphere. Thus, unlike other air pollutants, local concentrations of GHGs are almost never the issue – it is the global concentration of GHGs that are of concern. Accordingly, the statements should be revised to remove the reference to GHGs.

NLRC Response:

The statement "Air quality and greenhouse gas levels will remain consistent with current baseline information and data. Local short-term changes in air quality and greenhouse gas levels may be triggered in the event of fire" is made in the context of " what the future environment would be like should the Project not be approved" (see the first sentence in section 3.10 page 3-204). If the project is not approved and consequently not built, GHG from the project certainly will not be an issue.

If the project is not built then the only thing that may trigger changes to local air quality in the natural environment is a fire. A fire is an accidental event that will only temporarily cause changes in local air quality, thus having a negligible effect on the global concentration of atmospheric components. The GHG emitted from the fire will last but the source will be local and short term. The statement is correct.

If the project is not done in NL, the production is likely to be done in another country not requiring best fuel and best available technologies. As GHG are a worldwide issue, the resulting effect will be worse with more pollution and more GHG emitted on the planet.

WASTEWATER

The EIS should include recognition of the need to comply with the *Petroleum Refinery Liquid Effluent Regulations* under the federal *Fisheries Act* (Volume 2, Appendix A). Based on applicability of these regulations to the project, and the need to understand and manage potential effects on water quality, the following information should be provided:

- a water management program;

NLRC Response:

General - NLRC will develop and implement a comprehensive water management plan, including potable water, process water and firewater management, stormwater management, and wastewater management (as outlined in EIS Volume 2, Section 11.0 and Volume 3, Section 9.0 Environmental Management and Section 10.0 Environmental Monitoring and Follow-Up).

- a clarification of whether hydrostatic testing of pipelines will be carried out, and if so, the composition and fate of spent hydrostatic test fluids; and,

NLRC Response:

Hydrostatic pressure testing will be required for some pipelines, tanks and process vessels. A detailed procedure will be put into place for hydrostatic testing including a description of the fluids to be used with the handling, treatment and disposal of these fluids. The procedures will be written to comply with all applicable regulations. No Hydrostatic testing will be required for marine intake or outfall.

- the wastewater treatment system, including a characterization of both the influent and the effluent (at the last point of control), and an indication of how compliance will be monitored.

EC regards the last point of control to be that point at which the operator no longer has control over effluent quality (i.e. when the effluent leaves the treatment system and enters the discharge pipe - not the diffuser, which is considered to be part of the control system). All other compliance points should be identified (e.g. stormwater release). In support of EIS conclusions, the proponent should describe how the proposed treatment system will be designed, maintained and operated so as to meet the requirements of the *Petroleum Refinery Liquid Effluent Regulations*.

NLRC Response:

Wastewater Management

1. WASTEWATER TREATMENT

The wastewater treatment system will be designed and constructed to remove contaminant material from the wastewater streams generated by and collected within the Refinery, including:

- *Crude unit desalter effluent water*
- *Delayed Coking Unit process water*
- *Potentially contaminated storm water (oily surface water runoff)*
- *Water recovered from tank drainage and slops processing*
- *Excess stripped sour water*
- *Cooling Tower Blowdown*
- *Steam Generation Blowdown*
- *Boiler Feed Water System regeneration and rejects*
- *Process Unit Blowdown*
- *Sanitary waste*

The wastewater treatment system will be designed to maximize the potential for wastewater reuse within the Refinery. The specific requirements of the system will be developed during the detailed engineering phases of the project. The design will be based on specific information regarding the volume of water and nature of the contaminants as these details become available from Process Licensors and process unit designs.

The water treatment system will be designed to ensure that all regulatory requirements are met for the discharge of effluent from the Refinery, including the requirements of Schedule A of the Newfoundland Provincial Water and Sewage Regulations and Section 4 of the Federal Petroleum Refinery Effluent Regulations.

The treatment processes that are expected to be used include:

- *CPI Separation*
- *API Separation*
- *Dissolved Air / Gas Flotation*
- *Equalization Tank*
- *Biological Treatment*
- *Filtration / Clarification*
- *Tertiary Treatment*
- *Sludge Processing and Disposal*

Primary Oil / Water Separation

Oily Water System

Potentially contaminated oily water and oily surface runoff streams will first be treated to remove suspended oil before further treatment in the Wastewater Treatment system. The bulk of the water in the oily water system will come from unit run off during rain storms, tank farm area drainage, steaming and water washing of piping and equipment and other maintenance activities.

Oily water will be collected in an oily water pond that will be sized to capture potentially contaminated water during storm periods. The pond volume will be based on a 1 in 25 year storm for a 12 hour duration. Skimming facilities will be provided to remove large amounts of surface oil. Primary oil water separation will then take place in a Corrugated Plate Separator (CPS) or Corrugated Plate Interceptor (CPI).

The first section of the corrugated plate separator (CPI) is used to reduce the flowing velocity of the water that allows the heavy solids to drop out and the large globules of oil to float to the surface. Remaining Oily wastewater then flows through a series of corrugated plates where the remaining small globules of oil are pushed to the surface by capillary action. The oil collects and overflows into an oil recovery sump then is pumped to a skim oil tank and on to the slop recovery system. The heavy solids and sludge settles out and is transferred to a truck for disposal.

Process Water System

The process water system reduces the contaminants from all the process wastewater streams. An API separator will provide primary oil / water separation for process water treatment.

The API Separator is a gravity based oil – water separator. In the first section of the API separator is the forebay, which slows down the flow of the wastewater and enables heavy solids to settle. The second section is a three channel section. As the water flows through these channels, oil floats to the top and solid settles to the bottom. The free oil is skimmed off of the surface with flight skimmers. Free oil, which is pulled to one end of the channel, is removed by a rotating skimmer drum. Oil is also removed manually via an adjustable slotted pipe skimmer. The water is treated further in Secondary Oil / Water Separation systems.

The API separator will be a covered unit to minimize VOC vapour emissions.

Secondary Oil Water Separation

The water from the API Separator and CPI separator is treated with flocullant and then processed in an air flotation unit. Possible technologies are Dissolved Air or Gas Flotation (DAF or DGF), or Induced Air or Gas Flotation (IAF or IGF). The technology selected will be based on the actual volume and nature of the contaminants.

The purpose of the flotation unit is to further reduce the hydrocarbon content of the water in order to make the water of a suitable for biological treatment. The result is the formation of a floc at the surface of the water which is removed.

Heavy particles fall to the bottom of the flotation unit where they are removed as a sludge.

Equalization Tank

The treated water from the flotation units is combined with excess stripped sour water and sent to an Equalization Tank. The overall wastewater treatment process is essentially based on the biological treatment step, which is susceptible to sudden changes in composition, flow and temperature. The Equalization Tank provides for the equalization of both flow and composition of the feed water going to the Biological Treatment process.

Biological Treatment

There are many technologies available for biological water treatment, including aeration, batch reactors, Rotating Biological Contactors (RBC's) and Membrane Biological Reactors (MBR's). The technology selected will be based on the actual volume and nature of the contaminants.

Due to the enhanced processing capabilities, it is envisaged at this stage that aeration basins will be used for biological water treatment. The aeration basins use a waste activated sludge process. The process concentrates the waste activated sludge in an aeration tank to enable enhanced contaminant reduction in the treated wastewater.

Filtration / Clarification

The treated water from the biological treatment unit will be pumped through effluent solids filters. Clarification equipment, such as conventional circular gravity clarifiers or Lamella plate separators, will also be provided based on the actual volume and nature of the contaminants.

Tertiary Treatment

Tertiary water treatment facilities will be considered for the wastewater treatment system based on the actual flows and contaminant concentrations. Various tertiary treatment technologies are available, including:

- *Sand filters*
- *Multimedia filters*
- *Granular Activated Carbon (GAC) fluidized bed reactors*
- *Micro-filtration*
- *Reverse Osmosis*
- *Activated Carbon Absorbers*

At this stage of the Refinery design, activated carbon absorbers have been selected as part of the wastewater treatment system. Organic contaminants are absorbed within the activated carbon structure. However the tertiary treatment system technology and design will be finalized once the actual contaminant concentrations are determined.

Sludge Processing and Disposal

All the sludge streams from the various wastewater treatment processes will be further processed before disposal. Sludge treatment processes include gravity thickeners, filter presses, sludge driers and centrifuges. The final design will be based on the nature of the sludge to be disposed of and determination of the optimal sludge disposal mechanism.

2. EFFLUENT DISCHARGE INTO MARINE ENVIRONMENT

The following is a list of chemical constituents that are typically found in refinery effluent. Due to the diverse nature of crude supply and the processing required, specific, effluent parameters and concentrations will not be determined until the selection of the feedstock and the design of the process is complete.

Sampling at the outfall location will be conducted and the following parameters will be compared to the provincial Environmental Control Water and Sewage Regulations under the Water Resources Act, the federal Petroleum Refinery Liquid Effluent Regulations under the Fisheries Act, and the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life. These regulations and guidelines do not cover all of the parameters identified as wastewater contaminants; however, they are covered under sections 34 and 35 of the Fisheries Act.

Wastewater treatment system effluent will be designed and monitored to ensure compliance with all applicable regulations, both provincial and federal.

- *Flow*
- *Temperature*
- *Pressure*
- *pH*
- *COD*
- *BOD*
- *NH_3/NH^{4+}*
- *$H_2S/HS/S^{2+}$*
- *TSS*
- *TDS*
- *Oil & Grease*
- *Hardness (Ca^{2+}/Mg^{2+})*
- *TOC*
- *PO_4*
- *Phenols*
- *Benzene*
- *PAH*
- *Other HC*
- *Sodium (Na)*
- *Calcium (Ca)*
- *Magnesium (Mg)*
- *Chloride*
- *Sulphate*
- *Ammonia*
- *Cyanides*
- *Sulphides*
- *Molybdenum (Mo)*
- *Titanium (Ti)*
- *Beryllium (Be)*
- *Arsenic (As)*
- *Silver (Ag)*
- *Cadmium (Cd)*
- *Cobalt (Co)*
- *Chromium (Cr-total)*
- *Cr(VI)*
- *Copper (Cu)*
- *Iron (Fe)*
- *Mercury (Hg)*
- *Nickel (Ni)*
- *Lead (Pb)*
- *Selenium (Se)*
- *Vanadium (V)*
- *Zinc (Zn)*

The concentration limits under the above listed related regulations are provided below.

NL Environmental Control Water and Sewage Regulations – Schedule A

Parameter	*Environmental Control Water and Sewage Regulations*
BOD	*20 mg/L*
TSS	*30 mg/L*
TDS	*1000 mg/L*
Oil & Grease	*None to be visible*
PO_4	*1.0 mg/L (P_2O_5)*
Phenols	*0.1 mg/L*
Sulphides	*0.5 mg/L*
Arsenic (As)	*0.5 mg/L*
Silver (Ag)	*0.05 mg/L*
Chromium (Cr-total)	*1.0 mg/L (Cr^{3+})* *0.05 mg/L (Cr^{6+})*
Copper (Cu)	*0.3 mg/L*
Iron (Fe)	*10 mg/L*
Mercury (Hg)	*0.005 mg/L*
Nickel (Ni)	*0.5 mg/L*
Lead (Pb)	*0.2 mg/L*
Selenium (Se)	*0.01 mg/L*
Zinc (Zn)	*0.5 mg/L*
Temperature	*Maximum of 32°C*
pH	*5.5 – 9.0*

Petroleum Refinery Liquid Effluent Regulations Schedule I (Wastewater)

Name of Deleterious Substance	*Monthly amount in pounds per 1,000 barrels of crude oil*	*One day amount in pounds per 1,000 barrels of crude oil*	*Maximum daily amount in pounds per 1,000 barrels of crude oil*
Oil & Grease	*3.0*	*5.5*	*7.5*
Phenols	*0.3*	*0.55*	*0.75*
Sulfide	*0.1*	*0.3*	*0.5*
Ammonia Nitrogen	*3.6*	*5.7*	*7.2*
Total Suspended Matter	*7.2*	*12.0*	*15.0*

Petroleum Refinery Liquid Effluent Regulations Schedule II (Storm Water)

Name of Deleterious Substance	*Pounds per 10,000 Canadian Gallons of Storm Water*	*Pounds per 1,000 Canadian Gallons of crude oil per day*
Oil & Grease	*1.0*	*25.0*
Phenols	*0.1*	*2.5*
Total Suspended Matter	*3.0*	*75.0*

Canadian Water Quality Guidelines for the Protection of Aquatic Life

Parameter	*Marine Guideline*
Arsenic	*12.5 µg/L*
Benzene	*110 µg/L*
Cadmium	*0.12 µg/L*
Chromium	*56 µg/L (Cr^{3+})* *1.5 µg/L (Cr^{6+})*
Mercury (inorganic)	*0.016 µg/L*
PAH (Naphthalene)	*1.4*
pH	*7.0 – 8.7*
Temperature	*Not to exceed ±1°C*

The treatment system will be monitored at several locations along the treatment stream for confirmation of operating parameters. Monitoring of the effluent before discharge will ensure that discharged effluent will meet the regulatory requirements. Treated water will be held in the final effluent pond and tested before release.

3. COMPLIANCE MONITORING

The wastewater effluent will consists of the refinery's process water, cooling tower circulation water (heated water), the desalination discharge (heated and high brine water) and contaminated stormwater runoff from the plant site, the tankfarm, etc.

The wastewater from above sources will be directed to the marine outfall, where a sampling control point will be installed on land (a manhole or chamber) just before entering the marine outfall pipe. This point will provide "the last control point" to ensure effectiveness of the wastewater treatment system and the characterization of both the influent and the effluent in relation to the ability of the treatment system to meet the requirements (concentration limits) of both federal and provincial legislations (listed above). The details of the type of sampling (on-line automated or manual), sampling frequency, substances, etc. will be determined at the detailed design stage and permitting and approvals process.

The proponent is also committed to monitor the receiving water quality at the diffuser and within the effluent discharge "zone of influence" (e.g., within 100 m radius from the diffuser. This effects/compliance monitoring program (sampling locations, frequency and substance to be sampled will be detailed as part of permitting and approvals.

STORAGE TANKS AND PIPELINES

Based on information presented in relation to storage tanks and pipelines (Volume 2, Section 3.2, p. 3-14), the proponent should clarify the following design and operation features so as to facilitate an understanding of potential environmental effects and mitigation and monitoring options:

- how the secondary containment system for the tank storage area, consisting of dyking, diversion drainage channels and remote impounding, will function;

  NLRC Response:

  The secondary containment system will consist of a system of lined dykes surrounding the tanks to contain liquid releases. The system will be designed to meet the requirements of local, national and internal standards and well as industry best practices for safety and loss control. The design will meet the requirements of the "Storage of Gasoline and associated Products" "NFPA" "National Fire Code of Canada" as well as other applicable codes.

  Where the full volume of a tank plus the requirements for freeboard cannot be provided with the dyking around a tank spills will be directed to a lined impoundment basin remote from the tank. Liquids that flow into the impoundment basin will be monitored and treated as required before release. This is the same system that is in place at the existing Whiffen Head Transhipment facility and has performed very well.

- whether the underground piping is double-walled;

  NLRC Response:

  It is not our intent to use underground piping for hydrocarbons in the tank farm.

- which types of storage tanks (internal floating roof or fixed roof tanks) will used to store the crude and products;

  NLRC Response:

  Internal Floating Roofs will be used for storage of crude oil and refined products.

- how samples are taken from an internal floating roof tank given that a stilling well is not shown (Figure 3.6); and,

  NLRC Response:

  This detail was shown for general information only. Tank design will be determined during Detailed design phase and is not required for the EIS.

- whether the tank suction/fill line passes through the wedge sump (Figure 3.6) (if this is the case, it is unclear how water will be drawn off, as water will be redistributed into the tank, leading to corrosion).

NLRC Response:

This detail was shown for general information only. Details will be developed and finalized during the detail design phase and is not required for the EIS.

The proponent should also clarify whether the tank farm protection systems will be designed in accordance with the *National Fire Code* or the *National Fire Protection Association Guidelines*.

NLRC Response:

The tank farm will be designed in accordance with the National Fire Code of Canada 2005 or the National Fire Protection Association Guidelines, as well as, Insurance Underwriter's requirements.

CHEMICAL STORAGE AND MANAGEMENT

Chemical Storage Facilities

With regard to chemical storage facilities (Volume 2, Section 6.1.7), the proponent is encouraged to consider the National Research Council of Canada publications, *National Fire Code of Canada* and the *National Building Code of Canada*. The proponent should describe how it would take these codes (accessible at http://www.nationalcodes.ca or via 613-993-9960 or codes@nrc-cnrc.gc.ca) into account in the design, construction and maintenance of the chemical storage facilities.

NLRC Response:

The proponent will meet the full requirements of these codes in the design, construction and maintenance of the chemical storage facilities. Reference to these codes are included in Appendix B Master Codes and Standards List, Volume 2.

Chemical Management Planning

The proponent has identified several chemical substances that are likely to be associated with the proposed facility (Volume 2, Section 6.1.7, p. 6-14). The Government of Canada recently announced a categorization process (Canada's New Chemical Management Plan), which is likely to result in specific risk management actions under CEPA (e.g., prohibition, virtual elimination, performance agreements). Pertinent excerpts from the Plan accessible at http://www.ec.gc.ca/CEPARegistry/subs_list/dsl/s1.cfm are as follows:

- Government of Canada scientists, in co-operation with industry and health and environmental groups, have categorized the 23,000 substances on Canada's Domestic Substances List ("DSL") under CEPA into high, medium and low priorities for further work. Approximately 4300 chemicals were retained for further evaluation and/or management. Various processes are now in place to further define the risks associated with these chemicals including:

- An industry challenge program for the high priority chemicals (approximately 200). The federal government will be publishing, in batches of 15-30 substances every three months, a profile of these substances for industry and other stakeholders to provide any additional information in their possession. All challenge substances will be assessed within 3 years. Industry will have six months to comment on the profiles and provide requested information;

- Medium priority chemicals (approximately 2600) will be subject to standard risk assessment over the next 13 years;

    - Low priority substances (approximately 1200) will be subject to a rapid screening over the next year;

    - Government will review the information provided through the various assessment processes and decide what actions are to be taken through an expedited application of CEPA. Risk management actions for all substances will be implemented in accordance with the CEPA Process.

The proponent should describe how chemicals are to be selected and managed based on this national initiative.

NLRC Response:

The proponent will comply with CEPA and will follow the requirements of any new legislation and/or regulation with regard to the management of chemicals. A permitting and approvals framework to be developed for the project will include monitoring for new regulations, policies, guidelines etc. A commitment to Best Environmental Practices is one of the project Design Principles.

NEW SUBSTANCES

The *New Substances Notification Regulations* (Chemicals and Polymers) and the *New Substances Notification Regulations* (Organisms) are two sets of regulations made under the CEPA which set out the information that must be submitted to EC prior to the import or manufacture of any new substance in Canada. The potential applicability of these regulations should be recognized and reflected in the EIS including Appendix A in Volume 2. Information on new substances could be important to the environmental assessment, given implications for environmental impacts and appropriate mitigation and monitoring.

A 'new substance' is a substance which is not on the DSL; it can be a chemical, polymer, micro-organism or organism (including genetically modified organisms). The sole basis for determining if a substance is new to Canada is the DSL. The Non-domestic

Substances List ("NDSL") specifies substances not on the DSL, but accepted as being in use internationally. Substances on the NDSL are subject to the notification regulations for introduction to Canada, but involve fewer information requirements.

Prior to the import or manufacture of new substances in Canada, specific details are needed to confirm whether they are subject to the regulations and associated information requirements The proponent is encouraged to consult the CEPA Registry at http://www.ec.gc.ca/CEPARegistry/ for more details on the regulations.

NLRC Response:

After reviewing the substances identified under the Domestic Substances List (DSL) as maintained by the Minister under subsection 66(1) of the Canadian Environmental Protection Act, the proponent can state that it has no intention of importing or manufacturing new substances (substances not on the DSL). See Appendix D of this document, which should replace Appendix A of Volume 2.

FUELS

The applicability of the following CEPA fuel-related regulations should be recognized and reflected in the EIS including Appendix A in Volume 2:

- The *Gasoline Regulations* specify the allowable lead and phosphorus content in leaded and unleaded gasoline that is produced, imported, sold or offered for sale in Canada. Gasoline for use in aircraft is exempted and gasoline for use in competition vehicles, as defined by the regulations, is also exempted except for record and reporting requirements;

NLRC Response:

The products produced by the proposed refinery will have lead and phosphorus contents below those outlined in Canadian Gasoline Regulations, as the primary markets for these products will be Europe and the US.

The *Sulphur in Gasoline Regulations* restrict the sulphur content in gasoline produced in or imported into Canada. Primary suppliers have the option of either meeting the limit on a "flat" basis or on a "pool average" basis with a never-to-be-exceeded cap. Each option has different limits;

NLRC Response:

The products produced by the proposed refinery will have sulphur contents below those outlined in Canadian Sulphur in Gasoline Regulations, as the primary markets for these products will be Europe and the US.

- The *Benzene in Gasoline Regulations* limit the level of benzene in produced or imported gasoline. They also restrict the level of benzene in gasoline sold or offered

for sale. In addition, the Regulations restrict the Benzene Emissions Number ("BEN"), a calculated parameter that relates gasoline composition to predicted emissions of benzene from vehicle tailpipes. Companies may elect to meet a per-litre limits or yearly pool average limits;

NLRC Response:

The products produced by the proposed refinery will have benzene contents below those outlined in Canadian Benzene in Gasoline Regulations, as the primary markets for these products will be Europe and the US.

- The *Contaminated Fuels Regulations* restrict the import and export of contaminated fuels as defined in item 13 of the List of Toxic Substances, except in accordance with the Regulations;

NLRC Response:

NLRC will not import or export contaminated fuels as defined in item 13 of the List of Toxic Substances, except in accordance with the Regulations

- The *Fuels Information Regulations, No. 1,* require every person who produces or imports more than 400 cubic metres of a liquid fuel such as aviation turbo fuel, gasoline, kerosene, diesel fuel or fuel oils per year to submit to EC information as outlined in Form 1 and Form 2 of the Regulations; and,

NLRC Response:

Noted. The proponent will comply with these regulations. Form 1 and Form 2 (of the Fuels Information Regulations, No. 1) will be submitted annually.

- The *Sulphur in Diesel Fuel Regulations* applies to every person who produces, imports or sells diesel fuel. The regulations align Canadian requirements for the allowable level of sulphur in diesel fuels for on-road vehicles, off-road engines, locomotive engines and vessel engines with those of the United States.

NLRC Response:

Noted. The diesel fuel produced by the proposed refinery will have sulphur contents below those outlined in Canadian Sulphur in Diesel Fuel Regulations, as the primary markets for these products will be Europe and the US.

For more information on these regulations, the proponent is encouraged to consult the CEPA Registry at http://www.ec.gc.ca/CEPARegistry/. The fuels compliance promotion package at:
http://www.ec.gc.ca/cleanair-airpur/Fuels_Regulations_Compliance Promotion_ Package_ 2005-WS9AC4B7EB-1_En.htm may also be helpful.

NLRC Response:

The proponent notes that the Fuels Regulations Compliance Promotion Package is provided to manufacturers, importers and/or blenders of fuel in Canada to inform and remind them of their regulatory obligations under the Canadian Environmental Protection Act, 1999 (CEPA 1999).

HAZARDOUS WASTES

Regulatory Requirements

As "there are no disposal sites for hazardous wastes available in the province" (Volume 1, Section 7.9), all hazardous wastes from the facility shipped out of Newfoundland and Labrador for disposal or recycling in another province will be subject to the *Interprovincial Movement of Hazardous Waste Regulations* ("IMHWR") under the CEPA. The proponent should note that EC has proposed recommendations for updating the IMHWR to include the definitions of used oil and used oil filters. These proposed recommendations were published in *Canada Gazette*, Part 1 on September 2nd, 2006, that was followed by a 60-day comment period. At this time, written comments received are under review and will be taken into consideration by EC prior to drafting and publishing final recommendations in *Canada Gazette*, Part II.

NLRC Response:

The proponent recognizes that all hazardous wastes from the proposed refinery shipped for disposal or recycling in another province will be subject to regulations including the Interprovincial Movement of Hazardous Waste Regulations.

The *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* ("EIHWHRMR") under the CEPA should be consulted before an international shipment of hazardous waste is exported from Canada (e.g. spent catalysts and other hazardous wastes and hazardous recyclable materials identified in the EIS). If the EIHWHRMR are applicable to the project, a permit would be required. The potential need for such a permit should be recognized (e.g. Appendix A of the EIS, Volume 2).

For more information on the IMHWR and EIHWHRMR, including proposed revisions, the proponent is encouraged to consult the CEPA Registry at http://www.ec.gc.ca/CEPARegistry/ and the Waste Reduction and Management Division website at http://www.ec.gc.ca/wmd-dgd/. The proponent can also contact Ms. Marie-Josée Sirois at (902) 426-3574 or marie-josee.sirois@ec.gc.ca. The potential applicability of these regulations should be recognized in the EIS.

NLRC Response:

"The Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations ("EIHWHRMR")" has been added. See Appendix D of this document for new 'Appendix A' of Volume 2.

General

The Waste Management Plan described in Volume 2, Section 11.6.5 focuses on handling, storage and disposal methods. The proponent should describe how waste minimization techniques would be considered in such a plan as mentioned in Section 6.1.12

NLRC Response:

All of the waste minimization techniques described in Section 6.1.12 will be implemented.

Substances which are subject to National Pollutant Release Inventory Reporting

The National Pollutant Release Inventory ("NPRI") was established under the CEPA in 1992 to collect data on substances of concern in Canada. This inventory administered by EC is the only legislated, nation-wide, publicly accessible inventory of its type in Canada. The NPRI database is accessible at http://www.ec.gc.ca/CEPARegistry/subs_list/NPRI.cfm.

Owners or operators of facilities which meet certain reporting criteria for certain substances are obligated to report annually to EC. The proponent has recognized the need to report to the NPRI throughout the project's lifecycle (Vol. 2, Section 8.1 & Vol. 3, Sections 4.4.3 and 10.1.1). The proponent should also describe how it would consider NPRI reporting data in conducting follow-up monitoring designed to verify the accuracy of impact predictions and the need for corrective actions. For additional information on NPRI reporting requirements, the proponent is encouraged to contact Mr. Jeffrey Stobo at (902) 426-4805 or jeffrey.stobo@ec.gc.ca.

NLRC Response:

The proponent will meet the requirements of NPRI reporting and follow up as required. Follow-up programs will support an adaptive management approach that will allow response to information from all sources, including NPRI.

ENVIRONMENTAL EMERGENCIES

Regulatory Requirements

The *Environmental Emergency Regulations* under the CEPA apply to any person in Canada who owns, or has charge, management or control of, a substance listed on Schedule 1 of the regulations that is present in a quantity equal to or greater than that specified in the Schedule. The regulations identify the information that must be submitted to EC within 90 days after acquiring a scheduled substance at or above the specified threshold quantities. An environmental emergency plan will also be required for all facilities that store or use any of the scheduled substances at or above the specified threshold quantities. When preparing an emergency plan, the proponent would be required to consider the following factors:

- The properties and characteristics of the substances;

  NLRC Response:

  When preparing the NLRC emergency plan, the proponent will take the properties and characteristics of the substances into account.

- The maximum expected quantity of the substance at the place at any time during the calendar year;

  NLRC Response:

  When preparing the NLRC emergency plan, the proponent will consider the maximum expected quantity of the substance at the place at any time during the calendar year.

- The commercial, manufacturing, processing or other activity in relation to which the plan is prepared;

  NLRC Response:

  When preparing the NLRC emergency plan, the proponent will consider the commercial, manufacturing, processing or other activity in relation to which the plan is prepared.

- The characteristics of the place where the substance is located and of the surrounding area that may increase the risk of harm to the environment or of danger to human life or health;

  NLRC Response:

  When preparing the NLRC emergency plan, the proponent will consider the characteristics of the place where the substance is located and of the surrounding area that may increase the risk of harm to the environment or of danger to human life or health.

- The potential consequences from an environmental emergency on the environment or human health. Consequences are identified through the use of worst-probable-case and alternative scenarios (more information can be found in CRAIM 2002)(see below); and,

NLRC Response:

The proponent has considered the potential effects of an environmental emergency on the environment and human health, and will develop this in more detail when preparing the emergency plan.

- A description of roles and responsibilities of individuals during an environmental emergency.

NLRC Response:

The NLRC will clearly outline the roles and responsibilities of individuals in the case of an environment emergency in the Emergency Response Plan.

The EC publication, *Implementation Guidelines for Part 8 of the Canadian Environmental Protection Act, 1999 – Environmental Emergency Plans*, provides direction on meeting these requirements. While the proponent recognizes the applicability of the *Environmental Emergencies Regulations* (e.g., Volume 3, Section 7.2.6, p. 7-56), only gasoline is identified as a substance to be stored on-site that is found on Schedule 1. It is requested that the proponent establish whether any other substances on Schedule 1 are likely to be associated with the proposed project, and describe how it intends to comply with the regulatory requirements. Further information on the regulations, including proposed amendments, are accessible at:
http://www.ec.gc.ca/CEPARegistry/regulations/detailReg.cfm?intReg=70

NLRC Response:

Gasoline is the largest volume of any substance that appears in Schedule 1, however there will likely be other substances on-site. Any and all substances that will be stored on site that are listed in Schedule 1 will be handled in accordance with these regulations.

General

Section 6.2 of the EIS Guidelines directs the proponent to outline an emergency response plan "that details measures to be taken to effectively respond to any foreseeable mishap that may occur as a result of the undertaking". The production, storage, transshipment and use of large quantities of substances at the project site present a risk to the environment that deserves particular attention in the environmental assessment. Project design and planning should maximize opportunities to prevent accidental releases, reduce consequences, and ensure adequate preparedness and capacity to respond to and recover from any accidental events which should occur.

NLRC Response:

The NLRC emergency response plan will be prepared in such a way as to prevent accidental releases, reduce consequences, and ensure adequate preparedness and capacity.

The *Environmental Emergency Regulations* requirements are specific to the substances listed in Schedule 1. The proponent has indicated that emergency response plans will be prepared for any industrial accident or malfunction scenario that could result in adverse environmental effects (Volume 2, Section 12.0 and Volume 3, Section 8.0). The proponent is encouraged to describe how environmental emergency prevention, preparedness, response and recovery plans, will reflect a consideration of applicable standards and best practices including the following:

- Canada Standards Association (CSA) *Emergency Planning for Industry* (third edition of CAN/CSA–Z731-03);

NLRC Response:

NLRC will comply will Canada Standards Association (CSA) *Emergency Planning for Industry.*

- *2004 Emergency Response Guidebook* (ERG2004) accessible at http://www.tc.gc.ca/canutec/en/guide/guide.htm; and,

NLRC Response:

NLRC will comply with the 2004 Emergency Response Guidebook (ERG2004).

- Council for Reducing Major Industrial Accidents/Conseil pour la reduction des accidents industriels majeurs (CRAIM) *Risk Management Guide for Major Industrial Accidents* (2002 edition) accessible at http://www.uneptie.org/pc/apell/publications/pdf_files/CRAIM_PDF_EN.pdf

NLRC Response:

NLRC will comply.

The proponent should confirm its intent to report all spills, releases and deposits into the environment to the Canadian Coast Guard Regional Operations Centre (1-800-563-9089) as soon as possible. The Operations Centre will notify appropriate federal and provincial agencies. The proponent should also highlight its reporting obligations under federal legislation and regulations.

NLRC Response:

NLRC intends to report all spills, releases and deposits into the environment to the Canadian Coast Guard Regional Operations Centre (1-800-563-9089) as

soon as possible. NLRC recognizes that The Operations Centre will notify appropriate federal and provincial agencies.

WILDLIFE

Mandate

The conservation of migratory birds is the joint responsibility of the countries these birds visit during the breeding, migration, and non-breeding seasons. EC is responsible for fulfilling Canada's obligations for the conservation of migratory birds through administration of the *Migratory Birds Convention Act* ("MBCA") and the associated regulations. Migratory birds protected by the MBCA generally include all seabirds except cormorants and pelicans, all waterfowl, all shorebirds, and most landbirds (i.e. birds with principally terrestrial life cycles). Most of these birds are specifically named in the EC publication, *Birds Protected in Canada under the Migratory Birds Convention Act*, Canadian Wildlife Service Occasional Paper No. 1.

EC, Fisheries and Oceans Canada, and Parks Canada Agency share responsibility for the protection and recovery of species listed under the *Species at Risk Act* ("SARA"). The Parks Canada Agency is responsible for species, including aquatic species, occurring in or on federal lands as defined in subsection 2(1) of the *Parks Canada Agency Act* (e.g., national parks and national historic sites); Fisheries and Oceans Canada is responsible for aquatic species; and, EC is responsible for all other species, including migratory birds, listed under the SARA. The general prohibitions of the SARA (sections 32 and 33) apply on all federal lands, as well as to aquatic species and a species of bird protected under the MBCA wherever they occur.

Baseline information on Birds and Implications for the Effects Assessment

General

EC reviewed the migratory bird component study and provided comments to the Newfoundland and Labrador Department of Environment and Conservation on August 31st. In those detailed comments, EC identified limitations, and requested clarifications, that could influence the assessment of impacts and identification of appropriate mitigation and follow-up monitoring measures. The following comments on presentation of information related to pelagic, coastal and terrestrial birds in the EIS are offered to reinforce the importance of addressing the identified limitations and clarification requests so that potential impacts can be understood and appropriately managed.

Pelagic and Coastal Birds

Given the limitations of the component study, care should be taken when referring to data collected during the "monthly" pelagic bird surveys. These birds represent non-breeding/wintering birds in inner Placentia Bay. Too much weight is given to the surveys when discussing pelagic seabird use of the study area. For instance, it appears that although 10s–100s of thousand of birds are present in Placentia Bay, only a few are observed in the study area. The reader may be unaware that the surveys were not conducted when the 10s-100s of thousands of birds were present in Placentia Bay. Statements highlighting the few pelagic seabirds (i.e. repeated use of the word "only") observed during the surveys should be clarified or removed.

NLRC Response:

The surveys undertaken for NLRC were designed to augment existing information about seabirds in Placentia Bay: the wider literature on seabirds, including information on breeding birds in Placentia Bay, was included in the Newfoundland and Labrador Refinery Project Environmental Impact Statement, Volume 3 Biophysical Assessment (Section 3.7.3). The EIS clearly states in numerous places the importance of Placentia Bay as a summering area for pelagic birds, including those that breed elsewhere (e.g., Greater Shearwaters, see page 3-150 of the EIS) and those that breed in and near Placentia Bay (e.g., Northern Gannets, see page 3-151).

Additional pelagic bird surveys were conducted in June and August 2007 (Table A), following preparation and submission of the EIS. The densities of seven species of seabirds (Northern Fulmar, Greater Shearwater, Sooty Shearwater, Manx Shearwater, Northern Gannet, Black-legged Kittiwake and Black Guillemot) were higher during the 18 June survey than any of the other surveys conducted from August 2006 to August 2007. These relatively high densities are likely related to the presence of prey, most notably, schools of capelin. During the capelin spawning season, which typically occurs sometime in the June to July period, seabirds traditionally concentrate near shore to feed on capelin. The Northern Gannets and Black-legged Kittiwakes observed in June probably originated from the breeding colony at Cape St. Mary's. Of note, in July 2007, bird watcher tourist groups traveling on the Marine Atlantic ferry reported many hundreds of shearwaters in Placentia Bay on the approaches to Argentia (B. Mactavish, LGL, pers. comm.). Very low densities of seabirds were observed during the August 2007 surveys (Table A) and these densities were similar to the results obtained during the August and September 2006 surveys (see Table 3.29 in the EIS for the 2006 results). NLRC and regulatory agencies will determine follow-up programs for pelagic seabirds.

Table A. Average densities of marine-associated birds (per km^2) during 10-minute counts in Placentia Bay, June and August 2007. [n = the number of 10-minute counts conducted along the survey route.]

	Survey Route A (*n* = 25 counts)	Survey Route A (*n* = 42 counts)	Survey Route B (*n* = 40 counts)	Survey Route C (*n* = 37 counts)
Species	**18-Jun-07**	**24-Aug-07**	**23-Aug-07**	**28-Aug-07**
Common Loon	0	0	0	X
Northern Fulmar	0.03	0	0	0
Greater Shearwater	0.96	0	0	0
Sooty Shearwater	0.64	0	0	0
Manx Shearwater	0.13	0	0	0
unidentified shearwater	1.76	0	0	0
Northern Gannet	3.78	0.47	0.1	X
Double-crested Cormorant	0.03	0	0.02	0.03
Great Cormorant	0.10	X	0.26	X
unidentified cormorant	0.74	X	0	0.27
Bald Eagle	0	0	0	X
Semipalmated Plover	0	0	X	0
Ring-billed Gull	0.13	0	0	X
Herring Gull	0.77	2.37	1.86	3.7
Great Black-backed Gull	0.06	0.08	0.1	0.1
Black-legged Kittiwake	0.61	0.02	0.02	0
Common Tern	0.03	X	0	X
unidentified tern	0	0	X	0
South Polar Skua	X	0	0	0

For example:

- "only four Northern Fulmars were observed, including three in September and one in December" (Volume 3, Section 3.7.3, p. 3-148);

  NLRC Response:

  Delete "only" from the above statement.

- "only three Sooty Shearwaters were recorded and these birds were seen in August" (Volume 3, Section 3.7.3, p. 3-150);

  NLRC Response:

  Delete "only" from the above statement.

- "a single Leach's Storm-Petrel was observed on transect at the southern end of survey route B on 20 October 2006" (Volume 3, Section 3.7.3, p. 3-151).

NLRC Response:

It is not necessary to change the above statement as it accurately presents the results of the pelagic surveys.

The following information should also be taken into account in refining the evaluation of potential impacts and identifying appropriate mitigation and monitoring measures:

- New information from Robertson *et al*. (2002) concerning the numbers of breeding pairs of the Leach's Storm-Petrel on Middle Lawn Island (13 879) and Green Island (65 280) could be used to update Table 3.28 and p. 3-151. Black Guillemots also breed on Middle Lawn Island (denoted as Present in Table 3.28). Source: Robertson, G. J., J. Russell and D. Fifield. 2002. Breeding population estimates for three Leach's Storm-petrel colonies in southeastern Newfoundland, 2001. Canadian Wildlife Service Technical Report Series No. 380. Atlantic Region. iii. + 21 pp.

- Black-legged Kittiwakes have been known to colonize the Columbier Islands (p. 3-152) Cairns *et al*. 1989 (500 pairs in 1970s). There is also evidence of breeding common murres at this site. Source: Cairns, D. K., W. A. Montevecchi and W. Threlfall. 1989. Researchers Guide to Newfoundland Seabird Colonies. Second Edition. Memorial University of Newfoundland Occasional Papers in Biology. Volume 14.

NLRC Response:

Replace Table 3.28 in the EIS with the following table.

Table 3.28 (revised). Seabird colonies designated as Important Bird Areas in and near the Study Area.

Species	Cape St. Mary's	Middle Lawn Island	Corbin Island	Green Island
Northern Fulmar	12 [a]			
Manx Shearwater		11 [b]		
Leach's Storm-Petrel		13,879 [c]	100,000 [d]	65,280 [c]
Northern Gannet	12,156 [e]			
Herring Gull	present [f]	20 [f]	5000 [f]	present [d]
Great Black-backed Gull	present [f]	6 [f]	25 [f]	
Black-legged Kittiwake	10,000 [f]		50 [b]	
Common Murre	10,000 [f]			
Thick-billed Murre	1000 [f]			
Razorbill	100 [f]			
Black Guillemot	present [c]	present [c]	present [c]	
TOTALS	33,268	13,916	105,075	65,280

Sources: [a] Stenhouse and Montevecchi (1999); [b] Robertson 2002; [c] Robertson et al. (2002); [d] IBA web site: www.bsc.org; [e] Chardine (2000); [f] Cairns et al. (1989).

- The list of broader scale summaries of birds killed by oil spills (p. 4-128) should include reference to Wiese and Robertson's 2004 estimate of 300,000 oiled murres and dovekies in Newfoundland waters in the late 1990s. Source: Wiese, F. K. and G. J. Robertson. 2004. Assessing seabird mortality from chronic oil discharges at sea. J. Wildl. Manage. 68: 627-638.

NLRC Response:

Insert the following sentence on page 4-128 in subsection titled "Past Oil Spills In and Near the Study Area". Place before the last sentence "Based on dated information…"

An estimated 315,000 ± 65,000 Common Murres, Thick-billed Murres and Dovekies were killed annually between 1998 and 2000 in southeastern Newfoundland due to illegal chronic discharge of oil from ships (Wiese and Robertson 2004).

- In EC's opinion, Common Murres are not scarce during the non-breeding season (p. 3-157). Although outnumbered by Thick-billed Murres, they are taken all winter long in the hunt in Placentia Bay. They are certainly as abundant as puffins, especially in outer parts of the bay.

NLRC Response:

Page 3-157 Section Common Murre replace the sentence "In fall and winter it is expected to be scarce in Placentia Bay" with:" In fall and winter it is expected to be uncommon and usually out numbered by Thick-billed Murre."

- The section on Razorbills (P. 3-158) should be updated with information from Chapdelaine *et al*. 2001. Source: Chapdelaine, G., A.W. Diamond, R.D. Elliot and G. J. Robertson. 2001. Status and population trends of the Razorbill in eastern North America. Can. Wildl. Serv. Occas. Pap. No. 105. Ottawa.

NLRC Response:

Replace the entire subsection titled Razorbill (p.3-158) with the following text:
"The Razorbill breeds in the North Atlantic Ocean from Maine, eastern Canada, Greenland and Iceland to Great Britain. It winters south to North Carolina and France. Razorbills are relatively scarce compared to Common and Thick-billed Murres. Most of the 38,419 pairs breeding in eastern North America are located in southeast Labrador and in Quebec in the Gulf of St. Lawrence (Chapdelaine et al. 2001). About 893 pairs nest on the Avalon Peninsula of Newfoundland. In Placentia Bay, 100 pairs nest at Cape St. Mary's and 169 pairs nest at four sites on St. Pierre et Miquelon (Chapdelaine et al. 2001). The Razorbill is expected to be scarce in Placentia Bay throughout the year, but particularly scarce during winter. During the monthly pelagic bird survey program in Placentia Bay from August 2006 to April 2007, the Razorbill was observed once during October and March (Table 3.29)."

- Species and age distribution of birds affected in a late 2004 spill near Cape St. Mary's was documented by Robertson *et al.* 2006. Details in Wilhelm *et al.* 2007 can be used to update the information presented by Wilhlem *et al*. 2006. Sources: Robertson, G.J., P.C. Ryan, J. Dussureault, B.C. Turner, S.I. Wilhelm, and K. Power. 2006. Composition of beached marine birds from an oiling event in south-eastern Newfoundland Labrador, November 2004.
  Marine Ornithology 34: 141-146.

  Wilhelm, S.I, G.J. Robertson, P.C. Ryan, D.C. Schneider. 2006. An assessment of number of seabirds at risk during the November 2004 Terra Nova FPSO oil spill on the Grand Banks.

  Wilhelm, S.I, G.J. Robertson, P.C. Ryan, D.C. Schneider. 2007. Comparing an estimate of seabirds at risk to a mortality estimate from the November 2004 *Terra Nova* FPSO oil spill. Marine Pollution Bulletin 54: 537-544. Can. Wildl. Serv. Occas. Pap. No. 461. Atlantic Region. Vii + 25pp.

  NLRC Response:

  Based upon review of Robertson et al. (2006) and Wilhelm et al. (2007) make the following changes to section 4.6.4.

  On page 4-128, subsection Past Oil Spills In and Near the Study Area, make the following changes:

  At the end of the first paragraph add the following text: "More recently, in November 2004, hundreds of oiled seabirds, mostly Thick-billed Murres and Dovekies, arrived on beaches near Cape St. Mary's (Robertson et al. 2006). The cause of oiling was deemed as ship-source oil from illegal offshore dumping. Analysis of bird carcasses revealed that all age classes of Thick-billed Murres were equally affected."

  Delete the last sentence of the second paragraph and replace with: "Based upon bird density estimates and the area of the spill, it was estimated that between 3593 and 16,122 (mean 9858) murres and dovekies were at risk of being oiled. Comparable numbers were derived using a mortality model based on spill volume; it was estimated that 1905-12,480 murres and dovekies were killed as a result of the Terra Nova spill (Wilhelm et al. 2007)."

Terrestrial Birds

In the EIS, the proponent has claimed that "[b]ecause the densities of terrestrial birds in this area are relatively low and there are no apparent high quality terrestrial habitats, these impacts are assessed as not significant (Table 4.21)" (Volume 3, Section 4.6.1, p. 4-94). No conclusions regarding bird density can be reached based on the survey conducted as part of the component study.

NLRC Response:

Exchange the above sentence with the following text: "Because the terrestrial birds inhabit terrestrial habitats within the Project Area that are commonly found in eastern Newfoundland, these impacts are assessed as not significant for the overall populations of these species. Further field study during the 2008 breeding season (5 June and 5 July) using approved protocols will determine densities of breeding birds on the project site." However, the results are not expected to change the assessment of significance as stated in the EIS.

As indicated in the review of the component study, the methods used for the landbird survey were not appropriate to "acquire a list of species that breed in the refinery footprint area". As a consequence, the following underlined statements can not be used in support of EIS conclusions:

NLRC Response:

The NLRC survey has provided a list of the common breeding species and their relative abundances at the project site and a general picture of the breeding bird community. Further field study during the 2008 breeding season (5 June to 5 July) using approved protocols will confirm the presence, or not, of Species at Risk and obtain accurate densities of breeding species. However, the result of this additional survey is not expected to change the EIS conclusion, based on our team extensive experience in the project area.

- "No Peregrine Falcons were observed during field studies conducted in support of this EIS" (Volume 3, Section 3.6.7, p. 3-126);

NLRC Response:

Delete this statement and the first word ("However") of the following sentence.

- "However, no Gray-cheeked Thrush were observed during field studies conducted in support of this EIS" (Volume 3, Section 3.6.7, p. 3-127);

NLRC Response:

Delete this statement.

- "In addition, there is suitable nesting habitat for Rusty Blackbirds in the Project Area, but none were observed during field studies conducted in support of this EIS (Goudie et al. 2007)" (Volume 3, Section 3.6.7, p. 3-128);

- "No Red Crossbills were observed during field studies conducted in support of this EIS" (Volume 3, Section 3.6.7, p. 3-128);

NLRC Response:

Change the statement to: "There is suitable nesting habitat for Rusty Blackbirds in the Project Area."

- "It is possible that Peregrine Falcons (anatum: Special Concern; tundrius: Threatened) may occur in and near the Project Area during their fall migration but they were not observed during field studies in support of this EIS" (Volume 3, Section 4.10.1, p. 4-266).

NLRC Response:

Change to: It is possible that Peregrine Falcons (anatum: Special Concern; tundrius: Threatened) may occur in and near the Project Area during their fall migration.

Potential Project Interactions with Birds

General

The MBCA and regulations administered by EC include the following specific prohibitions:

- Under section 6 of the *Migratory Birds Regulations*, it is forbidden to disturb, destroy or take a nest or egg of a migratory bird; or to be in possession of a live migratory bird, or its carcass, skin, nest or egg, except under authority of a permit. [Under the *Migratory Birds Regulations*, no permits can be issued for the incidental take of migratory birds caused by an economic development activity such as the project].

- Section 5.1 of the MBCA sets out the following prohibitions related to deposit of substances harmful to migratory birds:

  (1) No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.

  (2) No person or vessel shall deposit a substance or permit a substance to be deposited in any place if the substance, in combination with one or more substances, results in a substance — in waters or an area frequented by migratory birds or in a place from which it may enter such waters or such an area — that is harmful to migratory birds.

The proponent has described several project activities that could have adverse effects on migratory birds, and their nests and eggs, and which must be managed in a manner that allows compliance with the MBCA and regulations. Further consideration of potential adverse interactions with birds related to construction, lighting, flares, transmission lines, and contaminants is important to the environmental assessment and to any conclusions regarding potential impacts and necessary management measures.

Construction Activities

It is understood from Figure 4.1 (Volume 3, Section 4.1.1, p. 4-1) that construction activities, including vegetation removal, will be carried on throughout the year. In fulfilling its responsibility for MBCA compliance, the proponent should take the following points into consideration:

- The breeding season for most birds within the project area occurs between May 1st and July 31st; however, some species protected under the MBCA nest outside this timeframe; and,

- While most bird species construct nests in trees and shrubs, a number of species of birds nest at ground level (e.g. sandpipers).

One method frequently used to minimize the risk of destroying bird nests, including nesting waterfowl, consists of avoiding certain activities, such as clearing, during the nesting period for migratory birds in the region. Risk of impacting active nests or birds caring for pre-fledged chicks, discovered during project activities outside the May 1st to July 31st window, can be minimized by measures such as the establishment of vegetated buffer zones around nests, and minimization of activities in the immediate area until nesting is complete and chicks have naturally migrated from the area. It is incumbent on the proponent to identify the best approach, based on the circumstances, to complying with the MBCA..

NLRC Response:

The NLRC, in consultation with CWS and Environment Canada, will develop a best approach (as practical) to minimize negative impacts on nesting migratory birds during construction activities (particularly clearing) in the proposed refinery footprint and access roads.

Lighting

The project includes a flare and several tall structures which may require navigation lights for aircraft safety. There will also be lighting on vessels and the associated marine terminal. Bird collisions at lit and floodlit structures are a known problem. In Atlantic Canada, nocturnal migrants and night-flying seabirds are the birds most at risk of attraction to lights. Attraction to lights may result in collision with lit structures or their support structures, or with other birds. Disoriented birds are prone to circling a light source and may deplete their energy reserves and either die of exhaustion or drop to the ground where they are at risk of depredation. Incineration in flares and stranding on vessels are also of concern.

In assessing the impacts of lights and flares, a focus should be placed on the most vulnerable species and the occurrence of infrequent, but potential large-scale, stochastic events (e.g. events associated with weather conditions, migratory seasons). In implementing steps to reduce potential adverse interactions with migratory birds, and to comply with the MBCA and regulations, the proponent should take the following best management practices into consideration.

- Only the minimum amount of pilot warning and obstruction avoidance lighting should be used;

- Only strobe lights should be used on tall structures at night, at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada;

- Only the minimum number of lights should be used as possible and the use of solid-burning or slow-pulsing red warning lights at night should be avoided;

- The time of operation of exterior decorative lights, such as spotlights and floodlights, should be minimized or avoided in cases where such lights are only intended to highlight features of structures, or to illuminate an entire structure. Especially on humid, foggy or rainy nights, the glow of such lights can draw birds from considerable distances. In the interest of protecting birds, it would be best if these lights were turned off, at least during the migratory season, when the risk to birds is greatest;

- Task lighting, as well as lighting for the safety of the employees, should be shielded to shine down and only to where it is needed, without compromising safety. Road and parking lot lighting should also be shielded so that little light escapes skyward and rather falls where it is required; and,

- As feasible, flaring should be avoided during select times when migratory birds are particularly vulnerable to impacts (e.g. when it is foggy at night, especially during migration seasons when flocks would be flying past the project site; during onshore storms).

The proponent should describe a plan for minimizing potential adverse interactions between birds and flares/lighting that includes a detailed avian collision monitoring program designed in consultation with EC. The monitoring program should concentrate survey efforts on peak spring and fall migration periods, as well as mornings following inclement weather, so as to facilitate the timely detection of adverse effects and implementation of appropriate adaptive management actions. The proponent should confirm that it is prepared to provide such monitoring results to EC in a timely manner, including immediate notification (within 24 hours) of any collisions involving a single species at risk or large numbers of birds (>10).

NLRC Response:

NLRC will apply best management practices to reduce potential adverse interaction with migratory birds as outlined in EC comments. NLRC will also develop an avian collision monitoring and mitigation plan in consultation with EC that considers the above points. The monitoring results will be including immediate notification (within 24 hours) of any collisions involving a single species at risk or large numbers of birds.

The proponent should confirm its intent to adopt the handling protocol for stranded Leach's Storm-petrels prepared by Canadian Wildlife Service and industry representatives (see Appendix A of this document) for both the project site and vessels.

NLRC Response:

As stated in the EIS, it is NLRC's intent to implement the handling protocol for Leach's Storm-petrels for the project site and its attendant vessels.

Transmission Lines

The proposed transmission line presents a collision or electrocution risk to birds which should be assessed. Erickson et al. (2001) estimated the number of bird collisions with power lines in the United States at somewhere between tens of thousands to several million per year. Bevanger (1998) listed 245 species of birds recorded as victims of power lines, with numbers of collisions ranging from 1 to 2,983 in documented studies. Power lines also pose a risk of electrocution if a bird should touch two phase conductors simultaneously or one conductor and a ground device. Bevanger listed 34 species of documented electrocution victims, with raptors being the most susceptible.

NLRC Response:

In addition to an evaluation of the risks of collision and electrocution to birds in the area, detailed measures that could be taken to minimize such risks should be identified, including line placement and orientation, marking of lines (e.g., bird flight diverters) and design of structures. A monitoring plan to evaluate the effectiveness of these measures should be described.

The project will have a 9 km long 430 kVa high voltage transmission line connecting to the provincial grid just north of the project site that will serve as the permanent power supply for the project. During construction there will be a 9 km long 35 kVa pole line along the access road to the site. Due to the concern that power lines may pose a risk of electrocution if a bird should touch two phase conductors simultaneously or one conductor and a ground device, NLRC will design the power lines to provide adequate spacing between the individual power lines to eliminate the risk of electrocution. The risk of collision with poles and power lines is low due to the limited length of the power lines and the fact that the power lines are orientated generally North - South in the direction of bird migration. Overhead power lines on site will be minimum or eliminated using underground conduits.

In addition, NLRC is committed to continued monitoring and reporting of incidents involving bird collisions.

In consideration of above mitigative measures and the fact that the area covered by the power line is relatively small it can be concluded that effect of the proposed power line on bird mortality is insignificant.

References

Avian Power Line Interaction Committee (APLIC). 1994. Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Edison Electric Institute. Washington, D.C.

Avian Power Line Interaction Committee (APLIC). 1996. Suggested Practices for Raptor Protection on Power Lines: the State of the Art in 1996. Edison Electric Institute and the Raptor Research Foundation. Washington, D.C.

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Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: the State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

Bevanger, K. 1994. Bird interactions with utility structures: collision and electrocution, causes and mitigating measures. Ibis 136: 412-433.

Bevanger, K. 1998. Biological and conservation aspects of bird mortality caused by electricity power lines: a review. Biological Conservation 86: 67-76.

Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young Jr., K.J. Sernka, and R.E. Good. 2001. Avian Collision with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States. National Wind Coordinating Committee (NWCC) Resource Document.

Manville, A.M. 2005. Bird Strikes and Electrocutions at Power Lines, Communication Towers, and Wind Turbines: State of the Art and State of the Science - Next Steps Towards Mitigation. USDA Forest Service Gen Tech Rep PSW-GTR-191.

Exposure to Contaminants

Birds may be attracted to constructed treatment ponds. It would be helpful if further details could be provided so that the risk of potential access by birds to such facilities could be better understood, and the likely effectiveness of safeguards determined. Ultimately, project design and operational measures should be put in place to prevent harmful exposure of migratory birds to contaminants.

NLRC Response:

With appropriate treatment and monitoring procedures in place, treatment ponds will not typically have anoil sheen on their surface. In the event of a plant malfunction, ponds will be monitored more regularly and if birds are attracted to the treatment ponds, scaring devices will be used to deter birds from the area. Any bird mortalities will be reported to appropriate regulatory agencies. A periodic review of operating procedures will be undertaken to ensure operational measures are in place to prevent harmful exposure of migratory birds to contaminants.

Accidents and Malfunctions

In the case of hydrocarbons, even a small spill could be significant if it reaches avian species at risk, sensitive habitats, or large numbers of birds. Therefore, in addition to the fundamental elements of a contingency plan, which are identified in this review, the proponent should describe the following details:

- measures that would be taken to keep birds away from a spilled substance; and,

- procedures for dealing with accidents in which birds are oiled and/or sensitive habitat(s) are contaminated including whether birds would be left alone, captured and cleaned, or euthanized.

NLRC Response:

Best mitigation is prevention, which is outlined in greater detail in the EIS. In addition, contingency plan for dealing with deterring birds from spilled substance and identifying procedures for dealing with contaminated birds will be developed in consultation with EC. As stated in the EIS, trained personnel will be on site for all emergencies, including oil spills, and NLRC will access existing local assistance.

Editorials

- It is stated in Section 2.4.6 (Volume 3) that "The following tables show lists of marine and terrestrial species at risk, which have been addressed in this volume (Table 2.4 and Table 2.5)". These tables are incomplete as additional marine and terrestrial species at risk were addressed. These included:

Marine Species

Ivory Gull (p. 3-197)

Terrestrial Species

Red Knot (p. 3-198, also noted in shore-based surveys conducted for the component study)
Gray-cheeked Thrush (pp. 3-127 and 4-266)
Rusty Blackbird (pp. 3-125 and 4-266)
Peregrine Falcon (pp. 3-125 and 4-266)
Eskimo Curlew (p. 3-126)

NLRC Response:

The relevant corrected tables are provided below. Also note the insertion of Fin Whale and Harbour Porpoise which are considered at risk by the federal government and which were assessed in the EIS.

Table 2.4 (revised). Marine Species at Risk Considered in Placentia Bay.

Species	**Federal *Species at Risk Act* Status or *COSEWIC* Status**	**Provincial Endangered Species Act Status**

Species	Federal *Species at Risk Act* Status or *COSEWIC* Status	Provincial Endangered Species Act Status
Fish		
Birds		
Barrow's Goldeneye	Special concern	Vulnerable
Harlequin Duck	Special concern	Vulnerable
Piping Plover	Endangered	Endangered
Ivory Gull	Endangered	Vulnerable
Red Knot	Not listed	Endangered
Marine Mammals		
Blue Whale	Endangered	Not listed
North Atlantic Right Whale	Endangered	Not listed
Fin Whale	Special concern	Not listed
Harbour Porpoise	Special concern	Not listed
Reptiles		

Table 2.5 (revised). Terrestrial Species at Risk Considered in Placentia Bay.

Species	Federal Species at Risk Act or *COSEWIC* Status	Provincial Endangered Species Act Status
Fish		
Birds		
Peregrine Falcon (*anatum* subspecies)	Special concern	Threatened
Peregrine Falcon (*tundrius* subspecies)	Special concern	Threatened
Eskimo Curlew	Endangered	Endangered
Red Knot	Endangered	Not listed
Short-eared Owl	Special concern	Vulnerable
Gray-cheeked Thrush	Not listed	Vulnerable
Rusty Blackbird	Special Concern	Not listed
Red Crossbill	Endangered	Endangered
Plants		

The list of species at risk for the island of Newfoundland presented in Table 3.25 and in the following paragraph (p. 3-125) is not complete. The Red Knot, Common Nighthawk and Chimney Swift were all absent from the list.

NLRC Response:

Common Nighthawk and Chimney Swift are rare vagrants to insular Newfoundland with only a few occurrences per year, mainly during spring and fall migration. They are very unlikely to occur in Placentia Bay.

The Red Knot is considered a marine-associated bird and as such it is included in Table 3.34 and described on page 3-198 of the EIS. However, please add the following text to the Red Knot subsection on page 3-198 based on results of recent coastal surveys that were not included in the EIS.

The Red Knot was observed at Come By Chance, Southern Harbour and Arnold's Cove during coastal bird surveys in 2006 and 2007 (Table B). Based on surveys conducted in support of the EIS, the Come By Chance location stands out as the most important site for Red Knot in the Study Area and this site may be important staging habitat on a provincial scale.

Table B. Numbers and locations of all Red Knots observed during coastal surveys conducted during August and September 2006/2007.

Location	Date	Number
Southern Harbour	23 Aug 06	2
Arnold's Cove	30 Aug 07	1
Come By Chance	24 Sept 06	4
Come By Chance	30 Aug 07	4
Come By Chance	14 Sep 07	8

With respect to the Peregrine Falcon (Table 3.25 and p. 3-125), it should be noted that the *anatum* and *tundrius* subspecies were lumped into one assessment at the April 2007 meeting of COSEWIC and the designation for both Peregrine subspecies is now Special Concern (not Threatened as is indicated for anatum). The SARA status remains as shown in Table 3.25.

NLRC Response:

In Table 3.25 change the first row to the following:

Peregrine Falcon (*anatum*)	*Falco peregrinus anatum*	Threatened (2002)	Special Concern (2007)	Threatened (Schedule 1)

On p. 3.125 in the paragraph under the heading Peregrine Falcon. In the fourth sentence change the word "Threatened" to "Special Concern".

Auks were not listed in Table 3.27. Contrary to the table legend, relative monthly abundance is not shown, only presence/absence. Monthly or seasonal abundance would be more useful, as many species vary in abundance over the course of the year. Shading for the Northern Fulmar is all grey, in contrast to that from the table in the MBCS which has the correct shading.

NLRC Response:

The title of the Table 3.27 should be changed to:

"Table 3.27. List of marine-associated bird species known to occur in the Placentia Bay Area, including the areas where they occur and their relative abundance."

The corrected version of this table is provided below. We are aware there is monthly variation in the abundance of birds. It is tempting to add abundances by month based on available knowledge and personal experience but such tables draw the criticism that the table is not valid without published information to back up the monthly abundance estimates.

Table 3.27 (revised). List of marine-associated species known to occur in the Study Area, including the areas where they occur and their relative abundance.

Species	Scientific Name	Occur[a]	Abundance[b]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Canada Goose	*Branta canadensis*	C	Uncommon												
Gadwall	*Anas strepera*	C	Rare												
American Wigeon	*Anas americana*	C	Scarce												
American Black Duck	*Anas rubripes*	C	Common												
Mallard	*Anas platyrhynchos*	C	Scarce												
Blue-winged Teal	*Anas discors*	C	Scarce												
Northern Pintail	*Anas acuta*	C	Uncommon												
Green-winged Teal	*Anas crecca*	C	Uncommon												
Ring-necked Duck	*Aythya collaris*	C	Uncommon												
Greater Scaup	*Aythya marila*	C	Uncommon												
Lesser Scaup	*Aythya affinis*	C	Scarce												
King Eider	*Somateria spectabilis*	C, P	Scarce												
Common Eider	*Somateria mollissima*	C, P	Common												
Harlequin Duck	*Histrionicus histrionicus*	C	Scarce												
Surf Scoter	*Melanitta perspicillata*	C, P	Uncommon												
White-winged Scoter	*Melanitta fusca*	C, P	Uncommon												
Black Scoter	*Melanitta nigra*	C, P	Uncommon												
Long-tailed Duck	*Clangula hyemalis*	C, P	Common												
Bufflehead	*Bucephala albeola*	C	Scarce												
Common Goldeneye	*Bucephala clangula*	C	Uncommon												
Barrow's Goldeneye	*Bucephala islandica*	C	Rare												
Hooded Merganser	*Lophodytes cucullatus*	C	Rare												
Common Merganser	*Mergus merganser*	C	Uncommon												
Red-breasted Merganser	*Mergus serrator*	C, P	Common												

Species	Scientific Name	Occur[a]	Abundance[b]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Red-throated Loon	*Gavia stellata*	C	Uncommon												
Common Loon	*Gavia immer*	C	Common												
Horned Grebe	*Podiceps auritus*	C	Scarce												
Red-necked Grebe	*Podiceps grisegena*	C	Uncommon												
Northern Fulmar	*Fulmarus glacialis*	P	Common												
Greater Shearwater	*Puffinus gravis*	P	Common												
Sooty Shearwater	*Puffinus griseus*	P	Common												
Manx Shearwater	*Puffinus puffinus*	P	Uncommon												
Wilson's Storm-Petrel	*Oceanites oceanicus*	P	Scarce												
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	P	Common												
Northern Gannet	*Morus bassanus*	P	Common												
Double-crested Cormorant	*Phalacrocorax auritus*	C, P	Common												
Great Cormorant	*Phalacrocorax carbo*	C, P	Common												
American Bittern	*Botaurus lentiginosus*	C	Uncommon												
Great Blue Heron	*Ardea herodias*	C	Rare												
Osprey	*Pandion haliaetus*	C	Common												
Bald Eagle	*Haliaeetus leucocephalus*	C	Common												
Black-bellied Plover	*Pluvialis squatarola*	C	Common												
American Golden-Plover	*Pluvialis dominica*	C	Common												
Semipalmated Plover	*Charadrius semipalmatus*	C	Common												
Spotted Sandpiper	*Actitis macularius*	C	Common												
Solitary Sandpiper	*Tringa solitaria*	C	Scarce												
Greater Yellowlegs	*Tringa melanoleuca*	C	Common												
Lesser Yellowlegs	*Tringa flavipes*	C	Scarce												

Species	Scientific Name	Occur[a]	Abundance[b]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Whimbrel	*Numenius phaeopus*	C	Common							■	■	■			
Hudsonian Godwit	*Limosa haemastica*	C	Scarce								■	■	■		
Ruddy Turnstone	*Arenaria interpres*	C	Common							■	■	■	■	■	
Red Knot	*Calidris canutus*	C	Scarce							■	■	■	■		
Sanderling	*Calidris alba*	C	Uncommon							■	■	■	■	■	
Semipalmated Sandpiper	*Calidris pusilla*	C	Common					■		■	■	■	■		
Least Sandpiper	*Calidris minutilla*	C	Common					■	■	■	■	■	■		
White-rumped Sandpiper	*Calidris fuscicollis*	C	Common							■	■	■	■	■	
Baird's Sandpiper	*Calidris bairdii*	C	Rare								■	■			
Pectoral Sandpiper	*Calidris melanotos*	C	Uncommon							■	■	■	■		
Purple Sandpiper	*Calidris maritima*	C	Common	■	■	■	■	■					■	■	■
Dunlin	*Calidris alpina*	C	Uncommon								■	■	■	■	
Short-billed Dowitcher	*Limnodromus griseus*	C	Uncommon							■	■	■			
Wilson's Snipe	*Gallinago delicata*	C	Common				■	■	■	■	■	■	■	■	
Red-necked Phalarope	*Phalaropus lobatus*	P	Uncommon					■	■	■	■	■			
Red Phalarope	*Phalaropus fulicarius*	P	Common					■	■	■	■	■	■		
Black-headed Gull	*Larus ridibundus*	C	Common	■	■	■	■	■				■	■	■	■
Bonaparte's Gull	*Larus philadelphia*	C, P	Rare							■	■	■	■	■	
Mew Gull	*Larus canus*	C, P	Rare	■	■	■	■							■	■
Ring-billed Gull	*Larus delawarensis*	C, P	Common				■	■	■	■	■	■	■		
Herring Gull	*Larus argentatus*	C, P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Iceland Gull	*Larus glaucoides*	C, P	Common	■	■	■	■	■					■	■	■
Lesser Black-backed Gull	*Larus fuscus*	C, P	Scarce	■	■	■	■					■	■	■	■
Glaucous Gull	*Larus hyperboreus*	C, P	Uncommon	■	■	■	■						■	■	■
Great Black-backed Gull	*Larus marinus*	C, P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Sabine's Gull	*Xema sabini*	C, P	Rare							■	■	■			

Species	Scientific Name	Occur[a]	Abundance[b]	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Black-legged Kittiwake	*Rissa tridactyla*	C, P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Caspian Tern	*Hydroprogne caspia*	C, P	Rare				■	■			■	■			
Common Tern	*Sterna hirundo*	C, P	Common					■	■	■	■	■			
Arctic Tern	*Sterna paradisaea*	C, P	Common					■	■	■	■	■			
Great Skua	*Stercorarius skua*	P	Scarce					■	■	■	■	■	■		
South Polar Skua	*Stercorarius maccormicki*	P	Scarce					■	■	■	■	■	■		
Pomarine Jaeger	*Stercorarius pomarinus*	P	Uncommon					■	■	■	■	■	■		
Parasitic Jaeger	*Stercorarius parasiticus*	P	Uncommon					■	■	■	■	■	■		
Long-tailed Jaeger	*Stercorarius longicaudus*	P	Scarce					■	■	■	■	■			
Dovekie	*Alle alle*	P	Common	■	■	■	■						■	■	■
Common Murre	*Uria aalge*	P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Thick-billed Murre	*Uria lomvia*	P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Razorbill	*Alca torda*	P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Black Guillemot	*Cepphus grylle*	P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Atlantic Puffin	*Fratercula arctica*	P	Common	■	■	■	■	■	■	■	■	■	■	■	■
Belted Kingfisher	*Ceryle alcyon*	C	Uncommon	■	■	■	■	■	■	■	■	■	■	■	■
American Crow	*Corvus brachyrhynchos*	C	Common	■	■	■	■	■	■	■	■	■	■	■	■
Common Raven	*Corvus corax*	C	Common	■	■	■	■	■	■	■	■	■	■	■	■

Notes: Shaded areas represent the months when species may be expected. Abundances may vary by month.
Source: Brown (1986); Lock et al. (1994); B. Mactavish, LGL, pers. obs.
[a] C = Coastal, P = Pelagic
[b] Common = likely present daily in moderate to high numbers; Uncommon = likely present daily in small numbers; Scarce = likely present regularly in very small numbers; Rare = usually absent, individuals occasionally present. Dark highlighted fields indicate presence of species in the area during that month.

The Ring-billed Gull numbers cited on p. 3-153 were derived mainly from Lock 1988, Can Field-Nat**.** Source: Lock, A. R. 1988. Recent Increases in the Breeding Population of Ring-billed Gulls, *Larus delawarensis*, in Atlantic Canada. Canadian Field-Naturalist 102: 627-633.

NLRC Response:

Most of the Ring-billed Gull numbers cited on page 3-153 were from the period 2005-2007, well after the publication of Lock (1988).

Wetlands

The *Federal Policy on Wetland Conservation* ("FPWC") was introduced "to promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future". The policy recognizes the importance of wetlands to the environment, the economy and human health, and promotes a goal of no-net-loss of wetland functions. In support of this goal, the FPWC and related implementation guidance identify the importance of planning, siting and designing a project in a manner that accommodates a consideration of mitigation options in a hierarchical sequence - avoidance, minimization, and as a last resort, compensation. EC encourages application of the FPWC to the project as a best practice. EC also supports the provincial government in its protection of wetlands on provincial lands, providing expertise as requested.

NLRC Response:

Noted. NLRC recognizes the ecological importance and benefits of wetlands and will take the 'Federal Policy on Wetland Conservation' into consideration throughout the design, construction and operation phases of the project.

ECOLOGICAL RISK ASSESSMENT

EC has reviewed the report entitled "Human Health and Ecological Effects Assessment for the Proposed New Refinery at the Southern Head of Placentia Bay, NL" (2007) prepared by Senes Consultants Limited in support of the EIS. Based on the departmental mandate, EC comments are limited to the ecological risk assessment. It would be helpful to the review if the proponent could offer the following clarifications:

- whether risks to ecological receptors have been assessed for the construction phase of the project as well as the operational phase;

NLRC Response:

The ecological risk assessment focuses on potential off-site risk, i.e. risk beyond the property limits. During construction, the main pathway for ecological risk is dust, noise and light. With implementation of the Environmental Protection Plan, including permits and approvals, construction related activities are not expected to have more than negligible effects on ecological receptors off-site and were not assessed further. Project construction activity is expected to be confined to the two access roads and the refinery property, on the outer part of the Southern

Head peninsula. In addition, NLRC has committed to completing air quality modeling for the construction phase to confirm these assumptions.

- the meaning of the term "off-site"; and,

NLRC Response:

The term "off-site" refers to an area that is outside of the refinery property limits. The landward boundary is approximated by the access road (Figure 4-1 in Volume 1) and is also shown in the Air Quality Component Study, Figure 1. The coastline is the boundary on the other three sides.

- whether all potential Chemicals of Potential Concern have been considered (Section 6.2.1) (i.e. are any other contaminants such as metals likely to be released into the environment?).

NLRC Response:

The Chemicals of Concern considered in the ecological risk assessment (Section 6.2.1)are based on the CCME National Framework for Petroleum Refinery Emission Reductions (2005). This CCME document also states that additional air pollutants may be identified in the future, based on the associated health prioritization tool. NLRC will remain in compliance with regulations and will monitor CCME guidance and industry practice throughout its operating life.

Upon Project approval, a detailed listing of each chemical and/or additive to be used during specific processes will be developed and include the Material Safety Data Sheets (MSDS) for each of these materials. Specific requirements and procedures for each chemical will be outlined in the Environmental Protection Plan (EPP) during all phases of the Project .

It is stated in Section 6.1.2 that because the maximum predicted soil concentrations of VOCs, polycyclic aromatic hydrocarbons and petroleum hydrocarbons after 30 years of aerial deposition would not be measurable, the predicted concentrations in waterbodies and groundwater would also be very low. These concentrations should be quantified.

For example, such data would assist in justifying the proposed exclusion of pathways (drinking water) and valued ecosystem components (seabirds). It is indicated in Sections 6.1.2 and 6.3.2, that the lack of toxicity data makes it difficult to assess the inhalation pathway for ecological receptors. The lack of data is not a valid reason for excluding a pathway from risk assessment. In such cases, a common approach is to select a closely related species for which there is sufficient toxicity data (ie. a surrogate) and use this species in the risk assessment process.

NLRC Response:

Based on the existing baseline data on soil and surface water in the vicinity of the present North Atlantic Refinery, which has bee operational over 30 years, and the fact that no measurable concentrations of VOC's, PAHs and petroleum hydrocarbon concentration in soil, surface water or graound water were found at

the proposed refinery site, the predicted impact on waterbodies, soil or groundwater is negligible.

Predicted concentrations of VOCs, PAHs and petroleum hydrocarbons in water bodies and groundwater are predicted to be indiscernible from background concentrations, thus cannot be quantified at this point in time. However, as NLRC intends to include water quality sampling in its monitoring programs, using the baseline established through project surveys, changes in the freshwater and marine environment in the general project area should be detected and consideration of this pathway re-visited. Further hydrology/groundwater work will be done following project approval.

A screening index value of 0.1 was proposed in Section 6.4.2 to evaluate the magnitude of ecological effects. An explanation of how this index was derived should be provided, together with a rationale for using it as a threshold for further levels of assessment.

NLRC Response:

Screening Level Assessment (SLA), such as was done for the proposed refinery project, is used to identify the likelihood of ecological risks posed by the presence of identified chemicals. The assessment uses a screening index value to determine whether there is a potential for adverse impacts in any given ecological receptor.

The screening index value is defined as the ratio of the modeled exposure or dose to laboratory toxicity data. Or, in other terms, the screening index is the ratio of the estimated exposure (e.g. soil or feed concentration) to the predetermined ecological benchmark for that receptor. These can be expressed in equation format as shown:

$$Screening\ Index = \frac{Exposure}{Toxicity\ Benchmark}$$

The exposure term and toxicity benchmark must be expressed on the same basis, such as concentration, dose or intake rate. This ratio may be referred to by other names such as an ecological screening quotient (ESQ) or an exposure ratio (ER). The use of a ratio, such as an SI, to identify potential effects is consistent with standard practice in ecological risk assessment (e.g. U.S. EPA 1998, U.S. EPA 1999, Suter 1993, Suter et al. 2000, CCME 1996)

If all pathways and exposure are accounted for in the assessment, an SI value of less than 1 indicates that the exposure to the ecological receptor is below the toxicity benchmark and thus adverse effects on ecological receptors are unlikely. Screening index values are not estimates of the probability of ecological impact. Rather, the index values are positively correlated with the potential of an effect, i.e., higher index values imply greater potential of an effect.

In the assessment of the potential impact of the proposed NLRC refinery, all potential pathways of exposure were accounted for, however only incremental soil and vegetation concentrations associated with emissions were estimated. Therefore, it is not appropriate to compare the calculated SI to a value of 1.0. A screening index (SI) value of less than or equal to 0.1 was used to indicate combinations of contaminants and receptors that would require further investigation. This is a conservative approach that allows the exposure associated with current conditions to equal up to 90% of the toxicity benchmark. The results of the assessment showed that the SI values estimated for terrestrial birds and mammals were below the value of 0.1 by orders of magnitude and thus no adverse ecological effects are anticipated as a result of the proposed refinery.

Screening assessments, often completed at a species level, involve assumptions that bias estimates of exposure and toxicity towards predicting an ecological impact (i.e., overestimating exposure or dose and underestimating the concentration required to produce a toxic response). As such, they provide a useful basis for further levels of assessment.

References:

Canadian Council of Ministers of the Environment (CCME) 1996. A Framework for Ecological Risk Assessment: General Guidance. March.

Suter II, G.W. 1993. Ecological Risk Assessment. Lewis Publishers: Chelsea, Michigan, USA, pp. 1-538.

Suter II, G.W., R.A. Efroymson, B.E. Sample and D.S. Jones 2000. Ecological Risk Assessment for Contaminated Sites. Lewis Publishers: New York, NY.

United States Environmental Protection Agency (U.S. EPA) 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. August. EPA530-D-99-001A.

United Stated Environmental Protection Agency (U.S. EPA) 1998. Guidelines for Ecological Risk Assessment. April EPA/630/R-95/002F

It would be helpful to identify populations of the more sensitive species of lichens directly on the maps showing the predicted ambient concentrations. As noted, emissions from the Come By Chance Refinery were once over 2.5 times greater than they are now (Section 4.10.2, Volume 3, p. 4-287). A more meaningful assessment of the potential harm to lichen populations could be carried out by comparing the total historic emissions in the area and their measured effects, to the total estimated emissions with the proposed refinery included. EC would welcome an opportunity to review the proposed depositional monitoring program that would allow assessment predictions related to effects on the Boreal felt lichen to be verified and appropriate corrective actions to be taken if necessary (e.g. Section 7.2).

NLRC Response:

In order to establish baseline information on occurrence and abundance of lichens and to provide the basis for future monitoring programs, NLRC carried out surveys for lichen in the project area. As part of this work, lichen from the refinery footprint and off-site locations (Sunnyside, Come By Chance and Goobies) were analysed for stable isotope composition, sulphur and nitrogen and trace elements, including heavy metals.

This work by R. Jamieson (See Appendix C of this document), Department of Earth Sciences, Memorial University, indicates that all samples showed signs of anthropogenic pollution. There are elevated levels of vanadium and nickel in lichen samples closest to the refinery (Refinery Road, Come By Chance and Sunnyside). Lichens sampled in more distant locations, Goobies and the Southern Head headland to the west of Come By Chance, showed less evidence of anthropogenic influence but reflected marine sources of sulphur input, such as sea spray. Jamieson suggests that there is some indication of the decreasing refinery emissions in the levels of pollutants in lichens.

NLRC has proposed to include lichen in its monitoring programs and to seek the advice of various agencies in design of follow-up programs.

A depositional monitoring program that would allow assessment predictions related to effects on the Boreal felt lichen will be developed in consultation with EC.

The Boreal Population of the Boreal Felt Lichen is listed on Schedule 1 of the SARA as a species of special concern (http://www.sararegistry.gc.ca/species /species Details_e.cfm?sid=703). In the recovery strategy for the endangered Atlantic population, published by EC in May 2007 (http://www.sararegistry.gc.ca/virtual_sara/files/plans/rs_boreal_felt_lichen_ final_0507_e.pdf), it is noted that "although the boreal population faces a different degree of vulnerability to threats compared with the Atlantic population, this recovery strategy will provide a valuable tool for recovery planning for both populations". In this spirit, the proponent is encouraged to consider pertinent information in the recovery strategy in completing the environmental assessment and designing related monitoring programs.

NLRC Response:

NLRC will take into consideration relevant information and recommendations in the Recovery Strategy for the Atlantic population of boreal felt lichen. Indeed, further field work to identify the locations of boreal felt lichens (and other associated species) within the proposed refinery and access road footprint is currently being undertaken; an important step in addressing a data gap on its distribution and abundance in Newfoundland. In addition, the mitigation measures outlined on page 4-272 of the EIS will minimize the potential impacts of the refinery project on this species.

Principles outlined in the recovery strategy for the Boreal Felt Lichen will be taken into consideration in the design and implementing of management plans, monitoring and follow-up programs for this species. NLRC is pleased to have been invited to participate in the CWS consultations on Erioderma pedicellatum management, planned for early 2008.

Surveys for E. pedicellatum (and other lichen species) have continued in the project area since the EIS was submitted. Another individual E. pedicellatum thallus has been located, near the proposed access road route on the eastern side of the peninsula.

DEPARTMENT OF FISHERIES & OCEANS CANADA (DFO)

The EIS relies heavily on details from the Freshwater and Marine Component Studies, related to baseline conditions, to address the harmful alteration disruption or destruction of fish habitat (HADD) which has yet to be finalized. In particular DFO comments on the Freshwater Component Study addresses concerns related to baseline studies and habitat quantification. Please be advised that these concerns have yet to be addressed by NLRC and could affect the final values for freshwater habitat quantification. DFO also expressed concerns related to the Marine Component Study which has yet to be addressed by NLRC. When addressed these concerns may effect the final values for marine habitat quantification. Therefore it is premature to include specific details related to habitat quantification. As such the impacts to the freshwater and marine environment should be addressed as the quantity of habitat to be affected by the footprint of project activities.

With respect to the sections on fish habitat compensation it is important to note that DFO has not approved the proposed habitat compensation strategy. DFO has provided comments to the proponent on the freshwater compensation strategy and is waiting for further information to determine its acceptability. DFO is also currently reviewing the marine compensation strategy to determine its acceptability. Therefore it is premature to include specific details on the compensation strategy within the EIS.

NLRC Response:

Since the issuance of the EIS and associated Component Studies on Freshwater and Marine Fish and Fish Habitat, NLRC had several discussions with DRO, Atlantic Regiona nd has provided the requested information on habitat quantification as well as submitted a revised (draft) compensation strategy for bother freshwater and marine HADD. (see appendix A).

The above-referenced compensation strategy has incorporated all these comments and recommendation of DRO. It is NLRC's understanding from recent communication with DFO, Atlantic Region, that the revised compensation strategy and other supplied information; clarifications and additional field surveys on habitat quantification (both freshwater and marine) have been conditionally accepted by DFO pending the inclusion of additional survey results.

Specific Technical Deficiencies, Concerns or Issues
All Volumes
Section: Preface Subject: The Environmental Assessment **Page**: 1
Other components subject to federal environmental assessment include the infilling of streams and ponds within the refinery footprint.

NLRC Response:

Please replace the 2nd paragraph on page 1 of the Preface with the following text:

"The undertaking is also subject to environmental assessment that will meet the requirements of the Canadian Environmental Assessment Agency (CEAA) process, which requires a Comprehensive Study Report (CSR) for the marine

terminal, marine intake and outfall, steam crossings and the infilling of streams and ponds within the refinery footprint. Transport Canada and Fisheries and Oceans Canada are the Co-Responsible Authorities for the CEAA assessment. Environment Canada, Health Canada and Natural Resources Canada are other Federal Authorities who provide expert advice to support the assessment."

Volume 1
Section 6.4.3 Freshwater Fish and Fish Habitat **Page** 6-9
There are no DFO Fish (HADD) Habitat Compensation Regulations. As per DFO Policy for the Management of Fish Habitat, any habitat loss must have associated fish habitat compensation in order to meet the Guiding Principle of No Net Loss of the Productive Capacity of Fish Habitat.

NLRC Response:

Please replace the 3rd paragraph of Section 6.4.3 on page 6-9 with the following text:

"Any loss of fish habitat required during construction of the Project would be subject NLRC mitigation measures and the DFO Policy for the Management of Fish Habitat, any habitat loss must have associated fish habitat compensation in order to meet the Guiding Principle of No Net Loss of the Productive Capacity of Fish Habitat."

Section 6.5.3 Marine Fish and Fish Habitat **Page** 6-11
2nd Para – States the marine facilities will affect approximately 11.3 ha of seafloor. Is this the size of the HADD to fish habitat? If not, clarification is required.

NLRC Response:

11.3 ha is the size of the HADD.

Section: 6.5.4 Marine Mammals, River Otters and Sea Turtles **Page**: 6-12
Canadian federal law should be specified as Species at Risk Act

NLRC Response:

Please replace the 2nd paragraph of Section 6.5.4, page 6-12 with the following text:

"Among the nine whale species that can potentially occur in Placentia Bay the blue whale and the North Atlantic right whale are listed as endangered species under the Species at Risk Act, which reflects the international consensus on the status of these species. The leatherback turtle also falls into this category. To date, however, there are no recorded sightings of either of these species occurring in Placentia Bay. However, both the fin whale and harbour porpoise both common in the Study Area are deemed to be of special concern by COSEWIC, the independent body that advises the federal government on species at risk issues."

Section: 6.10.1 Fish and Fish Habitat **Page**: 6-19
- 2nd Para – Specify fish habitat compensation plan

- How will other species (American eel) benefit from placement of salmonid spawning gravels? Further information should be given.

NLRC Response:

Please replace the 2nd paragraph of Section 6.10.1, page 6-19 with the following text:

"There will be a loss of approximately sixteen hectares of stream and pond environments that provide habitats for the various life stages of the fish species of concern. Therefore, NLRC in collaboration with the Department of Fisheries and Oceans has developed a fish habitat compensation plan that will seek to enhance spawning habitat for salmonid species within the Watson's Brook system. NLRC considers this is the most effective method to replace and enhance the salmoid productivity that will be lost during project construction. Watson's Brook is currently limited in terms of suitable spawning gravels. The strategic placement of suitable spawning gravels is predicted to create a net increase in the amount of spawning habitat, thereby more than compensating for the fish habitat loss. NLRC will continue to work with DFO, SAEN and other stakeholders to achieve this objective."

With regards to the spawning gravel - while the only life-cycle stage to extensively utilize freshwater habitat is the juvenile rearing, they do live in both the riverine and lacustrine habitats in Newfoundland and Labrador. They typically prefer soft bottom substrates in lacustrine habitat and therefore the creation of small ponds adequately connected to the main stem of Watson's Brook would most likely be the greatest benefit to American eels. The life-history requirements of American eel as outlined by DFO (Grant and Lee 2004) indicates that this species does utilize larger substrates, such as rubble, in streams for shelter (this would primarily be placed to provide juvenile salmonid rearing habitat). They would also utilize smaller substrates such as gravels and sand in streams, albeit to a lesser degree (this would be added to assisting in providing additional salmonid spawning habitat).
It should be noted, the revised habitat compensation strategy (submitted to DFO Sept 25, 2007, see Appendix F) has included DFO's recommendation regarding "like-for-like" as the first level of compensation.

Section 6.11.1 Fish and Fish Habitat **Page** 6-20
States 113 ha of marine habitat will be lost to infilling. In section 6.5.3 states 11.3 ha will be impacted. Clarification is required.

NLRC Response:

Note: the 113 ha of marine habitat lost has a typographic error. It should be 11.3 ha. Also the 38,730 ha of lobster habitat to be compensated should be 38,730 m^2 not 38,730 ha.

Please replace the 1st paragraph of Section 6.11.1, page 6-20 with the following text:

The primary effect of construction activities on fish and fish habitat will clearly be

on the habitat. Approximately 11.3 ha of rock outcrop, boulder/cobble/ sand and gravel habitat and its attendant marine algae will be lost to infilling activities. To offset this loss of productive habitat NLRC will continue, in consultation with the Department of Fisheries and Oceans and local fishers, to develop a detailed fish habitat compensation plan that will describe how habitat suitable for adult lobster will be created. The detailed plan will be based on a strategy that has been accepted by DFO. Based on its marine habitat surveys, NLRC has determined that 38,730 m^2 of adult lobster habitat will have to be improved to compensate for the natural lobster habitat affected by construction."

Volume 2
Section 1.6 Environmental Assessment
2nd Paragraph – Text gives impression that the Canadian Environmental Assessment Agency is also a RA

NLRC Response:

Please replace the 2nd paragraph of Section 1.6, page 1-15 with the following text:

"The Department of Environment and Conservation oversees the provincial process and development of the Environmental Impact Statement. Transport Canada and Department of Fisheries and Oceans are the Responsible Authorities (RAs) for the federal assessment, and the Canadian Environmental Assessment Agency (CEAA) are the Federal Environmental Assessment Coordinator (FEAC). The FEAC and the RAs work together to issue a report on the EIS called the Comprehensive Study Report (CSR)."

Section 3.3.3 Stormwater Management System **Pag**e: 3-22
Are these natural or manmade ponds? This should be specified in the paragraph.

NLRC Response:

Please replace the 2nd paragraph of Section 3.3.3, page 3-22 with the following text:

"The volume of stormwater generated from the site will be estimated using a computer model (HEC or HYSYS). The model will be used to size the underground piping network and above-ground channels required to collect and convey the stormwater from the site. A man-made sedimentation pond will be located and sized based on the estimated stormwater generation from the site. This pond will retain and prevent discharge of sediment from the project area into the environment. Stormwater from the process areas will be directed to a dedicated man-made (potentially) oily stormwater retention pond where it will be continuously evaluated for contaminants. If contaminants are found in the runoff, the water will be sent to the treatment plant for treatment or if the runoff is free of contaminants it will be either used on-site or discharged into the environment."

Section 5.8 Water Body Alteration **Pag**e: 5-7
Description of impacts to waterbodies (removal from site) should include some general discussion of HADD to fish habitat

NLRC Response:

Please add the following paragraph to the end of Section 5.8, page 5-7:

"The Fisheries Act contains a prohibition (HADD) with respect to the "harmful alteration disruption or destruction" of fish habitat. The Act permits the Minister to issue an Authorization (under Section 35 (2)) which will permit a "HADD" to occur. The issuance of an Authorization is at the discretion of the Minister; however the "rules" for issuing an Authorization are well established.

A HADD Authorization will be issued only in accordance with the DFO Policy for the Management of Fish Habitat. This policy has an objective of achieving a "net gain" in the productive capacity of fish habitat in Canada. The Policy has a Guiding Principle of "No Net Loss", i.e. existing fish habitat will be protected, while unavoidable habitat alterations are to be balanced by development of new habitat.

An Authorization must be issued before any action can be taken to destroy fish habitat; even if an authorization is "in process", such action can result in the laying of charges.

In order to receive an Authorization, the following must occur:

DFO determines that a HADD is likely (this determination acts as a "Trigger" for the Environmental Assessment Act). DFO defines a HADD as "any change in fish habitat that reduces its capacity to support one or more life processes of fish".

The Proponent is required to quantify the habitat which will be affected by their undertaking. This quantification must reflect the productivity of the habitat, and take into account the actual and potential use of the habitat by different fish species and life cycle stages. It must also identify all opportunities to avoid or mitigate potential habitat alteration, damage or disruption.

Once the habitat quantification is accepted by DFO, a HADD determination is made, i.e. a formal statement is made identifying the residual habitat which will be lost following the application of all reasonable mitigation measures. This determination establishes the basis for compensation.

The Proponent develops a Compensation Plan in two stages:

- A Compensation Strategy
- A Compensation Plan"

Section 6.2.4 Vessel Traffic Corridor (Shipping Lane) **Pag**e 6-26
First sentence states that the management scheme is "controlled" by MCTS in Argentia. The management scheme is actually monitored for compliance and traffic movements.

NLRC Response:

Please replace the 1st paragraph of Section 6.2.4, page 6-26 with the following text:

"Within Placentia Bay, there is a designated traffic separation and management scheme that is monitored for compliance and traffic movements by MCTS in Argentia. Inbound traffic operates within the boundaries of the eastern vessel traffic lane, whereas outbound traffic stays in the western lane. Traffic separation minimizes the risk of collisions by ensuring that there is single direction traffic within each traffic lane (see Figure 6.3 below, Source: Marine Communications & Traffic Services, Fisheries and Oceans Canada). The existing shipping lanes in Placentia Bay have been planned to maximize the safe transit of vessel traffic and minimize any potential adverse environmental effects on the marine ecosystems and local fishing industry. The current configuration of the shipping lanes follows a natural deepwater channel and was established based on extensive consultations with the oil industry, fisheries, government agencies and interest groups. NLRC has committed to work with these groups to minimize displacement of other users of the shipping lane as a result of its operations."

Section 6.2.5 Vessel Traffic Management **Page**: 6-27
Paragraph 4, should reference the Atlantic Pilotage Authority Regulations which refer to the Pilotage Zone which does not include Long Harbour and Argentia. Tankers will not normally be entering those excluded areas, except to go to anchorage off Long Harbour (FF).

NLRC Response:

Please replace the 4th paragraph of Section 6.2.5, page 6-27 with the following text:

"Specific requirements of the Atlantic Pilotage Authority Regulations, which are followed in Placentia Bay, are such that no vessel can enter the inner bay (north of Red Island) without having a registered pilot on board. A pilot station is located in the centre of the traffic lanes just off Red Island. Once the pilot station is reached, any vessel on route to a port must be piloted by a marine pilot from the Atlantic Pilotage Authority, stationed out of Arnold's Cove."

Section 8.6.1 Construction Phase **Page** 8-25
Are these natural or man-made ponds?

NLRC Response:

Please replace the 1st paragraph of Section 8.6.1, page 8-25 with the following text:

"The construction phase is anticipated to start in early 2008 and finish in 2011. During construction, the main source of water will be from drainage of some man-made ponds in the project footprint, runoff (sedimentation ponds) and potable water trucked to the site."

Please replace the 4th paragraph of Section 8.6.1, page 8-25 with the following

text:

"The objective of the storm water system will be to intercept water entering the project site from surrounding areas, precipitation falling on the areas under construction, and surface water encountered during construction. The intercepted runoff water, will be collected in temporary (or permanent) man-made sedimentation ponds of sufficient capacity and retention period to ensure settlement of suspended solids. The quality of the storm water will be monitored during retention procedures to ensure it meets the governing regulations prior to release into the surrounding environment."

Section 11.7.1 Fire Supply Integrity **Page** 11-9
Is this a natural or manmade water supply?

NLRC Response:

Please replace the 2nd paragraph of Section 11.7.1, page 11-9 with the following text:

"Water for firefighting purposes will be obtained from man-made freshwater reservoirs on-site. Water stored in the man-made firewater pond will be the primary source. Water in this pond will be supplied primarily from the uncontaminated stormwater stream from the project site and will be replenished as required from that source. The required firewater pond storage capacity is estimated at 8,750,000 USgal (33,130 m3). If the demand exceeds the volume of the firewater pond all uncontaminated freshwater reserves will be made available. The detailed operation of this system for water recycling is described in sections 3.3.2 and 8.5."

Appendix 2
Fisheries Act Section 35(2) is not discussed and not included in the table of permits required.

NLRC Response:

Please replace Appendix A of Volume 2 with the attached Appendix D of this document.

Volume 3
Section 1.2 Project Overview
Should specify the projects that are proposed, sounds as if they are all existing

NLRC Response:

Please replace the 7th paragraph of Section 1.2, page 1-4 with the following text:

"The Bay is also the location of other Projects and industrial development, such as the proposed Voisey's Bay Processing plant at Long Harbour, the existing Hydromet demo plant at Argentia, a proposed LNG terminal at grassy Point and an important location for fisheries and aquaculture industry as well as tourism, nature and ecological reserves including the world renowned Cape St. Mary's

Bird sanctuary at the entrance of the Bay."

Section 1.4 Environmental Assessment Process **Page** 1-8
The CEA Agency is not a responsible authority, they are the Federal Environmental Assessment Coordinator (FEAC) for the project.

NLRC Response:

"The Department of Environment and Conservation oversees the provincial process and development of the Environmental Impact Statement. Transport Canada and Department of Fisheries and Oceans are the Responsible Authorities (RAs) for the federal assessment, and the Canadian Environmental Assessment Agency (CEAA) are the Federal Environmental Assessment Coordinator (FEAC). The FEAC and the RAs work together to issue a report on the EIS called the Comprehensive Study Report (CSR)."

Section 2.1 Introduction **Page** 2-1
Effects of the environment on the project would include such things as storms, ice, wind, etc. The aspects such as site selection and route planning etc. would be part of project planning.

NLRC Response:

Please replace the 5th paragraph of Section 2.1, page 2-1 with the following text:

"Effects of the environment on the project include such aspects as ice, wind, waves, water level, current storm events etc., seasonal restrictions on construction activities, design criteria for infrastructure and buildings to accommodate severe storms or potential changes in sea level due to global warming, climatology and physical oceanography in the biophysical assessment and aspects such as work schedules, commuting distance and procurement policies in the socio-economic assessment. The environment is considered during project planning, for example site selection and route planning to avoid sensitive habitat."

Section 3.4.2 Hydrological Conditions **Page** 3-25
Culverts for small tributaries 1/25 year storm events for design – is this adequate for a project with at least a 25-year life-span?

In addition to crossing designs to adhere to guidelines regarding storm events, watercourse crossing should also be designed and sized to ensure they do not create a barrier to fish migration and are properly stabilized to prevent erosion and deposition of sediment into a watercourse.

NLRC Response:

Note:
The standard design for culverts for small drainage areas would normally be 1/10 years based on the importance of the roadway and the potential costs of damage associated with flooding. NLRC has recognized that there should be some conservativeness added to the design of the culverts due to climate change

considerations and have selected a 1/25 year return period instead of the typical 1/10 year. This will be evaluated during detailed design and consideration will be given to increasing the return period if warranted.

Please replace the 6th paragraph of Section 3.4.2, page 3-25 with the following text:

"Discharge conditions from the Come By Chance River will be applied for design of water crossing structures in each of the watersheds in the project area. The number and type of water crossings in the project area are discussed in Section 4.5.1. Due to the potential for ice and flooding problems (from experience and local knowledge of the rivers), the bridges in the project area will be designed conservatively using 1/100-year storm event. This is greater than the requirements recommended by DOEC for rural highways, but given the sensitivity of maintaining the integrity of the access roads to the refinery it is preferable to design for the more conservative parameters which will only result is a slightly more substantial structure but will provide for additional security for road traffic. For culverts that will cross the smaller tributaries, 1/25-year storm events will be used for design. Crossings will also be designed and sized to ensure they do not create a barrier to fish migration (e.g. counter-sunken as per DFO guidelines for stream crossing) and will be properly stabilized to prevent erosion and sediment deposition into any watercourse."

Section 3.6.6 Freshwater Fish and Fish Habitat – Species Present **Page** 3-115
The Freshwater Component Study indicates that threespine sticklebacks were captured during fish sampling in a number of ponds and stream. Please provide a species description.

NLRC Response:

Threespine sticklebacks occur in both fresh and brackish water environments along northern coastlines of the northern hemisphere, and occur regularly throughout Newfoundland. This fish is only about 2 to 3 inches long, and is usually silver in colour, with a laterally compressed body shape. This species derives its name from the number of spines on its back; these three spines are used as protection against attacks from larger fish and other predators (The Fluvarium, 2006). Threespine sticklebacks mostly feed on small crustaceans, oligochaetes, the larvae and eggs of insect and fish.

Spawning happens during the spring for the Threespine stickleback, usually between May and July. At this time, females continue to school, while males claim and defend territories to build nests to attract the females to lay their eggs. A distinct change in colouration between the sexes occurs; the females remain silvery with dark patterns throughout their body, and the males develop a red breast and throat, the irises of their eyes become blue, and the back often turns greenish. The male threespine stickleback builds a nest in a shallow depression usually excavated near shelter, typically rocks or vegetation. The nest is built using algae and aquatic plants (Curry, Gautreau & Yamazaki, 2007).

Curry, Allen; Gautreau, Mark; and Yamazaki, Gordon (2007). Inland Fishes of New Brunswick. Retrieved October 26th, 2007 from:

http://www.unb.ca/cri/projects/Fish_key/fish%20welcome.htm.

The Fluvarium (2006). Freshwater Fish. Retrieved October 26th, 2007 from: http://www.fluvarium.ca/education.php?edu=freshwater.

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Holletts Brook Small Pond **Page**:3-118
Figure 3.69 indicates that the small pond (no name) within Stream T1-1 was not surveyed and as such quantification of fish habitat was not conducted. Please clarify as to why this habitat was not quantified.

NLRC Response:

It was omitted in error and additional surveys are being undertaken to collect the appropriate information for habitat quantification. The result of the surveys will be made available to DFO immediately upon completion of the surveys for finalization of HADD quantification.

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Holletts Brook **Page**:3-118
It seems that reach 1 and 2 (brackish) have been omitted from the physical habitat description. As such the habitat units indicated at the bottom of page 3-118 will need to be adjusted to reflect the inclusion of reach 1 and 2 following quantification.

NLRC Response:

At the time of the surveys, the velocities measured for reach 1 and 2 were flowing upstream due to tidal influences and were therefore determined to be invalid. The tidal nature of the lower two reaches was also the reason that it was discounted as freshwater stream habitat in that life-cycle stages such as spawning cannot be completed. Velocity measurements will be re-attempted and the habitat quantified however, the tidal influence on the habitat suitability should be considered when determining quantification for freshwater habitat. The additional survey data, which is currently underway, as well as the additional habitat units, will be submitted to DFO immediately upon completion for finalization of HADD quantification.

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Holletts Brook Overland Flow **Page**:3-119
This section indicates that overland flow was identified and that this is not considered fish habitat because it was dry during low flow periods. Can this overland flow be considered an intermittent stream? Is it an obstruction to fish migration? Please clarify

NLRC Response:

The overland flow would not be considered an intermittent stream or fish habitat but merely high flow runoff from these relatively isolated small ponds. There is no real "substrate" or defined bank to these sections and the flow location could change from year to year high flows. Substrate consists of grasses (not aquatic) typically found in the area. Flow was seen during surveys and as such could provide opportunistic corridors to species in the watershed under the appropriate conditions (eg. American eels). In most situations, this section of stream would

be considered a barrier to migration.

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Holletts Brook Pond 2 **Page**:3-119
Please refer to DFO general comments above related the quantification of freshwater habitat. Please remove HEU values in Table 3.24.as these values have not been confirmed by DFO.

NLRC Response:

Please add the following text after Table 3.24, page 3-120:

"*HEU values to be confirmed by DFO."

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Holletts Brook Pond 5
A section related to Pond 5 should also be included. Please refer to DFO comments related to Pond 5 in the Freshwater Component Study.

NLRC Response:

Agreed. Additional sampling will be conducted at Pond 5 as per discussions with DFO. The additional survey data, currently underway, will be submitted to DFO upon completion of the survey for finalization of HADD quantification.

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Holletts Brook HEU's **Page** 3-119
Please refer to DFO general comments above related the quantification of freshwater habitat. Please remove HEU values as these values have not been confirmed by DFO.

NLRC Response:

Please replace the 4th paragraph of Section 3.6.6 "Fish Habitat Present Holletts Brook (Tributary T1), page 3-119 with the following text:

"Both brook trout and American eel were captured in Holletts Brook during electrofishing surveys and it has been calculated that approximately 16.55 and 17.44 Habitat Equivalent Units (HEU's) exist for brook trout and American eel respectively in T1 with tributary T1-1 containing 0.95 HEU's for American eel. The small tributary had an HEU of 0.00 for brook trout (not suitable). All HEU values to be confirmed by DFO"

Please replace the 2nd paragraph of Section 3.6.6 "Fish Habitat Present Pond P2, page 3-119 with the following text:

"A combination of fyke nets and baited minnow traps were all fished for 3 nights, yielding a total catch of 66 brook trout. Habitat equivalent units (HEU) for brook trout were calculated at 2.17 ha, to be confirmed by DFO."

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Watson's Brook – HEU's **Page:** 3-120
The Freshwater Component Study indicated a 180 m section of T2 (reach 4) was

identified as being overland flow. See DFO comments on Freshwater Component Study. Adjustments to the paragraph 2 may be required.

Refer to DFO general comments above related the quantification of freshwater habitat. Please remove HEU values in Table 3.24.as these values have not been confirmed by DFO.

NLRC Response:

The overland flow referred to above would not be considered an intermittent stream or fish habitat but merely high flow runoff from these relatively isolated small ponds. There is no real "substrate" or defined bank to these sections and the flow location could change from year to year high flows. Substrate consists of grasses (not aquatic) typically found in the area. Flow was seen during surveys and as such could provide opportunistic corridors to species in the watershed under the appropriate conditions (eg. American eels). In most situations, this section of stream would be considered a barrier to migration.

Please add the following text after Table 3.24, page 3-120:

*"*HEU values to be confirmed by DFO."*

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Pond 1 **Page:** 3-121
Please refer to DFO general comments above related the quantification of freshwater habitat. Please remove HEU values in Table 3.24.as these values have not been confirmed by DFO.

NLRC Response

Please replace the 2nd paragraph of Section 3.6.6 "Fish Habitat Present Watson's Brook (T2, T2-1 and T2-2), Pond P1, page 3-121 with the following text:

A total of 56 brook trout, 40 threespine stickleback and 3 juvenile Atlantic salmon were captured within Pond P1. HEU values for each species are 5.00 ha, 7.42 ha and 0.53 ha for brook trout, threespine stickleback and Atlantic salmon respectively. All HEU values to be confirmed by DFO."

Please add the following text after Table 3.24, page 3-120:

*"*HEU values to be confirmed by DFO."*

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Pond 7 **Page:** 3-121
Please refer to DFO general comments above related the quantification of freshwater habitat. Please remove HEU values as these values have not been confirmed by DFO.

NLRC Response:

Please replace the 2nd paragraph of Section 3.6.6 "Fish Habitat Present Watson's Brook (T2, T2-1 and T2-2), Pond P7, page 3-121 with the following text:

"A total of 38 Threespine sticklebacks and one Atlantic salmon were captured within Pond P7. Brook trout were not captured but are common throughout the Watson Brook drainage basin, therefore, HEU values for each species are 1.24 ha (stickleback), 0.29 ha (Atlantic salmon) and 0.92 ha (brook trout). All HEU values to be confirmed by DFO"

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Pond 8 **Page:** 3-122
Please refer to DFO general comments above related the quantification of freshwater habitat. Please remove HEU values as these values have not been confirmed by DFO.

NLRC Response:

Please replace the 2nd paragraph of Section 3.6.6 "Fish Habitat Present Watson's Brook (T2, T2-1 and T2-2), Pond P8, page 3-122 with the following text:

"A total of 53 brook trout, 81 threespine stickleback and 1 Atlantic salmon juvenile were captured within Pond P8. HEU values for each species are 3.91 ha, 5.75 ha and 0.10 ha for brook trout, threespine stickleback and Atlantic salmon respectively. All HEU values to be confirmed by DFO."

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Stream T3 **Page:** 3-123
This section indicates that overland flow was identified and that this is not considered fish habitat because it was dry during low flow periods. Can this overland flow be considered an intermittent stream? Is it an obstruction to fish migration? Please clarify

Please refer to DFO general comments above related the quantification of freshwater habitat. Please remove HEU values as these values have not been confirmed by DFO

NLRC Response:

The overland flow would not be considered an intermittent stream or fish habitat but merely high flow runoff from these relatively isolated small ponds. There is no real "substrate" or defined bank to these sections and the flow location could change from year to year high flows. Substrate consists of grasses (not aquatic) typically found in the area. Flow was seen during surveys and as such could provide opportunistic corridors to species in the watershed under the appropriate conditions (eg. American eels). In most situations, this section of stream would be considered a barrier to migration.

Please replace the 2nd paragraph of Section 3.6.6 "Fish Habitat Present Watson's Brook (T2, T2-1 and T2-2), Stream T3, page 3-123 with the following text:

"Brook trout were identified within the drainage basin rendering a total of 1.67 Habitat Equivalent Units (HEU), to be confirmed by DFO."

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**: Pond 3 **Page:** 3-123
Please refer to DFO general comments above related the quantification of freshwater habitat. Please remove HEU values as these values have not been confirmed by DFO.

NLRC Response:

Please replace the 2nd paragraph of Section 3.6.6 "Fish Habitat Present Watson's Brook (T2, T2-1 and T2-2), Pond P3, page 3-123 with the following text:

"A total of 24 brook trout were captured in Pond P3 with a HEU value of 1.08 ha, to be confirmed by DFO."

Section 3.6.6 Freshwater Fish and Fish Habitat **Subject**:
Description (physical habitat and fish sampling programs implemented) have not been included for ponds P4, P5, P6, P9, P10 and tributaries T4, and T6. Please include information related to these areas.

NLRC Response:

Sample Stream T4 (Fault Stream)
A stream survey was completed; however as this stream does not lie within the project footprint a detailed summary is not presented below.

Sample Stream T6 (Steep Stream)
A stream survey was completed; however, subsequent visits (late June) to this stream since the time of the stream survey have shown the stream to be intermittent at best. Therefore the stream is not considered fish habitat.

Sample Pond 4
Pond 4 is located on the northwest end of the project footprint and had a total area of 17,751.24 m^2. There was no visible inflow located for this pond and no fish species were present.

Sample Pond 5
Pond 5 is one of a cluster of small, interconnected ponds located on the northwest side of the Project footprint. All of the ponds were evaluated for depth, and littoral substrate. Of the four ponds clustered together, Pond 5 was the only one deep enough to sample. The ponds' outflow was located on the south end and the inflow was located at the north end. The total area of the pond was 4,895.61 m^2. The pond was sampled for fish using a single bag fyke net set for 24 hrs. No fish were caught during sampling and therefore the pond is considered not to contain any fish habitat.

Sample Pond 6
Pond 6 is located on the southeast end of the Project footprint and the total area of the pond was 2,415.63 m^2. One single bag fyke net was set near the mouth of the outflow along with two minnow traps for approximately 2.5 hrs. The pond was also angled (one rod) for 1.5 hrs using baited lures. No fish were caught in the net, traps or from angling and no fish were observed in the pond during the shoreline survey. As such, the pond is considered not to contain any fish habitat.

Sample Pond 9
Pond 9 is located approximately 200 m north of Pond 8, within the northeast section of the Project footprint and had a total area of 3,573.15 m^2. One double bag fyke net and one minnow trap were set in the pond for a 17 hr, overnight set. Neither the minnow trap nor the fyke net yielded any fish; there was however tadpoles and water beetles caught in the fyke net. The pond is not considered

fish habitat.

Sample Pond 10
Pond 10 is located approximately 200 m south of Pond 9 and had a total area of 3,677.36 ^{m2}. Fish sample gear was not set in the pond due to shallow water levels. The pond is not considered to contain fish habitat.

Section 3.7.2 **Subject**: Marine Fish and Fish Habitat **Page:** 3-130
Please provide DFO with a copy of the NL Refinery Fisheries Baseline Document (Canning and Pitt Associates 2007).

NLRC Response:

Please find attached a copy of NLRC's Fisheries Baseline Document (Canning and Pitt Associates 2007).

Section 4.1.2 Construction Phase Activities **Subject** Waterbodies **Page** 4-4
- Should specify that removal of waterbodies will result in a HADD of fish habitat
- There is no description as to how P1will be disconnected from Watson's Brook and what activities this will require (i.e. dyke, dam …). Please revise EIS to include this activity, associated effects, mitigations etc…
-"Bridge structures will be required for more substantial rivers (fish habitat)…" Does this mean the streams requiring culverts are non-fish habitat?
- Watercourse crossing should also be designed and sized to ensure they do not create a barrier to fish migration and are properly stabilized to prevent erosion and deposition of sediment into a watercourse.

NLRC Response:

Please replace the 1st paragragh of Section 4.1.2 "Land-based Construction, Watersheds", page 4-3 with the following text:

"Water bodies within the immediate footprint will be effectively removed from site and will not exist in the project area upon completion of construction, which will result in a HADD of fish habitat. Those water bodies with fish habitat will be electrofished to remove any fish, which will be relocated to an area of similar habitat that will remain unaltered. The water body will then be dewatered in a manner to prevent siltation, incorporating silt control measures. Unusable material from the drained water body will be excavated and removed to the USM waste site."

Please add the following text, to be inserted as paragraph 2, to Section 4.1.2 "Land-based Construction, Watersheds", page 4-3:

"There will be no dams constructed on site. Where partial infilling of a pond is required, as is the case with Pond P1, a silt curtain will be installed at the point between the pond area that is to remain and the area to be infilled. Infilling will start with clean rock fill at the silt curtain location and will proceed along the length of the infill area until the area is infilled with rock fill. Water in the infill area will be removed as per approved de-watering procedures and filtered through a

settlement pond."

Please add the following text to the end of Section 4.1.2 "Watersheds":

"Alignment of culverts will be such that the original direction of stream flow is not significantly altered. Where possible, crossing infrastructure will be installed at right angles to the stream to minimize the crossing length. Approaches to all stream crossings will be constructed with erosion resistant materials such as rock or clean gravel. Any materials placed in the stream to improve the crossing will be clean, non-erodable, and non-toxic to aquatic life.

Where streams are deemed to be fish habitat, culvert installations will be designed to allow the passage of fish and to preserve habitat. Cylindrical culverts will be countersunk below the streambeds so that there is sufficient depth of water for fish passage. This will be accomplished in multiple culvert installations by installing one culvert at a lower elevation than the others. For larger or more sensitive crossings, appropriate structures will be installed to preserve the natural substrate for resident fish populations. The stipulations of the Department of Fisheries and Oceans will be incorporated as required during design and construction as will the input of conservation and stewardship interests."

Section 4.1.2 Construction Phase Activities **Subject** Marine Construction **Page** 4-4
This section fails to describe the construction related to the marine outfall and marine intake. Please add this information.

NLRC Response:

Please add the following text to the end of Section 4.1.2 "Marine Construction", page 4-5:

"The seawater intake will consist of two (2) 1.2 m diameter high-density polyethylene pipes that will extend from the intake wet well at the shoreline to the seawater collection point approximately 985 m from shore. The pipe will be installed such that it is buried in the inter-tidal zone at the shoreline for protection from erosion and land-fast sea ice. It will be anchored with concrete bocks over the entire exposed length to prevent floating. The depth of the end of the intake will be at 18 m below low normal tide.

A wedge-wire or V-wire screen (Johnson Screen™) will be used at the end of the intake pipe to reduce the inlet velocity below 0.15 m/s. This reduced inlet velocity protects the surrounding aquatic species and serves to prevent debris from clogging the screen. The screen is also equipped with an air cleaning system in which a periodic blast of compressed air is backwashed through the screen assembly to remove any accumulated debris. The screen material will be selected specifically for the application to prevent corrosion and biofouling."

Wastewater from the refinery that has been treated in the wastewater treatment plant will be discharged through an ocean outfall that will extend to a depth of –18.0 m below chart data. The pipe has a diameter of 1.2 m and will consist of a solid HDPE pipe to –15.0 m below CD. After that point, 100 mm diameter

diffuser with check valve type ports, will be installed on the pipe at a spacing of 1000 mm. A total of 100 discharge ports will be required to provide sufficient dispersion of the wastewater in the current conditions at the discharge site.

The pipe will be anchored to the ocean floor using a series of concrete blocks. The section of the pipe containing the diffuser will be leveled either using a pad of washed granular material or concrete pedestals depending upon the characteristics of the ocean floor in that area.

The total length of the pipe is estimated to be 405 m. The estimated total wastewater discharge through the outfall during operations is 42,518 USgpm (2.68 m^3/s).

Section 4.1.2 Operations Phase Project Activities **Subject** Marine Operations **Page** 4-7 par. 1
Are capelin beaches present within the project area?

NLRC Response:

Please insert the following text after the 6th paragraph, Section 4.1.3 "Marine Operations":

"Capelin (a seasonal pelagic species) has occasionally been reported in the vicinity of Zone 3 – Marine Water Intake (Hollets Cove). However, local information indicates that they are not present in significant numbers and do not "spawn/roll" on the coarse beach material (cobble/gravel/bedrock). In addition to this, the complexity of the bedrock outcrops and large boulders that are interspersed throughout Hollets Cove are not conducive to commercial seining. Capelin is not commercially fished within the project footprint. Historical anecdotal information from fisherpersons who lived in the area of the project footprint (prior to resettlement in the late 1960's) indicates that the small unnamed cove located immediately to the west of Come By Chance Point and to the east of Hollets Cove was known as an area where capelin would "spawn/roll" in intermittent years. However, field surveys revealed a fairly coarse substrate (cobble/gravel) now characterizes this beach and there are no reports of capelin "spawning/rolling" in this area in recent memory."

Figure 4.21 Stream Crossing Locations Along Proposed Access Road **Page** 4-75
Have fish habitat surveys/fish sampling been conducted when determining if a crossing is or is not fish habitat?

NLRC Response:

No, fish sampling was not conducted, however fish habitat was characterized for all stream crossings. The information collected was primarily to determine whether the locations of proposed crossings were navigable under the Navigable Waters Protection Act. Any additional data required prior to culvert/bridge installation can be collected but at this point, the general habitat descriptions have been collected, summarized and submitted to the appropriate regulatory agencies. It is assumed that all standard mitigations and National Operational Statements will be required to mitigate and potential issues.

Section 4.5 Water Resource Effect Assessment **Subject** P1 **Page** 4.72
Project effects during construction have not be discussed for P1 how it will be disconnected from Watson's Brook.

NLRC Response:

Please add the following text to the end of Section 4.5.1 "Dewatering", page 4-73:

"Where partial infilling of a pond is required, as is the case with Pond P1, a silt curtain will be installed at the point between the pond area that is to remain and the area to be infilled. Infilling will start with clean rock fill at the silt curtain location and will proceed along the length of the infill area until the area is infilled with rock fill. Water in the infill area will be removed as per approved de-watering procedures and filtered through a settlement pond."

Section 4.5.3 Mitigation **Subject** Stream Crossings **Page** 4-75
Mitigations for culvert installations should also include appropriate sizing to prevent infilling and allow for countersinking, addition of substrate and baffles where required. Also DFO has implemented a National Operational Statement for Clear Span Bridge installations.

NLRC Response:

Please add the following text as paragraph 7 of Section 4.5.3, page 3-25:

"Where streams are deemed to be fish habitat, culvert installations will be designed to allow the passage of fish and to preserve habitat. Cylindrical culverts will be countersunk below the streambeds so that there is sufficient depth of water for fish passage. In some cases where flood flow is high, a multiple culvert installations may be required by installing one culvert at a lower elevation than the others. For larger or more sensitive crossings, appropriate structures will be installed to preserve the natural substrate for resident fish populations. The stipulations of the Department of Fisheries and Oceans will be incorporated as required during design and construction as will the input of conservation and stewardship interests. NLRC will also follow the DFO National Operational Statement for Clear Span Bridge installations."

Section 4.5.3 Mitigation **Subject:** Stream Crossings **Page** 4-76
Mitigation measures for fording should include DFO factsheet

NLRC Response:

Please add the following text to the end of Section 4.5.3 "Stream Crossings", page 4-76:

- *"DFO Factsheet for Temporary Fording Sites."*

Section 4.5.4 Residual Effects **Page** 4-77
Other residual effects include removal of Hollett's Brook watershed, and infilling of other

waterbodies. This should be addressed.

NLRC Response:

Please replace Section 4.5.4, page 4-77 with the following text:

"The overall residual effect on water resources in the project area is that 4.2 per cent of the Watson's Brook watershed will be removed as well as the complete removal of the Hollett's Brook watershed. Water bodies within the immediate footprint will be effectively removed from site and will not exist in the project area upon completion of construction. Loss of fish habitat will also be addressed in the Habitat Compensation Strategy."

Section 4.7 Freshwater Fish and Fish Habitat Effects Assessment Subject Project Boundaries **Page** 4-135 par 2
The projects spatial boundaries associated with the potential interactions should be extended to include watercourses which will be crossed as a component of the road development.

NLRC Response:

Please replace the 2nd paragraph of Section 4.7, page 4-135 with the following text:

"The spatial boundaries associated with the potential interactions and assessment of fish and fish habitat are those water courses within the boundaries as described in Section 2.7.2 of the assessment methodology. In general, the Project boundaries with respect to freshwater fish and fish habitat are those watercourses within the direct footprint of the facility (including infrastructure), the watercourses to be crossed during access road construction and those watercourses within any potential deposition or effluent zone of influence."

Section 4.7.1 Potential Effect During Construction **Subject** American Eel **Page** 4-136 par 4
American eel should also be highlighted for assessment purposes due to this species being identified as a species of special concern by COSEWIC.

NLRC Response:

Please replace the 4th paragraph of Section 4.7.1, page 4-136 with the following text:

"As shown above and described in Volume 2, construction interactions relate primarily to those potential pathways such as siltation, erosion, dust and blasting as well as those activities that will permanently affect existing fish and fish habitat as a result of the Project footprint. Spills are addressed separately in Accidents and Malfunctions (Section 7.0). For assessment purposes, the fish species of brook trout (Salvelinus fontinalis), Atlantic salmon (Salmo salar) and American eel (Anguilla rostrata) will be used as they represent the three species found within the Project Area that would be considered to have a fishery potential.

They would also be sensitive to habitat change."

Section 4.7.1. Project Effects during Construction **Subject**: Blasting **Page** 4-142
(4th Bullet) – Sentence should be more direct. Either additional mitigations will or will not be used.

NLRC Response:

Please replace the 4th bullet of Section 4.7.1 "Blasting", page 4-142 with the following text:

- *"If on-land blasts are required nearer to the watercourse than indicated above, then additional mitigative measures will be initiated which include the following:"*

Section 4.7.1 Potential Effect During Construction **Subject** Loss of Fish Habitat **Page** 4-143 par 2
The marine HADD has not been finalized as such DFO suggests identifying the quantity of marine habitat that is to be impacted by the footprint of marine activities.

NLRC Response:

Please replace the 2nd paragraph of Section 4.7.1 "Loss of Fish Habitat", page 4-143 with the following text:

"The location of the project footprint covers identified fish habitat (see Section 3.6.6 of the Existing Environment). The total amount of habitat directly within the Project Area has been quantified as per DFO guidelines and direction (see Bradbury et al. 2001 and McCarthy et al. 2007). The quantity of marine habitat that is to be impacted by the footprint of marine activities has been calculated at 23.47units (1 unit = 100m^2) of stream habitat equivalent and 15.5ha (1 ha = 100 units) of lacustrine habitat equivalent units as a result of the refinery footprint and infrastructure."

Section 4.7.2 **Subject** Change in Water Quality **Page** 4-147
This section states that "the overall change in water flows within Watson's Brook are minimal …" What has this statement been based on? How have flow impacts/requirements to Watson Brook downstream of the projected impacted area been determined?

NLRC Response:

Note:
The overall changes in flows from Watson's Brook are minimal based on the fact that only 4.2% of the watershed is affected. The location of the affected area is in the lower end at the Watson's Brook water shed therefore the hydrographic profile of Watson's Brook will have minimal change.

Section 4.7.3 **Subject** Mitigation **Page** 4-149 - 4-153
The freshwater habitat compensation strategy has not been approved by DFO. DFO has provided comments to the proponent and is waiting for additional information in order to determine the acceptability of this strategy. Therefore, it is premature to include

specific details on the freshwater strategy within the EIS.

NLRC Response:

NLRC is finalizing the draft Fish Habitat Compensation Strategy with guidance from DFO.

Section 4.7.3 **Subject** Loss of Fish and Fish Habitat **Page** 4-150 par. 2
It should also be noted that the Beak Habitat Classification system was also utilized when quantifying riverine habitat.

NLRC Response:

Please add the following sentence at the end of paragraph 2 on page 4-150:

"It should also be noted that the Beak Habitat Classification system was utilized during riverine habitat quantification."

Section 4.7.3 **Subject** Mitigative Measures and Table 4.46 **Page** 4-150
Please refer to DFO general comments above related the quantification of freshwater habitat. Please remove Table 4.46 related to HEU's as these values have not been confirmed by DFO.

NLRC Response:

Please add the following text after Table 4.46, page 4-150:

*"*HEU values to be confirmed by DFO."*

Section 4.8.1 Project Effects During Construction **Subject**: Construction Activities **Page** 4-164
Will development of the marine terminal require any dredging?

NLRC Response:

The development of the Marine Terminal will not require dredging.

Section 4.8.1 Project Effects During Construction **Subject**: Chemical Losses Affecting Water and Sediment Quality **Page** 4-168 par. 5
DFO guidelines suggest that fuel storage be a minimum of 100 m for any watercourse.

NLRC Response:

Please replace the 1st paragraph of Section 4.8.1 "Chemical Losses Affecting Water and Sediment Qualtiy", page 4-168 with the following text:

"Construction of the marine facilities will require the use of heavy machinery, vessels and barges, each with the potential to leak hydrocarbons into the surrounding waters. Chemical losses (e.g. fuels, greases, detergents) will be mitigated by taking a proactive approach to prevent leaks or spills. Hydrocarbon

releases from machinery and vehicles can be minimized through regular maintenance to ensure they are in good working order and thoroughly checked for leakage. Heavy equipment used during construction (e.g. cranes dump trucks, loaders) will only be refueled on dry, stable, land or barges specifically designed for that purpose; with heavy equipment not operating from barges completing work below the high water mark during low tide. No refueling or repairs of construction equipment will be done on the marine terminal or within 100 m of any waterbody. Floating booms will be in place during all construction activities, which will contain potential leaks or spills. Spill kits, containing such items as absorbents capable of retaining and removing oil sheen and waste storage containers will be available on barges and boats required for construction and the terminal itself."

Please replace the 2nd bullet of Section 4.8.1 "Chemical Losses Affecting Water and Sediment Quality", page 4-169 with the following text:

- *"Refueling equipment and vehicles at least 100 m from any water body, and over a non-permeable surface;"*

Section 4.8.1 Project Effects During Construction **Subject**: Chemical Losses Affecting Water and Sediment Quality **Page** 4-171 par. 2
Please adhere to DFO's Factsheet Blasting – Fish and Fish Habitat Protection

NLRC Response:

Please replace the 3rd paragraph of Section 4.8.1, page 4-171 with the following text:

"Regardless of the lack of anticipated effects, blasting during the marine terminal's construction will adhere to all mitigative measures as outlined in Section 4.8.3 and will be done in accordance with all acts, regulations and guidelines described therein. This includes allowing no blasting to occur within the marine environment. NLRC will also adhere to DFO's Factsheet on Blasting – Fish and Fish Habitat Protection."

Section 4.8.1 Project Effects During Construction **Subject** Loss of Fish Habitat **Page** 4-172
The proposed marine fish habitat compensation strategy has not been accepted by DFO; the strategy is currently under review to determine its acceptability. As such, it is premature to include specific details on the marine strategy in the EIS.

NLRC Response:

This comment has been resolved directly between NLRC and DFO.

Section 4.8.2 Project Effects During Operations **Subject**: Chemical Losses Affecting Water and Sediment Quality **Page** 4-183 and 184
DFO guidelines suggest that fuel storage be a minimum of 100 m for any watercourse.

NLRC Response:

Please replace the 1st paragraph of Section 4.8.2 "Chemical Losses Affecting Water and Sediment Quality", page 4-183 with the following text:

"Equipment located at the marine terminal during the operations phase will contain only small quantities of hydrocarbons. Only hydraulic fluid and medium oils (for gearboxes) will be used. The hydraulic fluid storage is to be located at least 100 m from any body of water within a secure equipment room provided with secondary containment of at least 110 per cent of the tank's capacity. Gearboxes will have catchment trays, as will bearings, where regular greasing occurs (as per manufacture's specifications). Any machinery requiring minor repairs will be taken to a suitable location on land to be fixed, with no repairs of mobile machinery being performed at the marine terminal or within 30 m of any water body. Only minor repairs and maintenance of non-mobile equipment (such as greasing of loading/unloading gear) will be performed on-site. All major repairs will take place offsite at an approved facility."

Please replace the 2nd bullet of Section 4.8.2 "Chemical Losses Affecting Water and Sediment Quality", page 4-184 with the following text:

- *"Refueling equipment and vehicles at least 100 m from any water body, and over a non-permeable surface;"*

Section 4.8.3 Project Effects During Operations **Subject**: Mitigations **Page** 4-191
As previously mentioned in the general comments section above DFO expressed concerns related to the Marine Component Study which has yet to be addressed by NLRC. When addressed these concerns may effect the final values for marine habitat quantification. As such the value and species identified as the HADD may require revision.

NLRC Response:

There comments have been addressed In a letter addressed to DFO, October 5, 2007. This letter can be found in Appendix F of this document.

Section 4.8.3 Project Effects During Operations **Subject**: Mitigations **Page** 4-194
Please adhere to DFO's Factsheet Blasting – Fish and Fish Habitat Protection

NLRC Response:

Please add the following bullet to the end of section 4.8.3 "Mitigations":

"NLRC will adhere to DFO's Factsheet on Blasting – Fish and Fish Habitat Protection."

Section 4.8.3 Project Effects During Operations **Subject**: Monitoring **Page** 4-194
A monitoring component is a requirement of an acceptable fish habitat compensation strategy.

The fish habitat compensation strategy for freshwater and marine habitat losses has not been accepted by DFO and therefore it is premature to include specific details within the

EIS.

NLRC Response:

Please Replace the 1st paragraph of Section 4.8.3 "Monitoring" with the following text:

- *"A monitoring program will be employed to monitor the structural stability and habitat utilization of the newly created lobster habitat. The monitoring program will include such things as video and photographic surveys, visual inspections, and assessment of new habitat utilization by flora and fauna."*

NLRC is finalizing the draft Fish Habitat Compensation Strategy with guidance from DFO.

Section 4.9.2 Project Effects During Operations **Subject**: Vessel Traffic **Page** 4-237
3rd Para – states an additional 900 tankers will be entering Placentia Bay every year (~ 500 combined from existing refinery and transshipment terminal and up to 400 from the proposed LNG facility. Tankers already enter for the existing facilities. Are these tankers entering in addition to what already enters Placentia Bay? Clarification is required.

NLRC Response:

Please remove the 3rd paragraph of Section 4.9.2, pare 4-237, this is a cumulative effect. The number of additional tankers from the proposed NLRC refinery is 400 to 450 every year.

Section 4.10.1 Project Effects During Construction Subject Mammals and Sea Turtles Page 4-279
It should be definitively stated if the list of mitigations will or will not be used.

NLRC Response:

Please replace the 2nd paragraph of Section 4.10.1 "Mammals and Sea Turtles", page 4-237 with the following text"

"There are no available recovery strategies or action plans in place for marine mammals in Atlantic Canada. A recovery strategy for leatherback sea turtles is available (ALTRT 2006) but no critical habitat has been defined. Mitigation and monitoring designed to minimize potential effects of construction activities on COSEWIC and/or SARA-listed marine mammals and sea turtles will include:"

Section 7.2.6 Types of Possible Spills **Subject** Oil Spills **Page** 7-55
Discussion of REET includes list of Environment Canada departments. Fisheries and Oceans is not part of Environment Canada.

NLRC Response:

Please replace the 2nd paragraph on page 7-55, Section 7.2.6 "Oil Spills" with the following text:

"NLRC recognizes that if it has a spill, NLRC as the RP and its oil spill response service provider will need to closely work with the Canadian Coast Guard and the Regional Environmental Emergency Team (REET) during a spill response in order to address numerous response issues. The REET is comprised of representatives from the Canadian Coast Guard, Environment Canada departments (weather services, environmental emergencies, wildlife) and the Government of Newfoundland and Labrador departments (such as Environment and Conservation). NLRC also recognizes its responsibilities to deal effectively with public concerns."

Section 10.1.2, Environmental Effects Monitoring and Follow-up **Subject** Marine and Freshwater Fish Habitat Compensation **Page** 10-6
The proposed fish habitat compensation strategy for the freshwater and marine habitat losses has not been accepted by DFO and therefore it is premature to include specific details on the strategy within the EIS.

NLRC Response:

NLRC is finalizing the draft Fish Habitat Compensation Strategy with guidance from DFO.

Volume 4
Section 1.1 Environmental Assessment **Page** 1-1
The CEA Agency is not a responsible authority, they are the Federal Environmental Assessment Coordinator (FEAC) for the project.

Comprehensive Study Report is generally CSR, not CSQ

NLRC Response:

Please replace the 1st paragraph of Section 1.1, page 1-1 with the following text:

"The proposed refinery project is being reviewed by provincial and federal environmental assessment processes. The Department of Environment and Conservation oversees the provincial process; Transport Canada and the Department of Fisheries and Oceans are the Responsible Authorities for the federal assessment and the Canadian Environmental Assessment Agency (CEAA) are the Federal Environmental Assessment Coordinator (FEAC)."

Please replace the 3rd paragraph of Section 1.1, page 1-1 with the following text:

"The EA documents (an Environmental Impact Statement (EIS) for the provincial government and a Comprehensive Study Report (CSR) for the federal government) identify the environmental impacts of the Project, identify mitigation measures, predict the significance of residual effects, and suggest appropriate monitoring and follow-on programs."

Editorial Comments
Volume 1
Section 4.1 Project Components and Activities **Page: 4-3**
(s) should be removed from includes

NLRC Response:

Please replace the 2nd paragraph of Section 4.1, page 4-3 with the following text:

"The new marine terminal will be located to the southeast corner near Doughboy Cove. The New refinery marine terminal will include, heavy lift construction dock, tug berth and causeway, jetty and offshore berthing facilities, and jetty control and emergency response building. A general layout of the refinery marine terminal is shown in Figure 4.4."

Section 6.3.2 Air Quality **Page 6-6**
The Whiffen Head Transshipment Terminal has not been operating since 1977.

NLRC Response:

Please replace the 1st paragraph of Section 6.3.2, page 6-6 with the following text:

Data from the Newfoundland and Labrador Department of Environment and Conservation show that existing air quality in the communities surrounding the proposed refinery site is well within its regulatory requirements for sulphur and nitrogen dioxides and particulates. This is with two oil-related industries already operating in the vicinity: the North Atlantic (Come By Chance) facility has been producing refined products for more than 30 years, directly across Placentia Bay from the project site; Newfoundland Transshipment Ltd. has operated the Whiffen Head Transshipment Terminal, just east of refinery, since 1997.

Section: 6.10.1 Fish and Fish Habitat Page: 6-19
2nd Para -…thereby more than….should be removed from sentence.

NLRC Response:

Please replace the 2nd paragraph of Section 6.10.1, page 6-19 with the following text:

"There will be a loss of approximately sixteen hectares of stream and pond environments that provide habitats for the various life stages of the fish species of concern. Therefore, NLRC in collaboration with the Department of Fisheries and Oceans is developing a plan to that will seek to enhance spawning habitat for salmonid species within the Watson's Brook system. NLRC considers this is the most effective method to replace and enhance the salmoid productivity that will be lost during project construction. Watson's Brook is currently limited in terms of suitable spawning gravels. The strategic placement of suitable spawning gravels is predicted to create a net increase in the amount of spawning habitat, compensating for the fish habitat loss. NLRC will continue to work with DFO, SAEN and other stakeholders to achieve this objective."

Section 8.2 Consultation Process **Page 8-2**
No net loss compensation programs should be fish habitat compensation programs

NLRC Response:

Please replace the 8th paragraph of Section 8.2, page 8-2 with the following text:

"NLRC is also supportive of the initiative of the Salmonid Association of Eastern Newfoundland to form a local river stewardship group. This group could be instrumental in providing local input to fish habitat compensation programs."

Volume 2
Section: 1.4.7 Best Environmental Protection Practices **Page**: 1-12
Reducing HADD of *fish* habitat

NLRC Response:

Please replace the 7th bullet of Section 1.4.7, page 1-12 with the following bullet:

- *"Reducing harmful alteration, disruption or destruction of fish habitat (HADD), and adoption of "no net loss" principle in the Project development;"*

Section 6.2.1 Vessel Traffic **Page**: 6-24
The first two paragraphs on this page are repetitive (same as paragraphs on page 6-23)

NLRC Response:

Please remove these 2 paragraphs.

Volume 3
Section 4.7.1. Project Effects during Construction **Subject**: Siltation, Erosion and Dust **Page** 4-136; Volume 3 – Section Marine Fish and Fish Habitat Effects Assessment Subject: Siltation, Erosion, and Dust Page 4-167
Title of Guidelines is Guidelines for the Protection of Freshwater Fish Habitat in Newfoundland and Labrador.

NLRC Response:

Please replace the 2nd paragraph of Section 4.7.1 "Siltation, Erosion and Dust", page 4-136 with the following text:

"The control of siltation, erosion and runoff from construction sites is addressed in many standard practices and guidelines such as the Guidelines for Protection for Freshwater Fish Habitat in Newfoundland and Labrador (Gosse et al. 1998), Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1993) and the Environmental Guidelines for General Construction Practices (Water Resources Management Division 1997). All discharges of runoff from construction activities will also conform to the Environmental Control Water and Sewage Regulations, 2003 under the Water Resources Act (O.C. 2003-231)."

Volume 3
Section Marine Fish and Fish Habitat Effects Assessment **Subject**: Effects Assessment: Residual Effects Page 4-173

First Sentence – typo

NLRC Response:

Please replace the first paragraph of Section 4.8.1 "Effects Assessment: Residual Effects", page 4-173 with the following text:

"Table 4.50 to Table 4.54 present the interactions between the Project and marine fish and fish habitat during construction activities as outlined above. As shown, all those other than habitat loss as a result of the infrastructure are reversible or are of minimal magnitude, extent and/or duration when mitigation methodologies are applied."

Section 10.1.2 Environmental Effects Monitoring and Follow-up **Subjec**t Marine and Freshwater Fish Habitat Compensation **Page** 10-7
Policy capacity should be changed to Productive capacity.

NLRC Response:

Please replace the 2nd paragraph of Section 10.1.2 "Marine and Freshwater Fish Habitat Compensation", page 10-7 with the following text:

"Appropriate fish habitat compensation plans will be developed and implemented in consultation with DFO and the communities, including the newly formed Salmon Stewardship group. NLRC's overall approach to marine and freshwater fish habitat compensation has been reviewed with DFO and is presented in this volume of the assessment. Compensation plans will address, as per the Policy for the Management of Fish Habitat, the "no net loss" productive capacity of fish habitats."

DFO RECCOMMENDATIONS:

DFO recommends to accept the EIS provided that concerns outlined above are addressed

List of Appendices

APPENDIX A

The Leach's Storm-Petrel:
General information and handling instructions

APPENDIX A

The Leach's Storm-Petrel:
General information and handling instructions

Urban Williams (Petro-Canada)
&
John Chardine (Canadian Wildlife Service)

The Grand Banks is an area that is frequented by large numbers of seabirds, representing a variety of species. Large populations are found in this area in both summer and winter, and come from the Arctic, northern Europe, and the south Atlantic, as well as from colonies along the Newfoundland Coast. One of the species found in the area of the Terra Nova Field is the Leach's Storm-Petrel (*Oceanodroma leucorhoa*).

The Bird:
Leach's Storm-Petrels are small seabirds, not much bigger than a Robin. They have relatively long wings and are excellent fliers. Leach's Storm-Petrels are dark brown in colour and show a conspicuous white patch at the base of the tail. In the hand, you can easily notice a small tube at the top of their bill, and you will also notice that the birds have a peculiar, not unpleasant smell (although some Newfoundlanders call these birds "Stink Birds"). Storm-Petrels are easy prey for gulls and other predators, and so to protect themselves from predation, Leach's Storm-Petrels are only active at night when on land at the breeding colonies.

Nesting Habitat:

Leach's Storm-Petrels are distributed widely in the northern hemisphere, however, their major centres of distribution are Alaska and Newfoundland. The bird breeds on offshore islands, often in colonies numbering tens or hundreds of thousands of pairs, even millions at one colony in Newfoundland. The nest is a chamber, sometimes lined with a some grass, located at the end of a narrow tunnel dug in the topsoil.. Depending on the colony, burrows may be under conifer or raspberry thickets or open grassland.

Reproduction:

In Newfoundland, Leach's Storm-Petrels lay their single egg in May and June. The egg is incubated by both parents alternately, sometimes for stretches exceeding 48 hours. The egg is incubated for 41-42 days, which is a long time for such a small egg. The peak hatching period is in the last half of July. The young petrel remains in the tunnel for about 63-70 days. Once breeding is over in late-August or early September, the birds

disperse from the colonies and migrate to their wintering grounds in the Atlantic. September is the most important period for migration of Storm-Petrels to the offshore areas such as near the Terra Nova field.

Populations:

Canada alone supports more than 5 million pairs of Leach's Storm-Petrels. Most of them are found in Newfoundland. The Leach's Storm-Petrel colony located on Baccalieu Island is the largest known colony of this species.

Nesting sites for Leach's Storm-Petrels are found along the southeast coast of Newfoundland. These are - i) Witless Bay Islands (78,000 nesting pairs), ii) Iron Island (10,000 nesting pairs), iii) Corbin Island (100,000 nesting pairs), iv) Middle Lawn Island (26,000 nesting pairs), v) Baccalieu Island (3,336,000 nesting pairs), vi) Green Island (72,000 nesting pairs), and vii) St. Pierre Grand Columbier (100,000 nesting pairs).

Feeding Habits:

Leach's Storm-Petrels feed at the sea surface, seizing prey in flight. Prey usually consists of myctophid fish and amphipods. The chick is fed planktonic crustaceans, drops of stomach oil from the adult bird, and small fish taken far out at sea. Storm-Petrels feed far out from the colony and it would be reasonable to assume that birds nesting in eastern Newfoundland can be found feeding around the Terra Nova site.

The Problem:

As identified in the C-NOPB Decision 97-02, seabirds such as Leach's Storm-Petrels are attracted to lights on offshore platforms and vessels. Experience has shown that Storm-Petrels may be confused by lights from ships and oil rigs, particularly on foggy nights, and will crash into lighted areas such as decks and portholes. Fortunately, this type of accident does not often result in mortality, however, once on deck the bird will sometimes seek a dark corner in which to hide, and can become fouled with oil or other contaminants on deck.

Period of Concern:

Leach's Storm-Petrels are in the Terra Nova area from about May until October and birds could be attracted to lights at any time throughout this period. The period of greatest risk of attraction to lights on vessels appears to be at the end of the breeding season when adults and newly fledged chicks are dispersing from the colonies and migrating to their offshore wintering grounds. September is the most important period for migration of storm-petrels to the offshore areas. Past experience suggests that any foggy night in September could be problematic and may result in hundreds or even thousands of birds colliding with the vessel.

The Mitigation:

On nights when storm-petrels are colliding with the vessel, the following steps should be taken to ensure that as many birds as possible are safely returned to their natural habitat.

- All decks of the vessel should be patrolled as often as is needed to ensure that birds are picked up and boxed (see below) as soon as possible after they have collided with the vessel. After collision, birds will often “freeze” below lights on deck or seek dark areas underneath machinery and the like.

- Birds should be collected by hand and gently placed in small cardboard boxes. Care should be taken not to overcrowd the birds and a maximum of 10-15 birds should be placed in each box, depending upon its size. The birds are very easy to pick up as they are poor walkers and will not fly up off the deck so long as the area is well-lit. They will make a squealing sound as they are picked up- this is of no concern and is a natural reaction to be handled (the birds probably think they have been captured to be eaten!).

- When the birds are placed in the box the cover should be put in place and the birds left to recover in a dark, cool, quiet place for about 5-10 minutes. The birds initially will be quite active in the box but will soon settle down.

- Following the recovery period, the box containing the birds should be brought to the bow of the boat or to some other area of the vessel that has minimal (if any) lighting. The cover should be opened and each bird individually removed by hand. The release is usually accomplished by letting the bird drop over the side of the vessel. There is no need to throw the bird up in the air at release time. If the birds are released at a well-lit part of the vessel they usually fly back towards the vessel and collide again.

- If any of the birds are wet when they are captured (i.e. they drop into water on the deck) then they should be placed in a cardboard box and let dry. Once the bird is dry it can be released as per the previous instruction. Also, temporarily injured birds should be left for longer to recover in the cardboard box before release.

- Any birds contaminated with oil should be kept in a separate box and not mixed with clean birds. Contact Canadian Wildlife Service at (709) 772-5585 for instructions on how to deal with contaminated birds.

- In the event that some birds are captured near dawn and are not fully recovered before daylight, they should be kept until the next night for release. Storm-Petrels should not be released in daylight as at this time they are very vulnerable to predation by gulls. Birds should be kept in the cardboard box in a cool, quiet place for the day, and do not need to be fed.

- Someone should be given the responsibility of maintaining a tally of birds that have been captured and released, and those that were found dead on deck. These notes should be kept with other information about the conditions on the night of the incident (moonlight, fog, weather), date, time, etc). THIS IS A VERY IMPORTANT PART OF THE EXERCISE AS IT IS THE ONLY WAY WE CAN LEARN MORE ABOUT THESE EVENTS.

Handling Instructions:

- Leach’s Storm-Petrels are small, gentle birds and should be handled with care at all times.

- It is recommended that the person handling the birds should wear thin rubber gloves or clean, cotton work gloves. The purpose of the gloves is to protect both the Storm-Petrel and the worker.
- As mentioned Storm-Petrel's have a strong odor that will stick to the handler's hands. Washing with soap and water will remove most of the smell.
- Handling Leach's Storm-Petrels does not pose a health hazard to the worker, however some birds may have parasites on their feathers, such as feather lice. These parasites do not present any risk to humans, however, as a precaution we recommend wearing cotton work gloves or thin rubber gloves while handling birds and washing of hands afterwards.

Wilson's Storm Petrels:

A relative of the Leach's Storm-Petrel is the Wilson's Storm-Petrel. They breed in the south Atlantic and Antarctica and migrate north in our spring to spend the summer in Newfoundland waters. This species is very numerous on the Grand Banks in the summer, and shares the same nocturnal habits as the Leach's Storm-Petrel. Thus it is possible that Wilson's Storm-Petrels may also be attracted to the lights of a vessel at night. The two species are very similar and should be handled in the same way as described above for our Leach's Storm-Petrel.

Permits:

A permit to handle storm-petrels issued by the Canadian Wildlife Service will be held on board the vessel to cover personnel involved in bird collision incidents.

Appendix B

Canning and Pitt Report - NL Refinery Fisheries Baseline Document: Placentia Bay Commercial Fisheries and Aquaculture Activities

NL Refinery Fisheries Baseline Document: Placentia Bay Commercial Fisheries and Aquaculture Activities

Prepared by Canning and Pitt Associates, Inc., April 2007

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1. Fisheries

This section describes the commercial wild (non-aquaculture) fisheries and aquaculture baseline for Placentia Bay, and for the area nearest the proposed refinery in particular. For the purpose of this baseline analysis, the study area is all of Placentia Bay encompassed by North Atlantic Fisheries Organization (NAFO) Unit Area (UA) 3PSc, as shown on the following maps.

Discussion of Placentia Bay's commercial fisheries includes a historical overview of those activities, recent changes in the area's fisheries management regime and a description of key species and harvesting patterns and locations. Current aquaculture operations and sites are also described, including a brief summary of development trends within this sector during the past decade. A final section provides a brief overview of the study area's fish processing sector.

As further discussed in the next section, in addition to relevant historical data, the commercial fisheries analysis relies on existing (2003-2006) federal Department of Fisheries and Oceans (DFO) data on study area fisheries resources and catches. The overview of past and current aquaculture activities is based on information obtained from the Newfoundland and Labrador Department of Fisheries and Aquaculture (DFA). The report also draws on background information from existing agency reports, other research studies and the consultant's files. The discussion on current aquaculture activities also relies heavily on consultations undertaken with all of the existing licence holders in Placentia Bay, as well as consultations with agency (DFA) managers and other industry participants presently exploring the potential for new aquaculture development opportunities in the area.

1.1. Data Sources

The statistical data and analysis in this report are based primarily on time-series data from the DFO, Newfoundland and Labrador Region and Maritimes Region[1] describing the quantity, month and location (fisheries management Unit Area) of fish harvesting. The datasets also include information on fishing gear, vessels and other information. They have been acquired from DFO in digital form, for the period from 1984 to 2006. The analysis for this document presents historical information about the Placentia Bay

[1] A small proportion of the harvest from within UA 3PSc is landed in Maritimes (Nova Scotia) Region (less than 15 tonnes in 2005); these datasets are included within the Newfoundland and Labrador Region data and are used in this analysis.

fisheries and then focuses on the current fisheries environment, i.e. the 2003-2006 period, which includes the most recently-available data.

About 15% of the harvest by quantity from UA 3PSc was specifically georeferenced in 2004, 2% in 2005 and 12% in 2006. Though this represents quite a small portion of the harvest overall, this section also provides maps of the georeferenced data that are available to indicate at least a subset of the harvesting locations[2] in Placentia Bay.

The main analysis of harvesting activities describes fish caught within the waters of fisheries management UA 3PSc (see Figure 1-1). This management and data area encompasses all of Placentia Bay, and captures species harvested from 3PSc wherever they were landed or processed. Thus catches by fishers who are not based in Placentia Bay are included while catches made by Placentia Bay-based vessels are excluded if they were harvested beyond the 3PSc area. For example, some of the larger (>35') vessels based in the area take a portion of their annual catch on fishing grounds farther offshore, such as St. Pierre Bank, whereas catches by fishers based in other areas of the province, e.g. in Fortune Bay, are included in the analysis if taken within 3PSc.

The calculation of the value of the fisheries is much more complex. In addition to variability that results from changes in the quantity of harvest from year to year (whether due to natural variability or changing quotas), prices also vary from year to year, and even within the fishing season, driven primarily by market conditions, which in turn are determined by supply and demand, currency exchange rates and other market factors. Quality issues also affect the prices paid for many species. Consequently, most of the analysis provided in this section involves quantity of harvests (tonnes of fish landed), which is directly comparable from year to year.

Other data sources include fisheries management plans and data tables (e.g. fishing enterprises) provided by DFO. Information on Aquaculture was provided by the DFA, including its AguaGIS.com database, and from individual aquacultural licence holders consulted for this analysis in November 2006 and again in April 2007.

[2] The location given is that recorded in the vessel's fishing log, and is reported in the database by degree and minute of latitude and longitude; thus the position is accurate within approximately 0.5 nautical mile of the reported co-ordinates. It should be noted that for some gear, such as mobile gear towed over an extensive area, or for extended gear, such as longlines which may be several miles long, the reference point does not represent the full distribution of the gear or activity on the water. However, over many data entries, the reported locations create a fairly accurate indication of where such fishing activities occur.

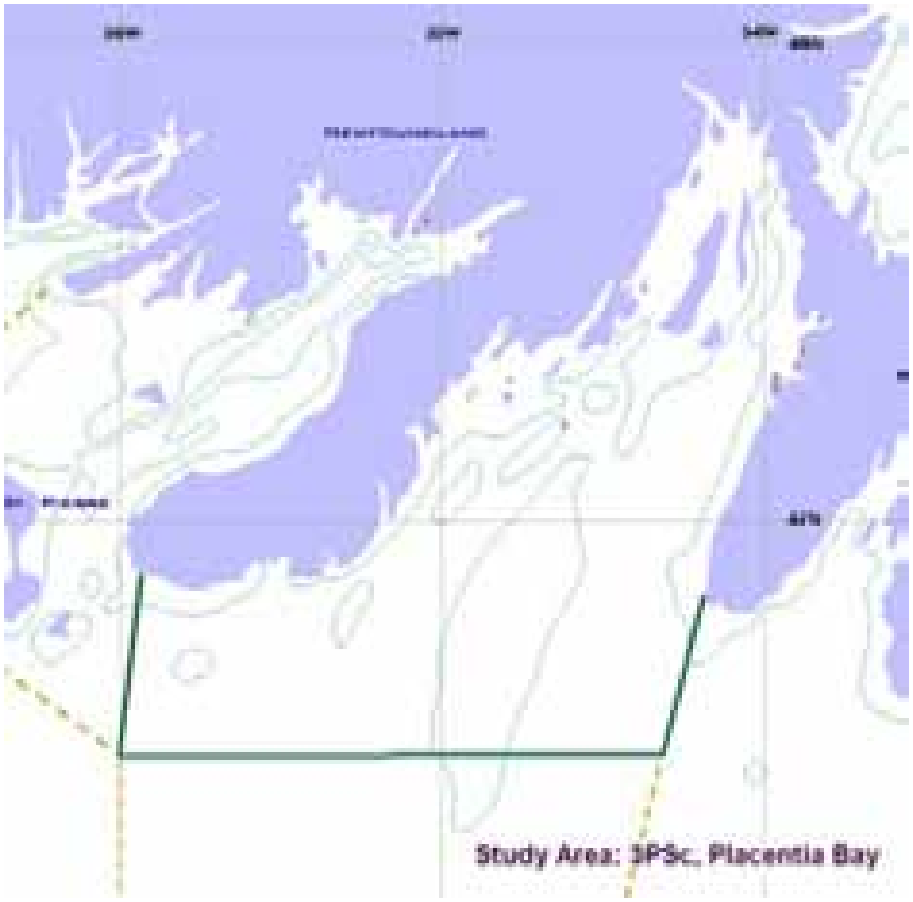

Figure 1-1: Study Area

1.2. Consultations

Though the terms of reference did not require the consultants to undertake any new consultations with commercial fisheries participants or aquaculture operators in the study area, relevant DFO and DFA managers and existing aquaculture licence holders were contacted to obtain current information on the area's fisheries and aquaculture sector activities.

Appendix 1provides a list of all persons consulted for this report.

1.3. Commercial Wild Fisheries

This section presents a detailed review of the commercial wild fisheries harvesting environment in the Placentia Bay study area. Topics addressed include the historical context, species harvested, monthly distributions of fishing activities, fishing gears used and geographic location of fishing activities where that information is available.

1.3.1. Historical Context, 1980s to the Present

Drastic changes occurred in the Placentia Bay commercial fisheries in the early 1990s when fisheries moratoria were imposed because of declining groundfish stocks. For example, within 3PSc for the period 1984-1990, 74% of the catch by quantity was cod while snow crab made up just 3%; during 1994-1995, immediately after the moratoria were imposed, cod made up only 6% of the harvest and snow crab catches increased to 24%. In terms of value, cod accounted for nearly 60% of the value of the 3PSc harvest (1984-1992), but only a negligible amount in 1994-1995 (see Figure 1-2).

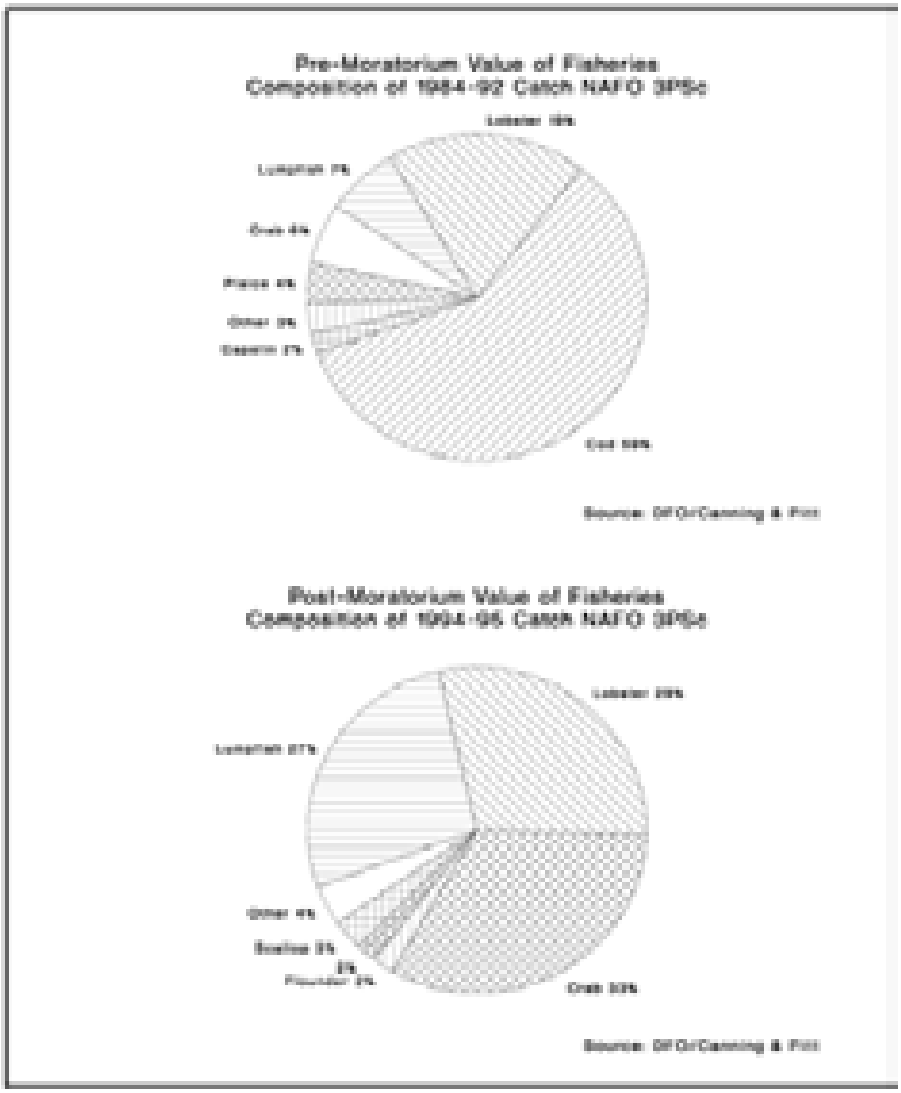

Figure 1-2: Pre-Moratorium Value of Fisheries Composition of 1984-92 Catch NAFO 3PSc

Between the landings highpoint in 1986 and the 1995 harvest, the quantity of biomass taken from Placentia Bay declined from more than 19,000 tonnes to under 3,000 tonnes, a drop of 85%. However, the landed value of the 3PSc fishery did not experience a similar decline owing to the changed composition of the catch, made up - in 1995 - primarily of high-priced species such as lobster, snow crab and lumpfish roe. In that year, the value of the fishery was only 8% lower than in 1986 ($9,740,000 compared to $10,634,000). Value continued to rise after 1995, until, by 2002 the harvest from 3PSc was worth more than $18 million, nearly 180% of the value of the harvest in 1986, the year that the peak quantity was harvested over this timeframe. Even with weaker prices in recent years, snow crab is still a very valuable species in this area.

A limited cod fishery was reinstated in 3PSc in 1997 under a strict management regime, and during 2000-2002 cod again accounted for nearly 60% of the harvest by quantity, though in recent years quotas have been reduced once more. The following graphs show the changes in the quantity of the harvest from 3PSc over the last 20 years (1987 – 2006). Figure 1-3 shows the overall quantity harvested (all species), and Figure 1-4 shows groundfish harvests (mainly cod) and Figure 1-5shows all other species (mainly shellfish and herring) over this period.

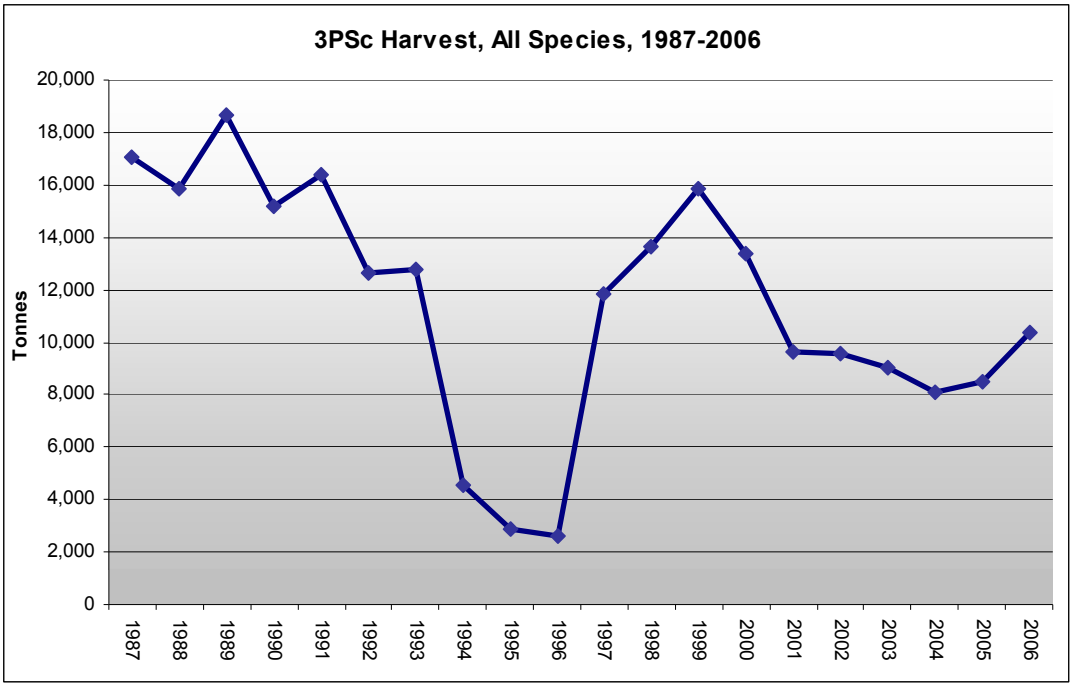

Figure 1-3: 3PSc Harvest, All Species, 1987-2006

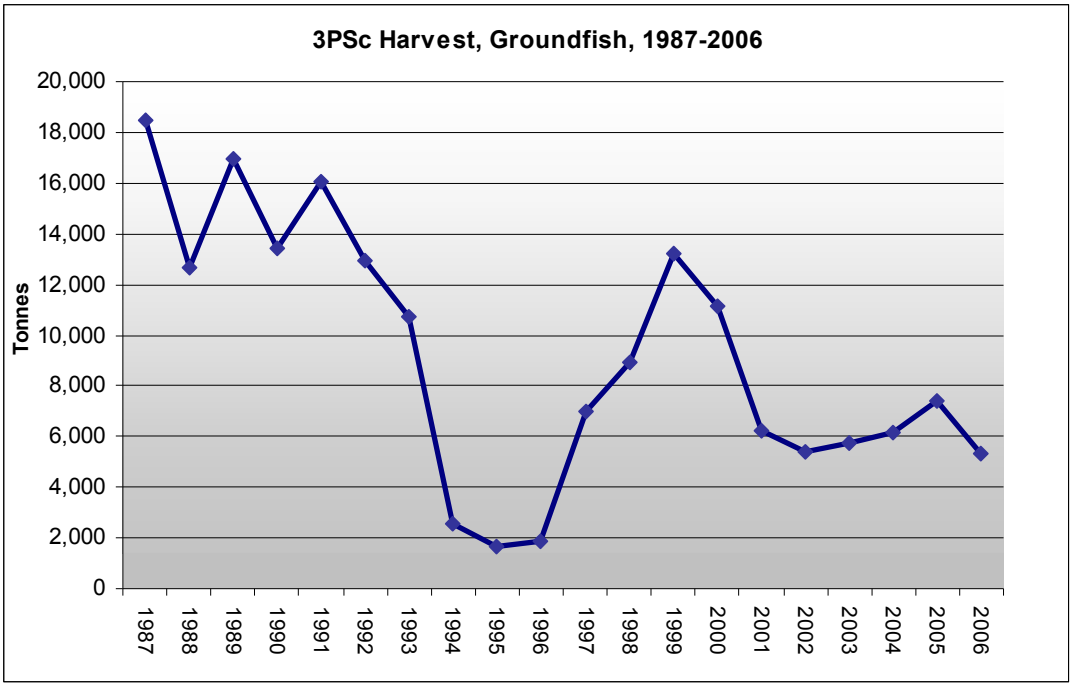

Figure 1-4: 3PSc Harvest, Groundfish, 1987-2006

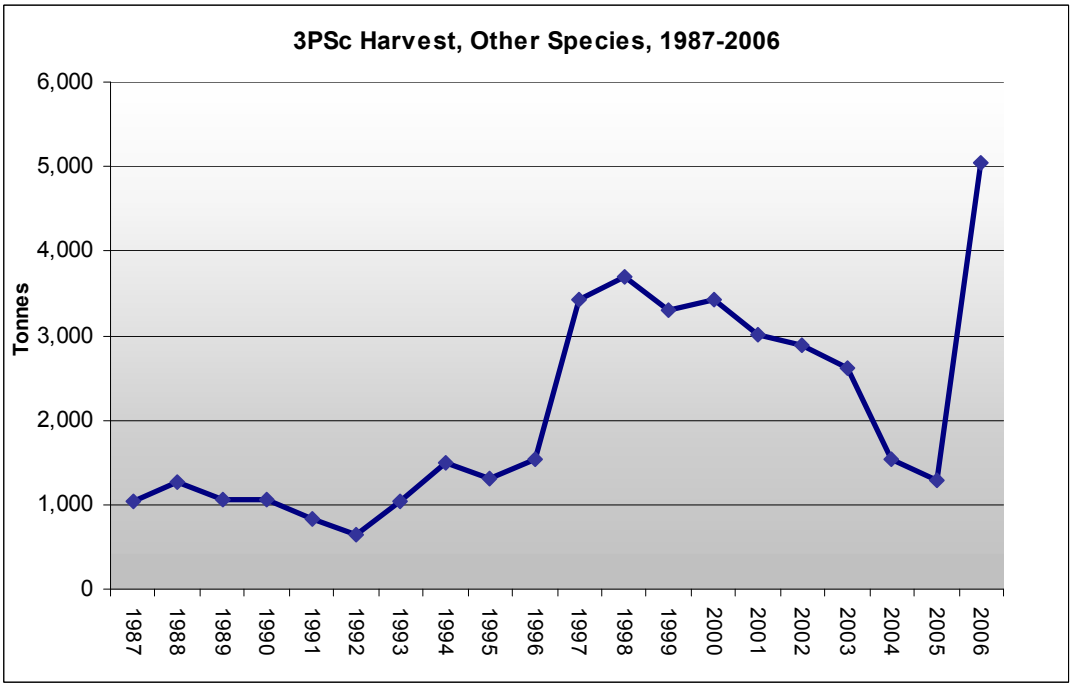

Figure 1-5: 3PSc Harvest, Other Species, 1987-2006

The notable increase in 2006 for non-groundfish species is owing to greatly increased whelk harvesting recorded in the DFO dataset for that year. However, DFO managers contacted about the whelk data report that relatively few fishers are harvesting whelk directly within Placentia Bay, and were not aware of any catch locations within the study

area. They suggest that most of this species catch is made in areas beyond 3PSc, e.g. in the St. Pierre Banks area (M. Eddy, pers comm., April 2007; R. Smith, pers comm., May 2007). However, some 60 records in the 3PSc data locate whelk harvesting in Placentia Bay, and the gear type associated with all the 3PSc whelk records (pot) is correct for this species.

Since the mid-1990s, the fisheries and fisheries management and licencing regimes in Placentia Bay have continued to evolve. Most significantly, a fish harvesting rationalization strategy was implemented in the province that reduced the number of participants in the harvesting sector, and a professionalization process was introduced which prescribed specific levels of experience and training required to be a professional fish harvester. Along with this system, DFO introduced the "core" harvesting enterprise designation, with restrictions on harvesting by those who are not part of such an enterprise.

The following sections provide more information on key aspects of present-day Placentia Bay fisheries.

1.3.2. Current Harvesting

The following Table 1-1 shows the composition of the harvest in 3PSc in recent years, based on 2003-2006 landings by year. As these data show, cod is still by far the most important species harvested in the area, with snow crab, herring and lumpfish (roe fishery), scallops and a few other groundfish species making up most of the remainder.

Table 1-1: 3PSc Harvest, 2003 - 2006 (Annual)

Species	Tonnes	% of Total
2003		
Atlantic cod	4,804.2	53.4%
Redfish	5.6	0.1%
American plaice	212.1	2.4%
Yellowtail flounder	13.2	0.1%
Winter flounder	91.3	1.0%
Turbot (Greenland flounder)	7.0	0.1%
Skate	48.3	0.5%
Pollock	7.7	0.1%
White hake	18.4	0.2%
Monkfish	9.3	0.1%
Herring	1,057.1	11.7%
Sea scallops	6.1	0.1%
Icelandic scallops	177.6	2.0%
Whelks	7.8	0.1%
Sea cucumbers	87.8	1.0%
Sea urchins	18.7	0.2%
Lobster	86.7	1.0%
Snow crab	2,222.5	24.7%

Species	Tonnes	% of Total
Lumpfish roe	121.7	1.4%
All other species	8.6	0.1%
Total	9,003.0	100.0%
2004		
Atlantic cod	4,594.9	57.0%
Haddock	6.0	0.1%
American plaice	143.0	1.8%
Winter flounder	68.0	0.8%
Skate	30.3	0.4%
Pollock	14.1	0.2%
White hake	71.2	0.9%
Herring	927.0	11.5%
Capelin	71.6	0.9%
Sea cucumbers	182.2	2.3%
Sea urchins	44.0	0.5%
Lobster	58.7	0.7%
Snow crab	1,243.0	15.4%
Lumpfish roe	602.2	7.5%
All other species	19.8	0.2%
Total	8,056.3	100.0%
2005		
Atlantic cod	5,016.6	59.1%
Haddock	40.8	0.5%
Redfish	6.7	0.1%
Halibut	10.0	0.1%
American plaice	239.0	2.8%
Winter flounder	99.1	1.2%
Skate	91.8	1.1%
Pollock	124.5	1.5%
White hake	507.1	6.0%
Monkfish	155.7	1.8%
Hagfish	180.7	2.1%
Herring	279.8	3.3%
Mackerel	33.1	0.4%
Sea scallops	47.6	0.6%
Icelandic scallops	121.7	1.4%
Whelks	77.4	0.9%
Sea cucumbers	307.6	3.6%
Sea urchins	31.9	0.4%
Lobster	70.3	0.8%
Snow crab	637.3	7.5%
Lumpfish roe	415.7	4.9%
All other species	14.1	0.2%
Total	8,494.5	100.0%
2006		
Atlantic cod	4,491.0	43.2%
Haddock	28.8	0.3%

Species	Tonnes	% of Total
Redfish	72.9	0.7%
Halibut	9.9	0.1%
American plaice	206.8	2.0%
Yellowtail flounder	6.0	0.1%
Winter flounder	92.4	0.9%
Skate	107.8	1.0%
Pollock	139.7	1.3%
White hake	126.4	1.2%
Monkfish	69.8	0.7%
Herring	870.9	8.4%
Mackerel	131.9	1.3%
Capelin	250.4	2.4%
Sea scallops	463.8	4.5%
Icelandic scallops	69.6	0.7%
Squid	9.7	0.1%
Whelks	1,993.9	19.2%
Sea cucumbers	140.1	1.3%
Sea urchins	19.6	0.2%
Lobster	69.3	0.7%
Snow crab	597.3	5.7%
Lumpfish roe	428.6	4.1%
All other species	4.5	0.0%
Total	10,396.6	100.0%

[1] Although the DFO data identify this harvest as "sea cucumbers" (*Cucumaria frondosa*), DFO managers consulted believe this is also an error in the dataset, either associated with the incorrect Unit Area designation (sea cucumbers are harvested off St. Pierre Bank in 3PS), or the incorrect species code was used when the data were entered. If the latter, these may be scallops (code 618, not code 619).

The annual DFO quotas for Atlantic cod have not yet been set for 2007, but are expected shortly (in May). In 2006, the IQs for various PB based fishers, by vessel size, was as follows:

< 25' 14,350 lbs / 6.51 tonnes (round weight)
25'- 34'11" 23,000 lbs / 10.43 tonnes (round weight)
35'- 65' 38,700 lbs / 17.55 tonnes (round weight)

The overall 2007 3PS snow crab quota is 4,065 tonnes, while the quota for Placentia Bay itself (3PSc, or CFA 10a) is 975 tonnes: 450 tonnes for Inner Placentia Bay, and 525 tonnes for Outer Placentia Bay. The Individual Quotas (IQs) are as follows:

For small boat (< 35') fishers
in Inner Placentia Bay 5,040 lbs / 2.29 tonnes
in Outer Placentia Bay 6,740 lbs / 3.06 tonnes

Placentia Bay-based crab fishers holding Supplementary licences are not permitted to fish this species within 3PSc. They harvest most of their crab allocation in 3PSf, i.e. within CFA 10a and 10bc, in which their 2007 IQ is 51,000 pounds; these Supplementary

licence holders also have a small allocation (4,102 pounds) within CFA 11s, as well as an exploratory IQ of 10,100 pounds in 3PSh (CFA 10d) south of 45 35 N (M. Eddy, DFO pers comm., April 2007; R. Smith, pers comm., May 2007). As such, Placentia Bay Supplementary crab licence holders have an overall 2007 IQ of about 65,000 pounds (29.5 tonnes).

In terms of economic value, the area's commercial fishers usually depend on three, high-value species - lobster, snow crab and cod - for the bulk of their annual fishing income.

While lobster accounts for only a small percentage by weight of the annual catch, given its high value this species remains very important to many study area fishers, and tends to be fished quite close to shore. Although the herring fishery is important (especially as bait), it does not have the direct economic value of the other three fisheries.

Section 1.3.3 below provides harvest information and recent values for the harvest specifically for ports near the proposed refinery site.

1.3.3. Seasonality

Currently, some harvesting is conducted year-round, as it was in the pre-moratorium (1984-1992) period, though in recent years it has been much less evenly distributed throughout the months as it once was (see Figure 1-6). Since 1996, the peak harvesting months have been June and July, but there has also been a fairly strong fishery in the late fall (for cod) as indicated in the graph.

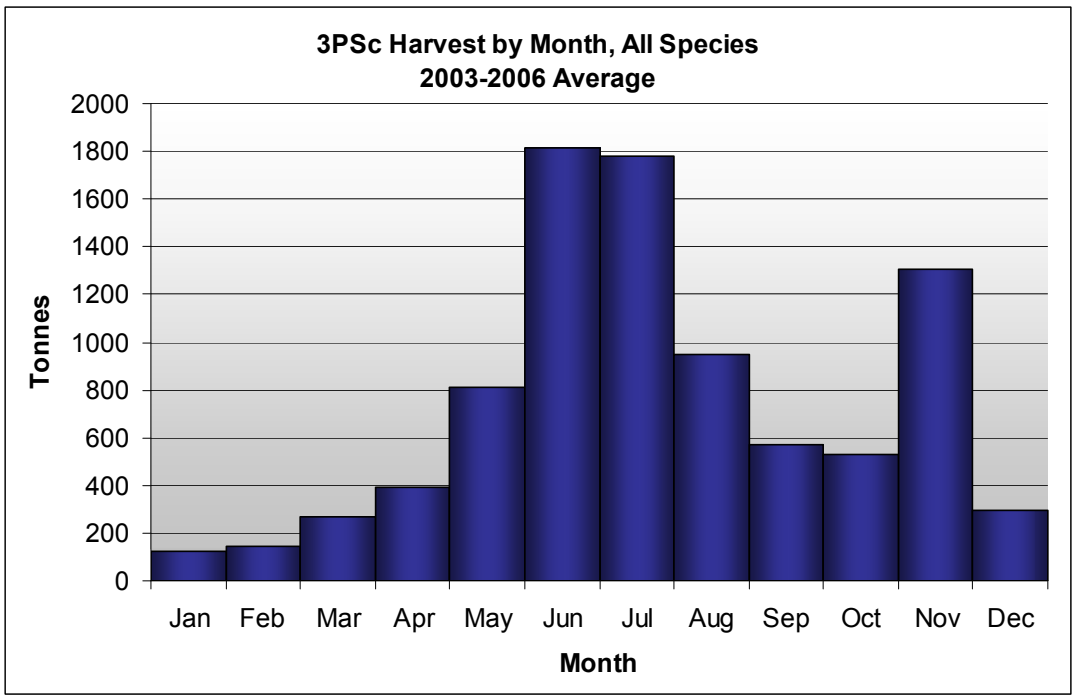

Figure 1-6: 3PSc Harvest by Month, All Species 2003-2006 Average

The following graphs show the timing of the 2003-2006 harvests for selected Placentia Bay species.

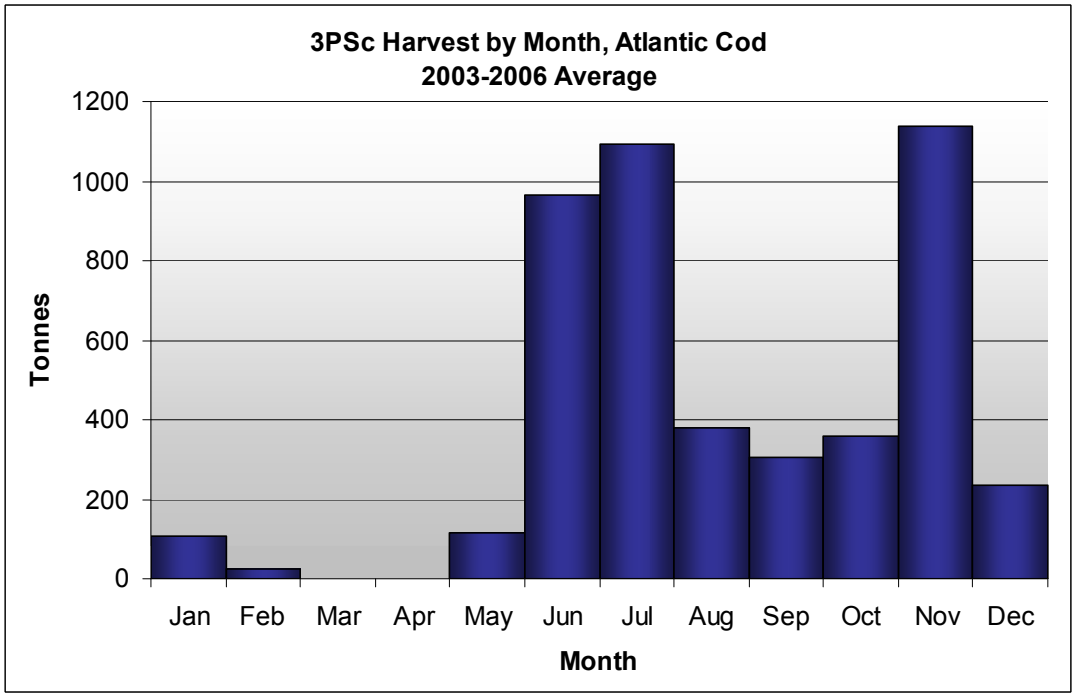

Figure 1-7: 3PSc Harvest by Month, Atlantic Cod 2003-2006 Average

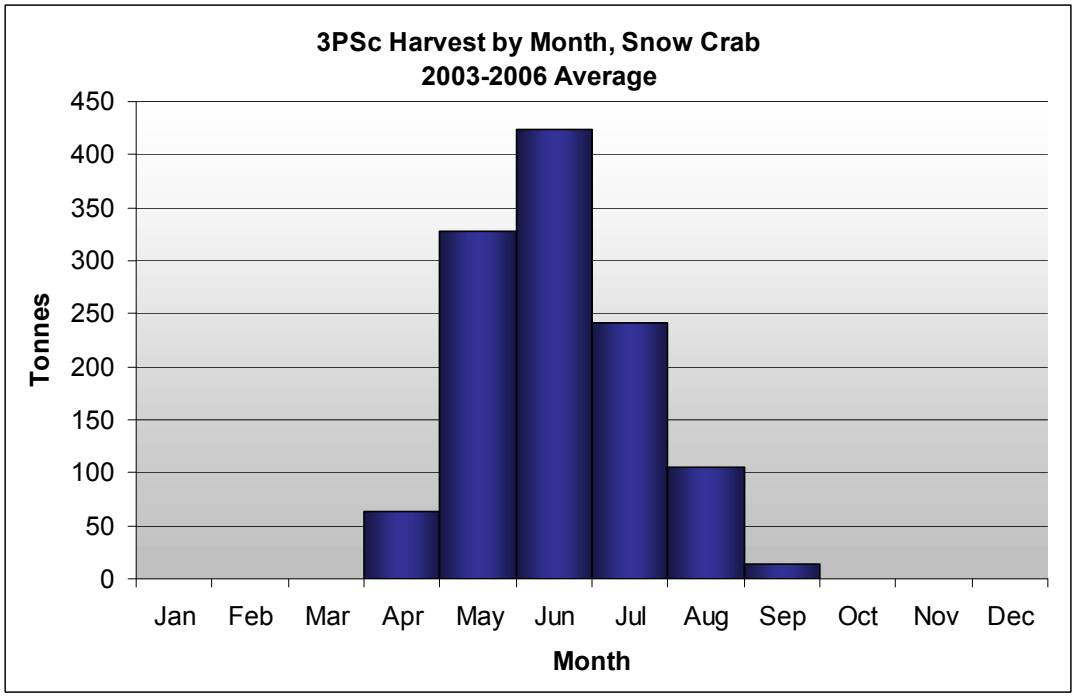

Figure 1-8: 3PSc Harvest by Month, Snow Crab 2003-2006 Average

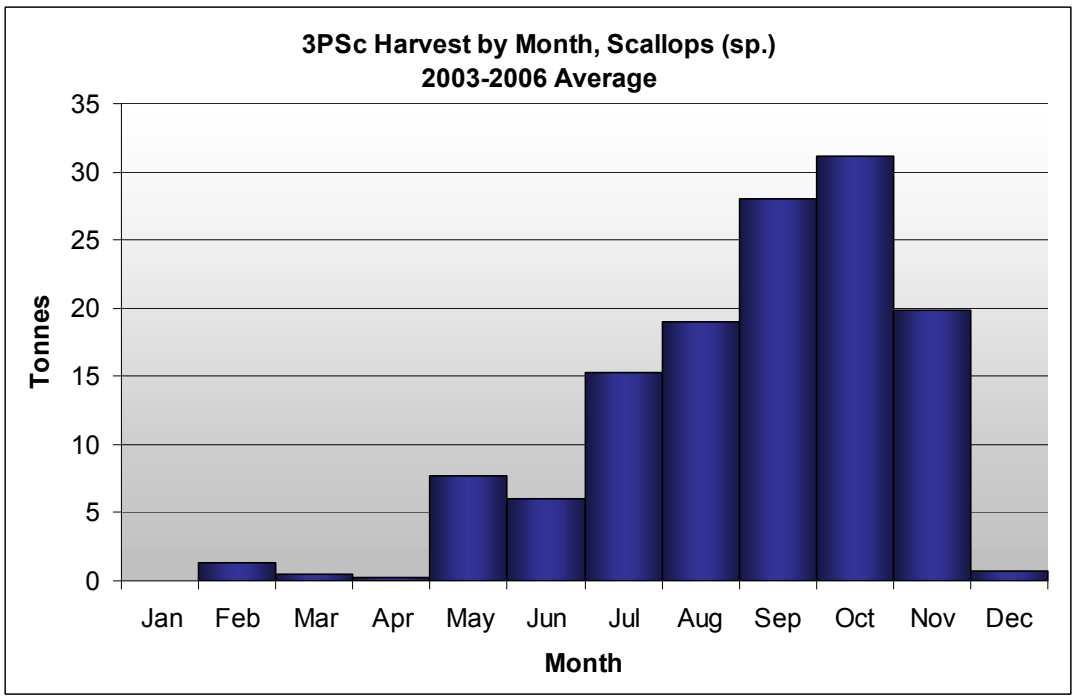

Figure 1-9: 3PSc Harvest by Month, Scallops (sp.) 2003-2006 Average

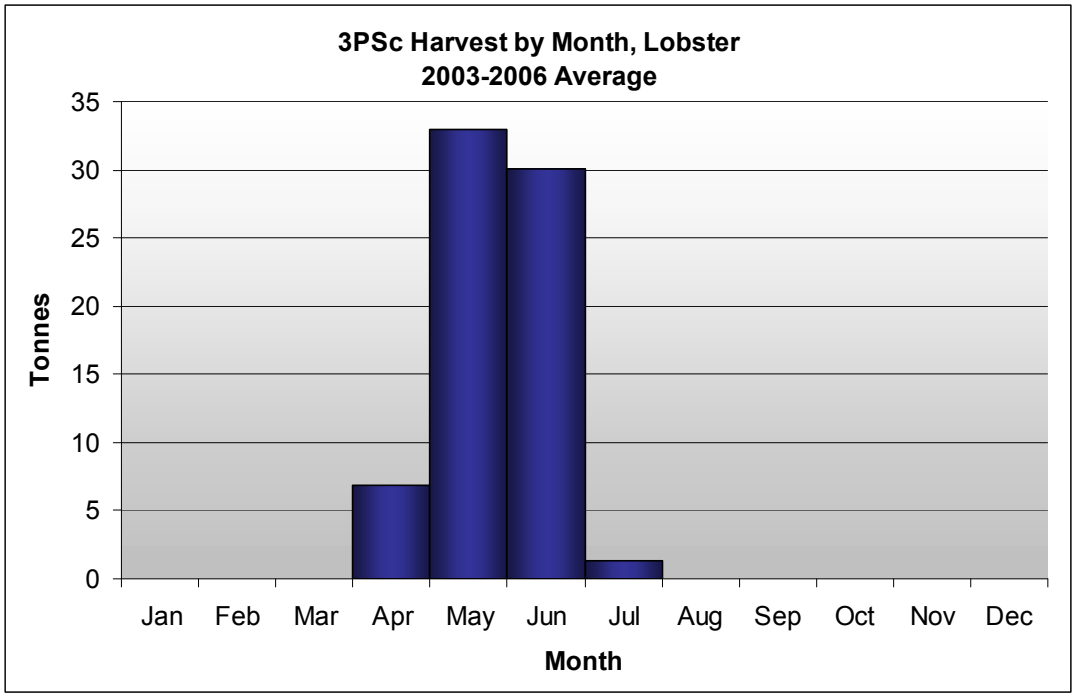

Figure 1-10: 3PSc Harvest by Month, Lobster 2003-2006 Average

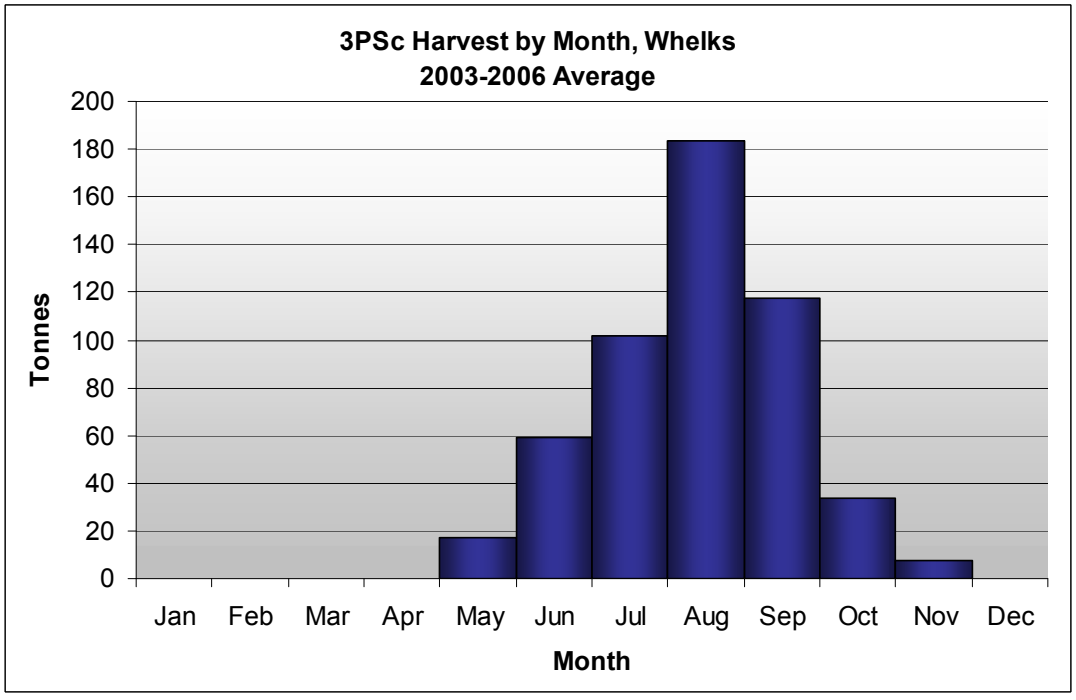

Figure 1-11: 3PSc Harvest by Month, Whelks 2003-2206- Average

1.3.4. Harvesting Locations

The following maps (Figure 1-12 to Figure 1-15)show the locations recorded in the DFO georeferenced dataset for all species, 2003 – 2006, aggregated, and then for selected species. As noted above, however, this represents only small sub-set of the 3PSc harvest. Some species (for example, lobster) are not represented at all in the georeferenced data. The Placentia Bay Traffic Separation lanes are also shown on these maps.

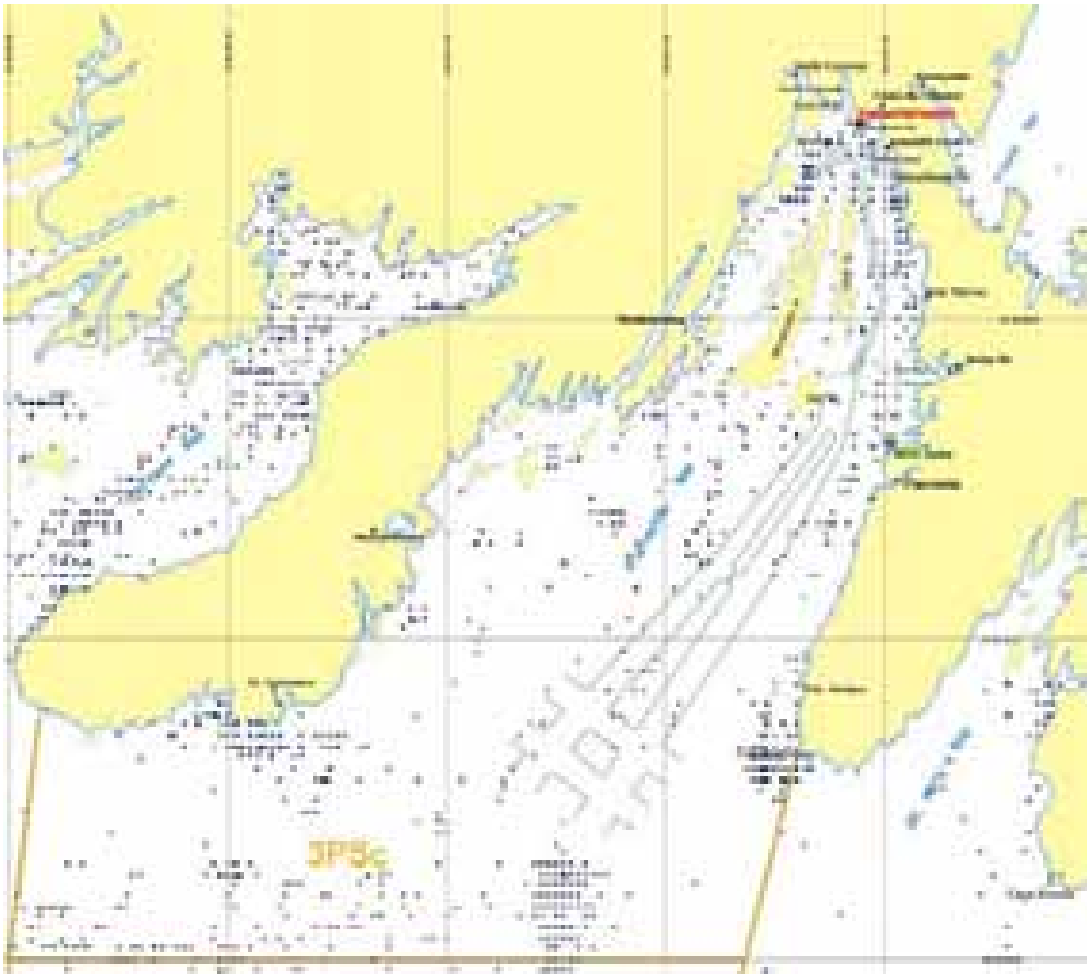

Figure 1-12: 2003-2006 Recorded Fishing Locations, All Months, All Species, Aggregated

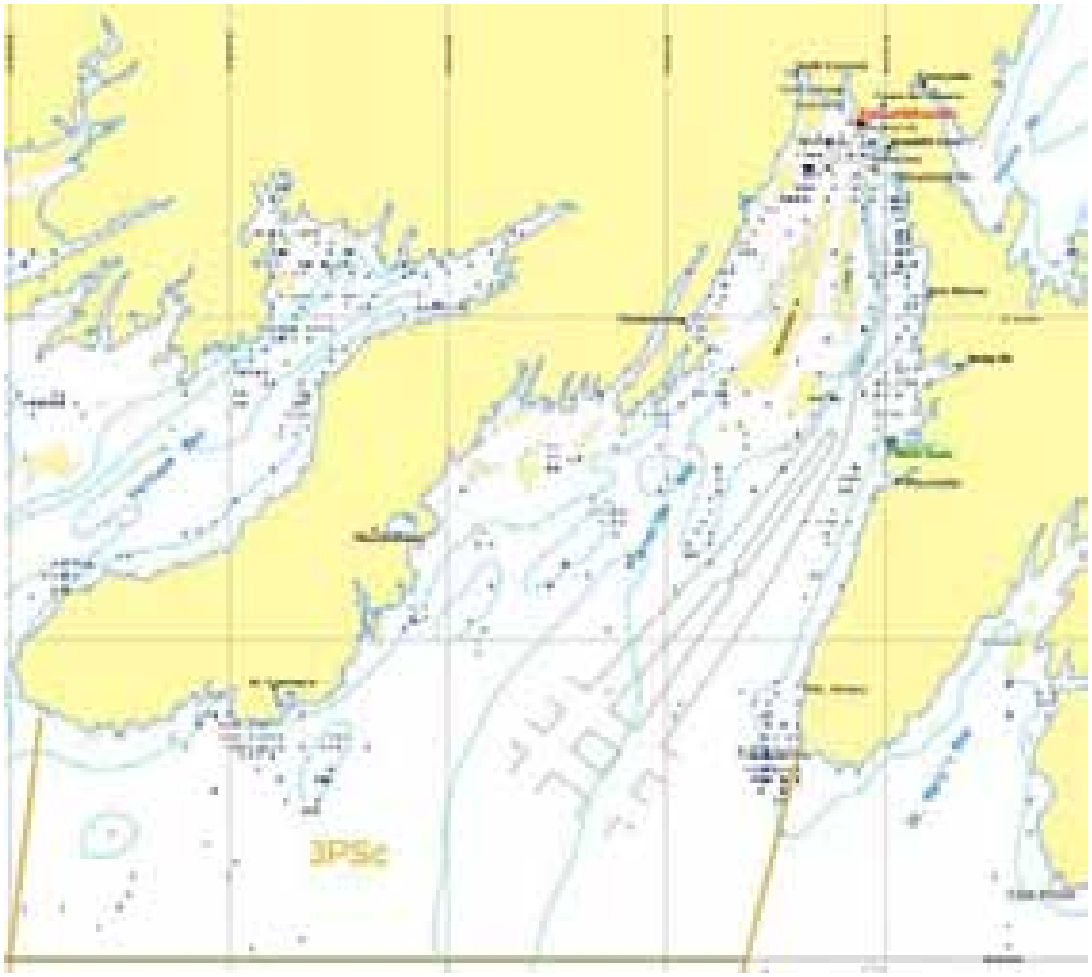

Figure 1-13: 2003-2006 Recorded Fishing Locations, All Months, Atlantic Cod, Aggregated

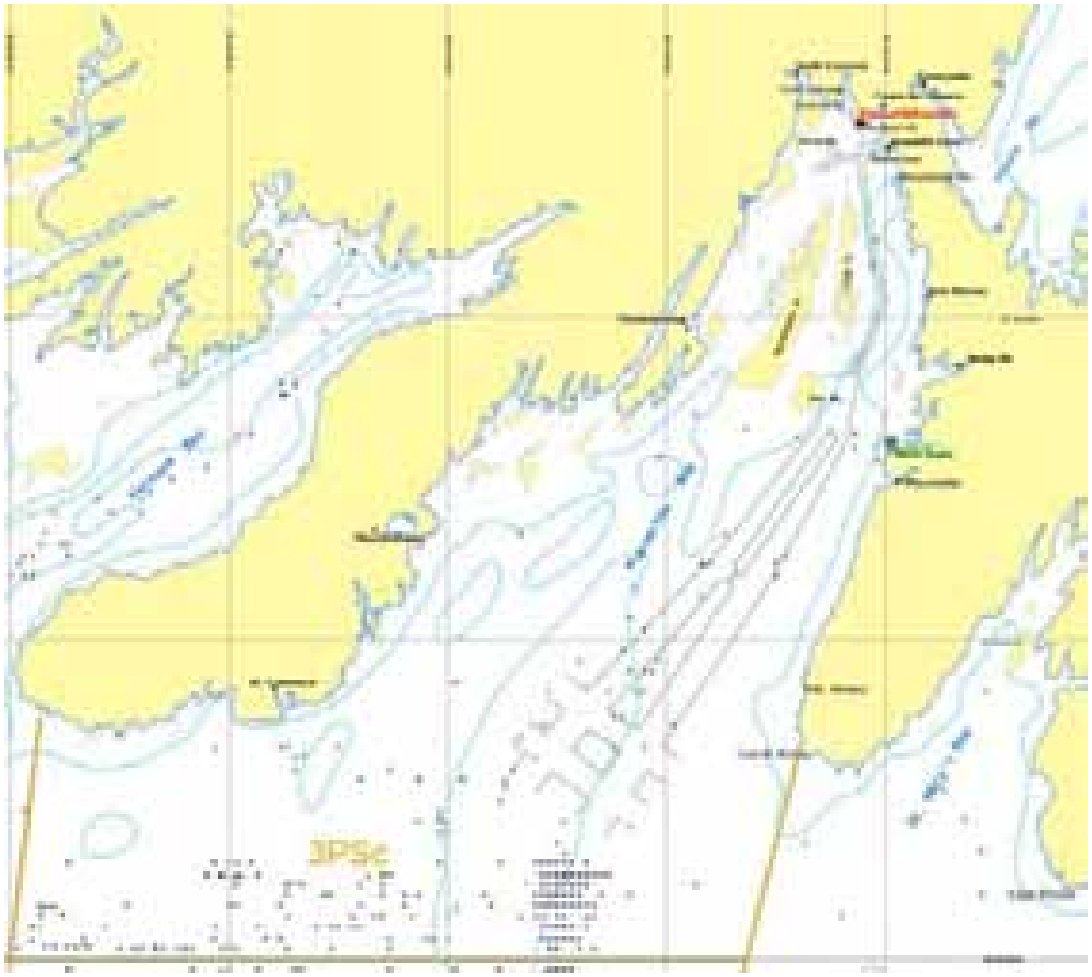

Figure 1-14: 2003-2006 Recorded Fishing Locations, All Months, Snow Crab, Aggregated

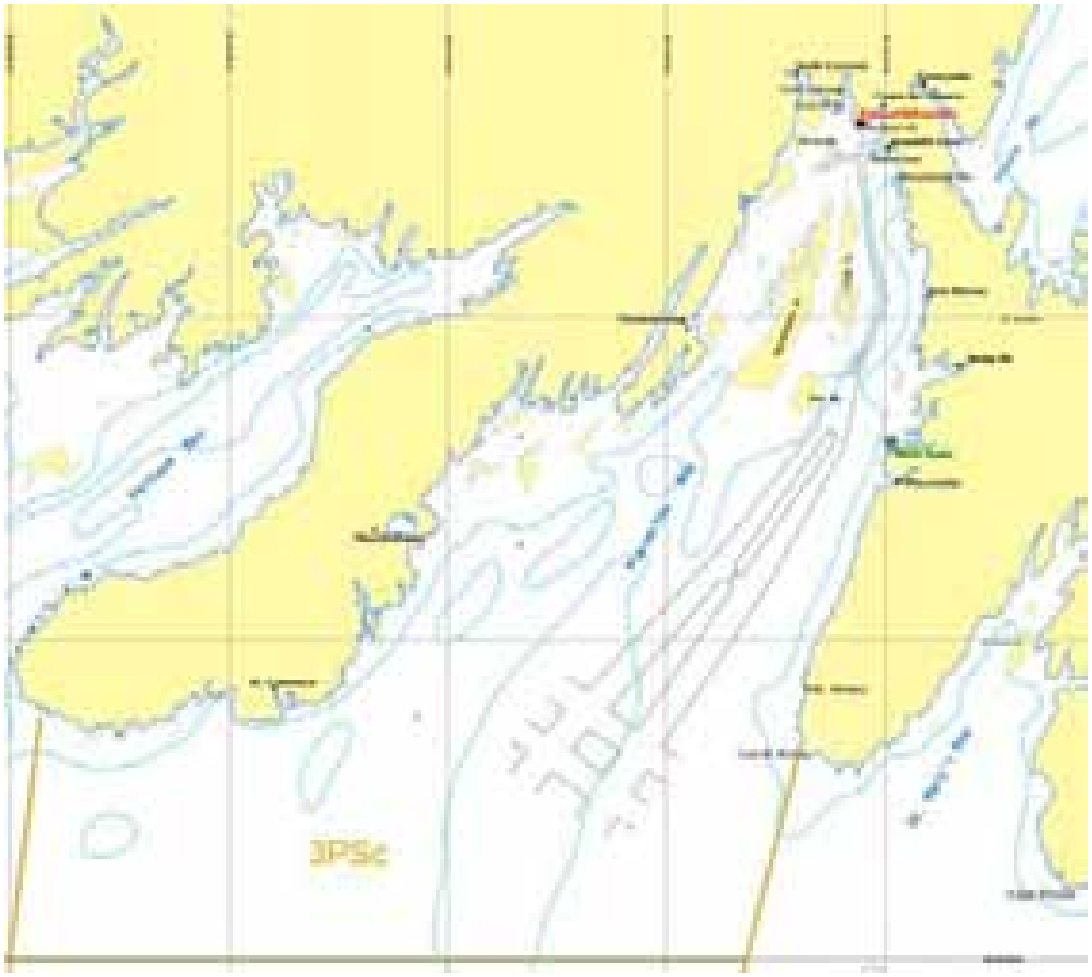

Figure 1-15: 2003-2006 Recorded Fishing Locations, All Months, Scallops (sp), Aggregated

Since so little of the catch data is specifically georeferenced and indicated on the preceding map, the following analysis was undertaken to provide a better indication of the locality of fishing effort. This looks particularly at fisheries activities in the general vicinity of the proposed refinery site. This analysis considers, for 2003 - 2006, the quantity of the harvest from the waters of 3PSc, (1) by the recorded Statistical Section (SS) of the fishing vessel's homeport, and (2) by the Statistical Section of the port where the catch was landed (port of landing).[3]

The DFO datasets indicate fishing vessel homeport SS for about 61% of the 2003-2006 catch (by quantity) harvested in UA 3PSc. Of this subset, more than 97% (by weight) is harvested by vessels registered in ports in Placentia Bay, i.e. ports within SS 29 – 32, indicated on the following map, Figure 1-16.

[3] DFO Newfoundland and Labrador Region does not disclose the specific homeport or port of landings for confidentiality reasons.

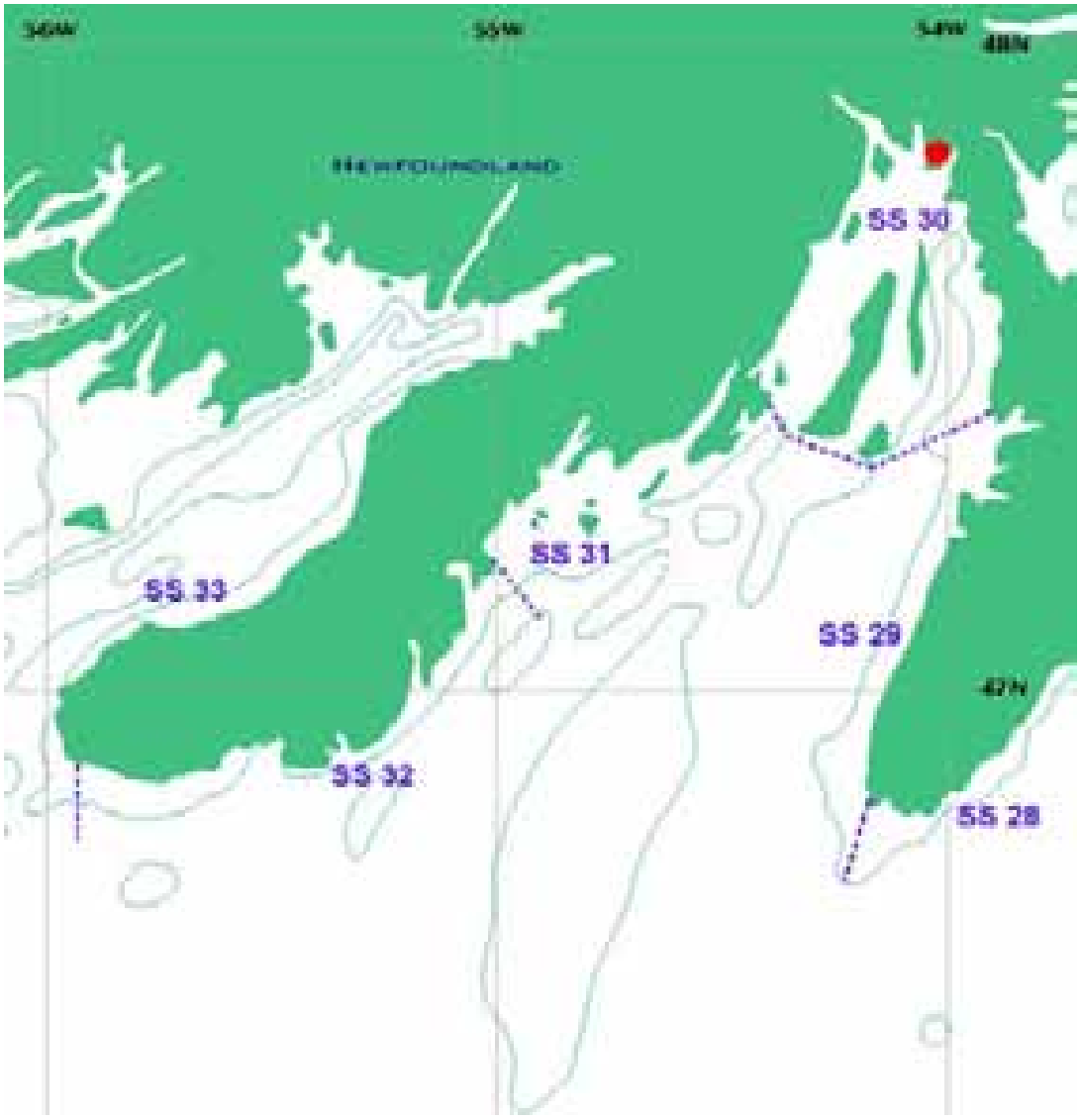

Figure 1-16: Placentia Bay and Area, Location of Statistical Sections

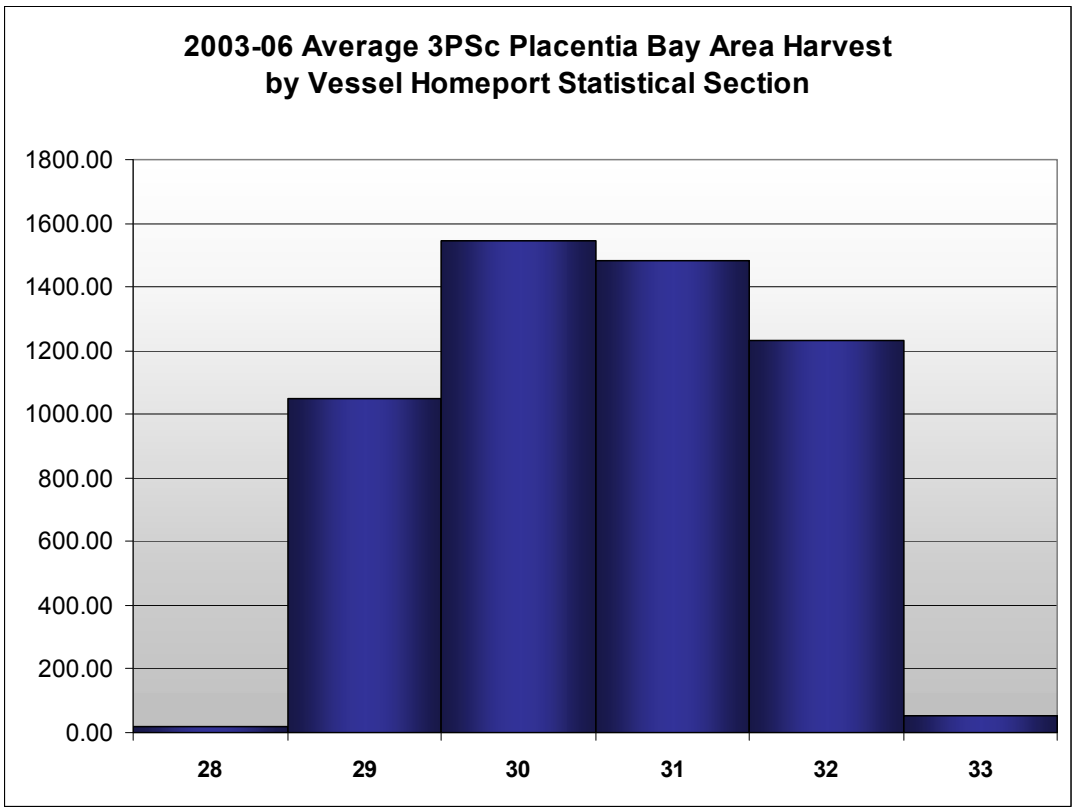

Figure 1-17: 2003-2006 Placentia Bay Harvest, All Species, by Statistical Section of Landing

The SS of the port of landing of the harvest (i.e. where it is brought to port and off-loaded) is indicated for 100% of the 3PSc catch. These locations range more broadly, indicating that the Placentia Bay harvest is landed in many ports around the island of Newfoundland and in Nova Scotia. For 2003-2006, though, 87% of the harvest was landed in Placentia Bay ports (though this does not mean it was processed there). Figure 1-17 compares the quantity of the harvest landed in 2003-2006 in the Placentia Bay Statistical Sections (SS 29-32) and those immediately adjacent to Placentia Bay (SS 28 and 33).

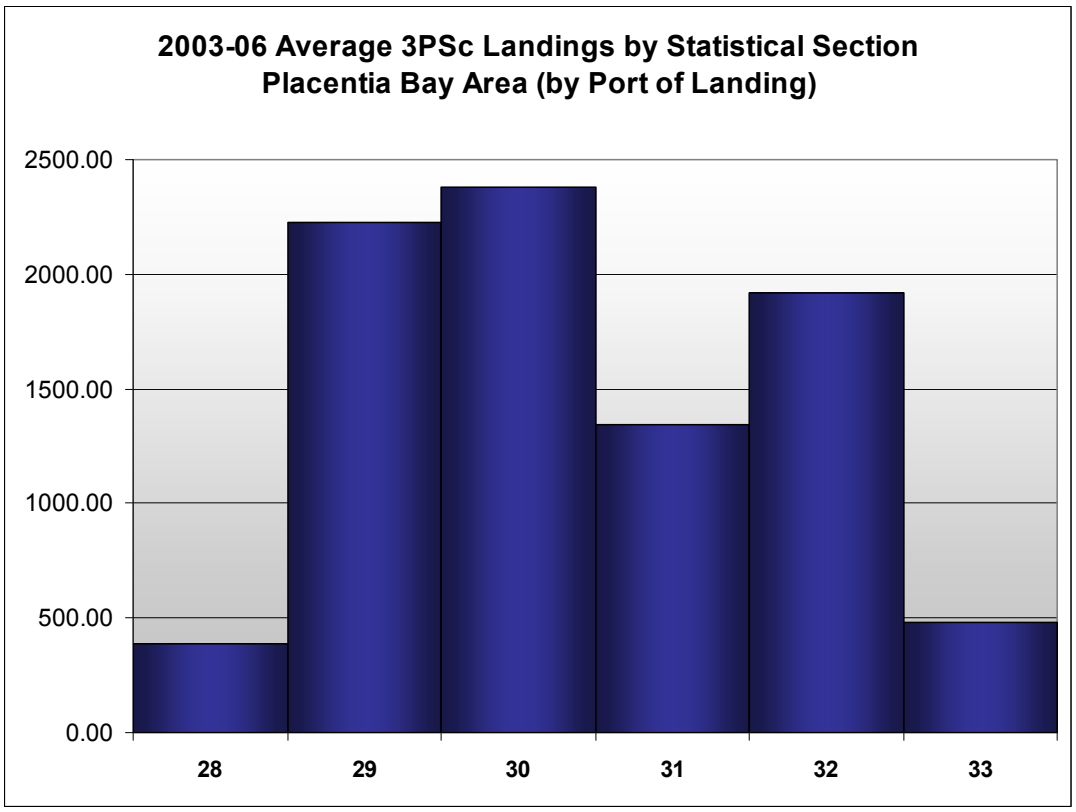

Figure 1-18: 2003-06 Placentia Bay Harvest, All Species, by Statistical Section of Landing

1.3.5. Refinery Area

As Figure 1-18 indicates, boats from SS 30, which contains the proposed refinery site, recorded the greatest proportion of the recent Placentia Bay harvest. Figure 1-18 shows that SS 30 ports also received close to the greatest proportion of the bay's landings that year.

The following tables (Table 1-2 and Table 1-3) show the quantity and value of the harvest by species in 2003-2006 (averaged) for vessels reported as based in SS 30 homeports, and the quantity and value of the 3PSc harvest landed in SS 30 ports. (Values are calculated based on the average annual quantities of landings for 2003-2006, applying recent prices. Specifically, these prices are the average landed amounts paid to harvesters in 2006, averaged over all months, for relevant species within the Newfoundland and Labrador Region[4]).

[4] See http://www.nfl.dfo-mpo.gc.ca/publications/reports_rapports/Land_All_2006.htm

Table 1-2: 3PSc Recorded Harvest by Vessels from SS 30 Ports (2003-2006 Averages)

Species	Tonnes	Value
Atlantic cod	1,108.1	$1,280,342
American Plaice	30.4	$21,214
Winter flounder	7.5	$3,108
Skate	5.2	$1,508
Herring	26.4	$5,388
Capelin	22.7	$6,378
Sea scallops	4.5	$7,561
Whelks	22.5	$22,149
Lobster	43.4	$478,592
Snow crab	248.5	$529,609
Lumpfish roe	21.1	$41,951
Other	6.8	$8,554
Total	1,540.4	$2,397,800

Table 1-3: 3PSc Harvest Landed in SS 30 Ports (2003-2006 Averages)

Species	Tonnes	Value
Atlantic Cod	1,608.4	$1,858,421
American Plaice	49.3	$34,406
Winter Flounder	17.6	$7,238
Skate	7.2	$2,078
Herring	349.2	$71,237
Capelin	56.2	$15,822
Sea Scallops	10.1	$17,076
Sea urchins	19.5	$25,947
Lobster	46.2	$509,117
Snow crab	184.1	$392,454
Lumpfish roe	16.9	$33,470
Other	13.0	$16,351
Total	2,364.8	$2,983,616

As Table 1-5 reports, in the ports between Southern Harbour and Garden Cove (in the general vicinity of the proposed refinery location), there are 92 Core fishing enterprises (based on 2003 records). Of these, nearly 80% use vessels less than 35 feet in length. In general, these smaller fishing boats tend to fish closer to shore than the larger boats and closer to their home ports and/or ports of landing.

This suggests that – despite the gaps in the mapped georeferenced data - the inshore areas in the general vicinity of the proposed refinery site (i.e. inner Placentia Bay) are likely very busy with small boat harvesting activities, such as lobster, cod and herring fishing, and these fishers are responsible for harvesting a significant part of the 3PSc resource.

In particular, the lobster fishery (which is 0% georeferenced) is known to occur relatively close to the fishers' home wharves, along rocky shorelines and nearshore islands, using small boats. This fishery – while making up less than 1% of the overall 3PSc harvest by quantity in 2003-2005 – accounted for almost 7% of the value of the bay's harvest. Within SS 30 ports, lobster represented more than 19% of the value of their catch.

More detailed mapping of these fishing locations will be conducted based on consultations during the next study (impact assessment) phase.

1.3.6. Fishing Gear

In many cases the fishing gear used is specific to the species harvested: pots for snow crab, scallop drags for scallops, diving for sea urchins. Cod is harvested using several gear types, but primarily it is harvested with gillnets in this area. Table 1-4 shows the quantity of the harvest by each gear type for the 2003-2006 period.

Table 1-4: 3PS Harvest by Gear Type, 2003-2006 Average

Gear	Tonnes	% of Total
Stern otter trawl	79.8	0.9%
Beach and bar seine*	32.6	0.4%
Tuck seine	22.3	0.2%
Purse seine	666.4	7.4%
Gillnets (set)*	5,265.6	58.5%
Longlines*	331.1	3.7%
Handlines*	246.5	2.7%
Trap*	110.5	1.2%
Pot*	1,764.5	19.6%
Dredge / drag	401.7	4.5%
Diving	28.5	0.3%
Hagfish barrel*	45.2	0.5%
Other	4.7	0.1%
Total (Average)	8,994.6	100.0%

* Fixed gear

The locations of the subset of georeferenced fixed and mobile gear fisheries are shown on the following maps (Figure 1-19 and Figure 1-20). In general, industrial activities and vessel traffic have a greater potential to conflict with fixed gear fisheries than with mobile gear.

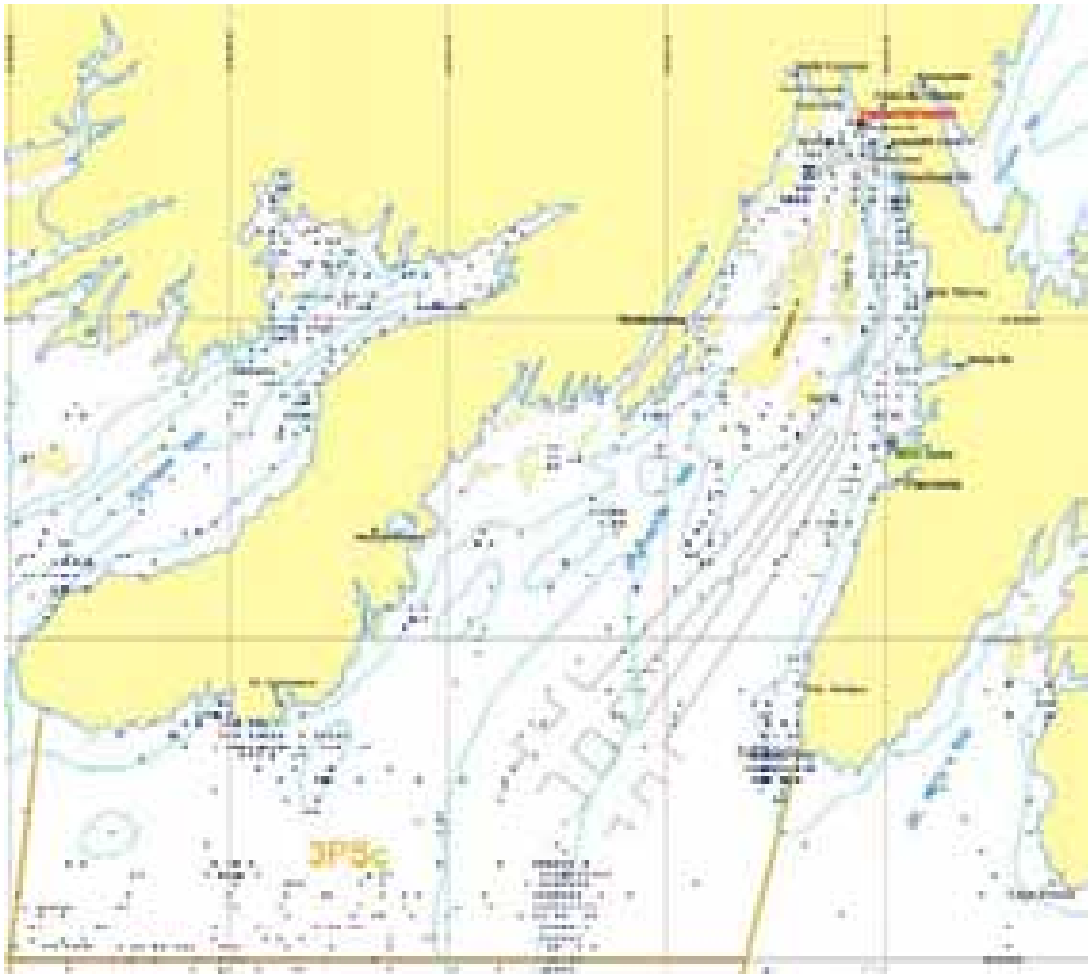

Figure 1-19: 2003-2006 Recorded Fishing Locations, All Months, Fixed Gear, Aggregated

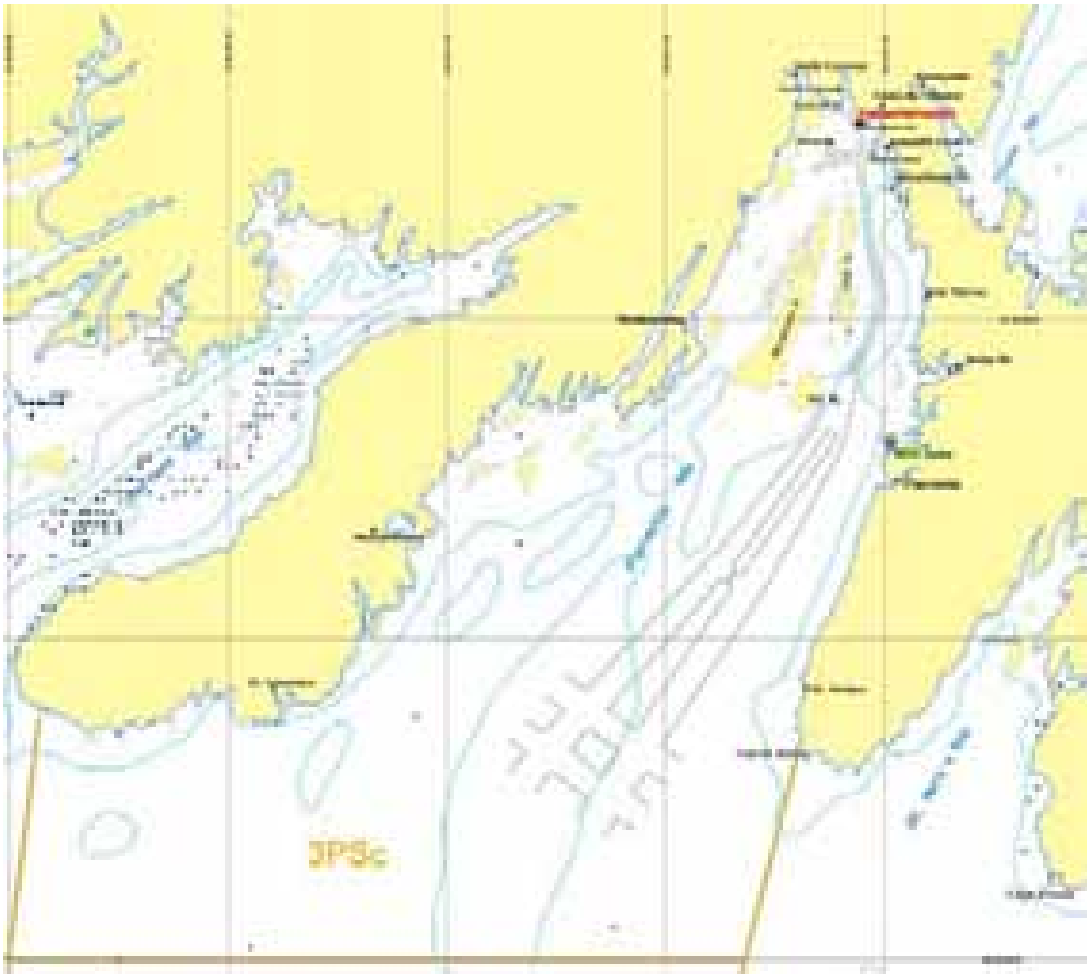

Figure 1-20: 2003-2006 Recorded Fishing Locations, All Months, Mobile Gear, Aggregated

1.3.7. Fishing Enterprises, Fishers and Fishing Licences

Data on the number or core and non-core fishing enterprises in the study area, as well as information on the distribution of species licences, were provided by DFO's Licensing Branch in St. John's. The latest data readily available for the purpose of this background report was for the year 2003. It is likely that these data adequately reflect the current (2005-2006) situation in the study area.

Table 1-5 to Table 1-7 show the number of core and non-core enterprises by community and vessel length for Placentia Bay (Fishing Area 10) in 2003.[5] Table 1-8 lists the numbers of licences.

[5] A "core" fishing enterprise is a commercial fishing enterprise holding key species licences, under a system established by DFO in 1996. New core enterprises are not normally created, though existing enterprises may be transferred to a new eligible harvester. DFO requires that the transfer go to a Level II

Table 1-5: Number of Core Enterprises and Vessel Size, Placentia Bay (2003 Data)

Home Port	<35 ft	35-64 ft	Total
St. Bride's	30	10	40
Patrick's Cove	1		1
Placentia (including Southeast)	10	11	21
Dunville	5		5
Jerseyside	2	1	3
Freshwater	1		1
Fox Harbour	5	3	8
Ship Harbour	6	1	7
Long Harbour	2	1	3
Mt. Arlington Heights	2		2
Fair Haven	13	1	14
Little Harbour East	12	5	17
Southern Harbour	28	16	44
Arnold's Cove	21	3	24
Come By Chance	4		4
North Harbour	13	1	14
Garden Cove	6		6
Swift Current	2	1	3
Prowseton & Sand Hr. (Vacated)	4	1	5
Davis Cove (Vacated)	6	1	7
Old Cove-Woody Island (Vacated)	1		1
Bar Haven (Vacated)	2		2
Haystack (Vacated)	1		1
Red Island (Vacated)	4		4
Brewley (Vacated)	1		1
Merasheen (Vacated)	5		5

professional fish harvester as certified by the Professional Fish Harvesters Certification Board (PFHCB) of Newfoundland and Labrador. A non-core enterprise is one holding other (perhaps single) species licences.

Home Port	<35 ft	35-64 ft	Total
Tack's Beach (Vacated)	2		2
Isle Au Valen (Vacated)	3		3
Little Paradise (Vacated)	2	2	4
Great Paradise (Vacated)	2		2
South East Bight	23	2	25
Monkstown	5	1	6
Petite Forte	17	3	20
Port Ann (Vacated)	1		1
Boat Hr (including Brookside)	8		8
Parkers Cove	11		11
Baine Harbour	8	3	11
Rushoon	2	1	3
Oderin (Vacated)	2		2
Red Harbour	16	1	17
Jean De Baie	1		1
Rock Harbour	1		1
Little Bay		1	1
Beau Bois	1		1
Fox Cove (near Burin)	1		1
Port Au Bras	1	1	2
Burin	17	7	24
Little St. Lawrence	1		1
St. Lawrence	9	7	16
Lawn	10	11	21
Lord's Cove	13	1	14
Point Au Gal	10		10
Lamaline	17	1	18
Point May	8		8
Total	**379**	**98**	**477**

Table 1-6: Number of Non-core Enterprises and Vessel Size, Placentia Bay (2003 Data)

Home Port	<35 ft	35-64 ft	Total
Placentia (including Southeast)	3		3
Jerseyside	1		1
Freshwater	2		2
Fox Harbour	2		2
Ship Harbour	1		1
Long Harbour	1		1
Mt. Arlington Heights	1		1
Fair Haven	3		3
Little Harbour East	4		4
Southern Harbour	6		6
North Harbour	2		2
Garden Cove	2		2
Swift Current	1		1
Red Island (Vacated)	1		1
Merasheen (Vacated)	1		1
South East Bight	1		1
Monkstown	1		1
Boat Hr (including Brookside)	2		2
Parkers Cove	1		1
Burin	2		2
Little St. Lawrence	2		2
St. Lawrence	4		4
Lawn	4		4
Lord's Cove	2		2
Lamaline	1		1
Total	**51**		**51**

*Key Licence Holders Only

Table 1-7: Number of Core and *Non-core Enterprises and Vessel Size, Placentia Bay (2003)

Home Port	<35 ft	35-64 ft	Total
St. Bride's	30	10	40
Patrick's Cove	1		1
Placentia (including Southeast)	13	11	24
Dunville	5		5
Jerseyside	3	1	4
Freshwater	3		3
Fox Harbour	7	3	10
Ship Harbour	7	1	8
Long Harbour	3	1	4
Mt. Arlington Heights	3		3
Fair Haven	16	1	17
Little Harbour East	16	5	21
Southern Harbour	34	16	50
Arnold's Cove	21	3	24
Come By Chance	4		4
North Harbour	15	1	16
Garden Cove	8		8
Swift Current	3	1	4
Prowseton & Sand Hr. (Vacated)	4	1	5
Davis Cove (Vacated)	6	1	7
Old Cove-Woody Island (Vacated	1		1
Bar Haven (Vacated)	2		2
Haystack (Vacated)	1		1
Red Island (Vacated)	5		5
Brewley (Vacated)	1		1
Merasheen (Vacated)	6		6
Tack's Beach (Vacated)	2		2
Isle Au Valen (Vacated)	3		3
Little Paradise (Vacated)	2	2	4
Great Paradise (Vacated)	2		2
South East Bight	24	2	26

Home Port	<35 ft	35-64 ft	Total
Monkstown	6	1	7
Petite Forte	17	3	20
Port Ann (Vacated)	1		1
Boat Hr (including Brookside)	10		10
Parkers Cove	12		12
Baine Harbour	8	3	11
Rushoon	2	1	3
Oderin (Vacated)	2		2
Red Harbour	16	1	17
Jean De Baie	1		1
Rock Harbour	1		1
Little Bay		1	1
Beau Bois	1		1
Fox Cove (near Burin)	1		1
Port Au Bras	1	1	2
Burin	19	7	26
Little St. Lawrence	3		3
St. Lawrence	13	7	20
Lawn	14	11	25
Lord's Cove	15	1	16
Point Au Gal	10		10
Lamaline	18	1	19
Point May	8		8
Total	**430**	**98**	**528**

*Key Licence Holders Only

Table 1-8: Core, Non-core and Recreational Licences (832 Fishers), Placentia Bay (2003)

Species	Total Licences
Bait	371
Capelin Fg	100
Capelin Ps	1
Eel	6
Groundfish Fg	518
Herring Fg	124
Herring Ps	10
Lobster	345
Mackerel Fg	105
Mackerel Ps	8
Salmon Atlantic	5
Scallop	225
Scallop Recreational	265
Seal	53
Seal Personal Use	42
Snow Crab Inshore	401
Snow Crab Supplementary	68
Squid	245
Tuna Bluefin	4
Whelk	86
Total	2,982

1.4. Placentia Bay Aquaculture

1.4.1. Development of Placentia Bay Aquaculture Activities (1997- 2007)

To date, the majority of the aquaculture development and investment activities in southern Newfoundland have been concentrated in the Bay d'Espoir and Fortune Bay areas. In 2000, the province's aquaculture Strategic Plan noted "The Newfoundland salmonid industry is located in Bay d'Espoir, the only area of the province that is suitable

for the growing of steelhead trout and salmon."[6] However, DFA aquaculture managers now believe that Placentia Bay has many of the desirable characteristics of Bay d'Espoir. As such, they are confident that Placentia Bay has significant growth opportunities, including possibilities for the development of salmonid farming, as well as further expansion of existing cod and mussel operations.

The development of aquaculture resources in Placentia Bay has been underway since about the mid-1990s. In 1997 there were about seven active aquaculture operations and several applications to investigate and/or develop additional sites. (Two sea urchin sites were later approved but by 2003 these were no longer active. A cod hatchery was also established in Placentia Bay in the early 1990s, but this was subsequently destroyed by fire.)

During 2000-2003, DFA reported a relatively significant level of expansion in the Placentia Bay aquaculture sector and a considerable interest in the development of new mussel and cod farming sites, particularly on the Burin Peninsula side of the bay and around Merasheen Island. During this period, DFA deployed thermographs in numerous locations to monitor water temperatures in order to assess whether such areas might be suitable for aquaculture.

By 2003 there were 15 approved aquaculture operations, including six blue mussel sites and nine cod grow-out facilities.[7] At that point, most of these aquaculture sites were still at a "developmental" stage, i.e. they had product in the water, but no significant amount of commercial sales. In 2004, DFA reported that only four operators were selling their product on a commercial basis.[8] Nevertheless, based on discussions with DFA experts and 2004 production and sales data obtained from selected aquaculture enterprises, the annual value of aquaculture production (after primary processing) in Placentia Bay was estimated at $500,000.[9]

In 2006, a detailed analysis of aquaculture operations in Placentia Bay was undertaken as part of a larger comprehensive study of oil spill risk assessment within the South Coast – Eastern Avalon region prepared for Transport Canada.[10] This study, based on data obtained from detailed consultations with industry participants as well as DFA experts, calculated current (2006/2007) mussel production levels in Placentia Bay at 3.5 million

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[6] Burke Consulting. 2000. Strategic Plan: Newfoundland and Labrador Aquaculture. Prepared in collaboration with Resource Development Associates.

[7] As of 2004, there were still no full-cycle ("egg to plate") cod aquaculture operations in the province, and all cod enterprises are thus "grow-out" facilities. However, current production of farmed cod is limited because of restrictions on taking wild cod for any purpose (DFA managers, pers comms., 2004)

[8] These included a cod farming facility on Jerseyman Island, two blue mussel farms at Crawley Island/St. Croix Bay and another mussel operation on Merasheen Island.

[9] Canning and Pitt Associates. 2005. Placentia Bay Project Benefits Study: Marine Institute Canadian Centre for Marine Communications.

[10] Canning and Pitt Associates, Inc. Risk Assessment of Oil Spills on the South Coast of Newfoundland and Labrador: Commercial Fisheries and Tourism (Phases 1 and 2), Final Report, March 2007. Prepared for RMRI (Canada) Inc. The RMRI study undertaken for Transport Canada is titled "Quantitative Assessment of Oil Spill Risk for the South Coast of Newfoundland and Labrador" and is expected to be released in May 2007.

pounds with a primary product value (before processing) of $1.4 million. These data were based on current production levels at the five commercially-active mussel farming sites within the Placentia Bay study area.

Currently, the annual value of aquaculture production within Placentia Bay is still relatively small compared to other areas where fish farming has been under development for a much longer period. For example, the study prepared for Transport Canada estimated that, in 2007, salmonid production in the Bay d'Espoir-Fortune Bay region will be about 6,500 tonnes with a primary product value of $34.5 million. By 2008, production levels in that region are expected to more than double, to 14,700 tonnes, which, at current product market values ($5,315 per tonne) would be worth an estimated $78 million. (Annual Blue mussel production levels in the Bay d'Espoir-Fortune Bay are currently estimated at 300,000 pounds valued at $120,000.)[11]

1.4.2. Placentia Bay Aquaculture Sites and Activities (2007)

According to the most recent (April 2007) DFA data there are currently 13 licenced aquaculture operations within Placentia Bay.[12] Applications for another 8 sites are awaiting DFA approval.[13] Currently licenced sites include five mussel farming operations and eight Atlantic cod grow-out sites.

Figure 1-21 shows the geographic location of existing aquacultural sites in Placentia Bay, and Table 1-9 provides relevant, more detailed information on these mussel and cod farming operations.

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[11] DFA experts and industry participants acknowledge that, for various reasons, mussel farming in the Bay d'Espoir-Fortune bay region has not been as successful as it has been in Placentia Bay, or in other provincial aquaculture zones, e.g. along the Northeast Coast.

[12] DFA managers report that, if an aquaculture site is licenced, it is deemed to be "active", even though it may not be at the commercial production stage, i.e. currently selling its product. It was also noted that, although their licences have been renewed annually, most of the Atlantic cod operations have had little or no activity over the past several years due to moratoria. Further, most of the area's cod sites are classed as "developmental" licences (for reasons related to the original intent of the cod grow-out sector and associated land tenure issues). Managers also note that even "developmental" mussel licences are considered active since these operations have gear deployed in the water, and hence "aquaculture" is being conducted (T. Budgell, pers comm., August 2006).

[13] DFA notes that there is no guarantee that all of these applications will receive final approval (T. Budgell, pers comm., August 2006 and April 2007).

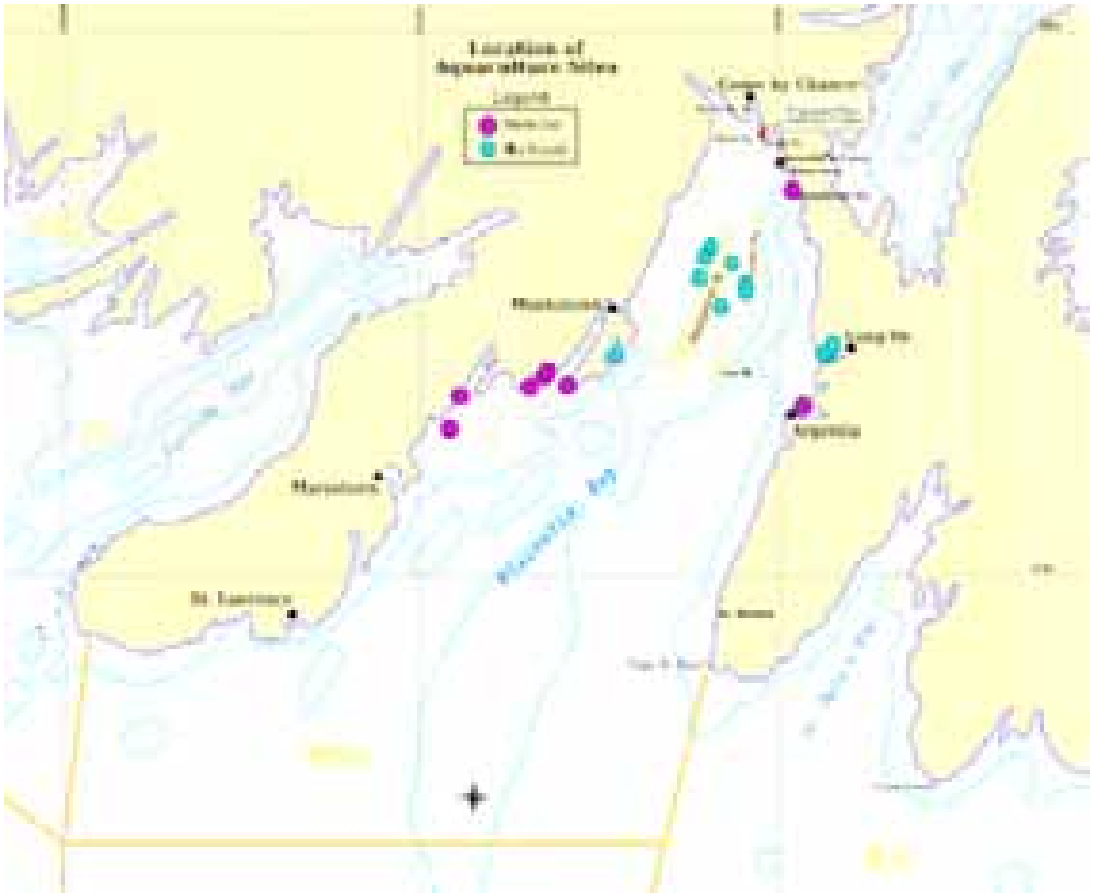

Figure 1-21: Existing Aquaculture Sites in Placentia Bay (2007)
Source. DFA site location data in Table 1.1 (from T. Budgell, August 2006)

Table 1-9: Placentia Bay Aquaculture Site Licences and Applications, 2007

Company Name	Location	Latitude (Deg / Min)		Longitude (Deg / Min)		Species
Licences						
Jones, Ambrose	Petite Forte	47	23.4	54	39.99	Atlantic Cod
Keating, Joseph (Baie Sea Farms)	Crawley Island, Long Harbour	47	25.5	53	51.33	Blue Mussels
Keating, Joseph (Baie Sea Farms)	Crawley Island, Long Harbour	47	25.5	53	52.43	Blue Mussels
Keating, Joseph (Baie Sea Farms)	St. Croix Bay	47	26.8	53	51.57	Blue Mussels
Leonard, Peter W.	Southern Harbour	47	42.8	53	57.6	Atlantic Cod
Moulton, Clayton	Flat Island Harbour	47	16.12	54	55.15	Atlantic Cod
Norman, Bernard	Jerseyman Island, Placentia Bay	47	20.09	54	53.24	Atlantic Cod
Pevie, Joseph and	Woody Island (North	47	22.38	54	42.34	Atlantic Cod

Company Name	Location	Latitude (Deg / Min)		Longitude (Deg / Min)		Species
Pearson, Christopher	Side)					
Pomeroy, Donald A. & Barry, John Jr.	Petite Forte Hr.	47	24.06	54	39.49	Atlantic Cod
Pomeroy, Donald A. & Barry, John Jr.	Gaultoin's Cove	47	20.9	54	35.4	Atlantic Cod
Sapphire Sea Farms Ltd.	Dunville, P. Bay	47	15.9	53	55.11	Atlantic Cod
Warren, Christopher J.	Big South West Cove, Merasheen I.	47	34.43	54	10.35	Blue Mussels
Warren, Christopher J.	Merasheen Island	47	36.22	54	9.85	Blue Mussels
Applications						
Merasheen Mussel Farms	Jean de Gaunt	47	32.9	54	14.17	Blue Mussels
Merasheen Mussel Farms	Dog Harbour	47	34.7	54	8.6	Blue Mussels
Merasheen Mussel Farms	Rose au Rue	47	30.1	54	10.86	Blue Mussels
Merasheen Mussel Farms	Barren Island	47	31.2	54	6.36	Blue Mussels
Merasheen Mussel Farms	Presque Hr	47	24.8	54	29.17	Blue Mussels
Warren, Christopher	Big South West (Expansion)	47	34.43	54	10.35	Blue Mussels
Mervin Hollett	Port Royal Arm	47	32.3	54	5.55	Blue Mussels
Merasheen Mussel Farms	Merasheen Island	47	36.22	54	9.85	Oyster add-on

Source: DFA, Newfoundland and Labrador (T. Budgell/Claudette Laing, DFA Grand Falls, April 2007)

1.4.3. Other Inactive/Abandoned Aquaculture Sites

In addition to the sites which DFA has currently approved, during the past decade or so aquacultural activities have been investigated, approved and developed at various other locations within Placentia Bay. While none of these older aquaculture sites are presently active or under development, some of these farming locations may be re-activated at some point in the future. Previously active or licenced aqauculture sites within the study area are shown below, and may give some indication of the potential for a more widespread development of the area's aquaculture sector in the future.[14]

Previous aquaculture sites (number) and species activities were located at the following sites:

[14] Information on these sites was obtained from DFA licence files (2003/2004), AquaGIS.com data, and Todd Budgell, pers comm., August 2006.

Blue Mussels
Bar Haven (3)
Gulch Head
Cross Island

Atlantic Cod
Fox Cove
Jigging Cove (near Monkstown)
Spanish Room Point
Petite Forte Harbour (2)
Muddy Hole, Sound Island
Chambers Island (3)
Isle Valen (3)

Salmon
Northeast Nonsuch Arm
Boat Harbour

Sea Urchins
Cooper Island

1.4.4. Current Status of Aquacultural Production Activities in Placentia Bay

Consultations with all operators presently involved in the Placentia Bay aquaculture sector were undertaken (in November 2006 and April 2007) to obtain further information about the present status of these farming operations, including their current production levels, future plans and any concerns related to the proposed Refinery at Southern Head.

The following Table 1-10 presents an overview of recent activity levels, current licence status and economic output of DFA approved aquaculture sites. This table updates baseline information obtained from DFA based on consultations with industry participants. (Appendix 1 provides a list of all industry participants and agency managers consulted for this report.)

Table 1-10: Current Activity Status of Placentia Bay Aquaculture Sites (April 2007)

Company/Operator	Location	Species	Current Status
Keating, Joseph (Baie Sea Farms)	Crawley Island, Long Harbour	Blue Mussels	Operation has had commercial sales for the last 5 years or more; owner has plans to expand production from current levels
Keating, Joseph (Baie Sea Farms)	Crawley Island	Blue Mussels	Operation has had commercial sales for the last 5 years or more; operator has plans to expand production from current levels

Keating, Joseph (Baie Sea Farms)	St. Croix Bay	Blue Mussels	Operation has had commercial sales for the last 5 years or more; operator has plans to expand production from current levels
Warren, Christopher J.	Big South West Cove, Merasheen Island	Blue Mussels	Operation has had commercial sales for the last 5 years or more; operator has applied to DFA for site expansion, expects to increase production of mussels
Warren, Christopher J.	Merasheen Island	Blue Mussels	Operation has had commercial sales for the last 5 years or more; operator has applied to DFA to add oyster farming activities to the site
Hollett, Mervin	Port Royal Arm	Blue Mussels	Licence status/approval is uncertain pending DFO review of objections from scallop fisher(s) operating near the site; no commercial sales to date; operator hopes to begin mussel farming in 2007 or 2008 if DFA/DFO approvals are obtained; if so, operator anticipates commercial sales of 400-500,000 pounds in 4-5 years
Leonard, Peter	Southern Harbour	Atlantic Cod	Licence has been renewed but no commercial sales to date; operation presently inactive, no equipment on site; operations may resume pending DFO allocation of cod for grow-out; potential for commercial sales will depend on the same factors that have affected growth of other PB cod grow-out operations (availability of growing stock, feed supply and market conditions)
Norman, Bernard	Jerseyman Island	Atlantic Cod	Licence has been renewed, but operation is currently inactive, no commercial sales to date; equipment (four Polar cages) still on site; operator hopes to begin farming steelhead trout in 2008
Pomeroy, Donald A. and Barry, John Jr.	Petite Forte Harbour	Atlantic Cod	Licence status is uncertain and operator is awaiting word from DFA and NWPA application renewal; no equipment presently on site; operator may renew cod farming if approvals are forthcoming
Jones, Ambrose	Petite Forte	Atlantic Cod	Licence status uncertain; operator reported commercial sales for two or three years, but ceased cod farming activities in 2004; owner not sure if operations will resume in future
Merasheen Mussel Farms Inc.	Barren Island	Blue Mussels	Awaiting DFA approval
Merasheen Mussel Farms Inc.	Jean de Gaunt Island	Blue Mussels	Awaiting DFA approval

Merasheen Mussel Farms Inc.	Presque Harbour	Blue Mussels	Awaiting DFA approval
Merasheen Mussel Farms Inc.	Rose au Rue	Blue Mussels	Awaiting DFA approval
Merasheen Mussel Farms Inc.	Dog Harbour	Blue Mussels	Awaiting DFA approval
Merasheen Mussel Farms Inc.	Merasheen Island	Oyster	Awaiting DFA approval; operator has applied to add oyster activities to existing mussel operations at this site
Warren, Christopher	Big South West (Expansion)	Blue Mussels	Awaiting DFA approval (expansion of existing site already licenced by DFA)
Moulton, Clayton	Flat Island Harbour	Atlantic Cod	DFA licence has lapsed; site was commercially active for only one year (2001-2002)
Pevie, Joseph and Pearson, Christopher	Woody Island	Atlantic Cod	No commercial sales since 2001; licence lapsed in 2006
Pomeroy, Donald A. and Barry, John Jr.	Gaultoin's Cove (near Great Paradise)	Atlantic Cod	Operator reports that DFA licence for this site has probably lapsed; last commercial sales were in 2003
Sapphire Sea Farms Ltd.	Dunville	Atlantic Cod	DFA reports that site licence lapsed several years ago

Source: DFA, Newfoundland and Labrador (DFA Grand Falls, April 2007); Canning and Pitt, Inc. industry consultations November 2006 and April 2007

As indicated in the above table, although there are some 13 DFA-licenced aquaculture sites within the study area, only five of these are presently in commercial production. All of the commercially-active operations are engaged in mussel farming; the remaining sites - all of which are licenced for Atlantic cod - are currently not in production, and several of these operations have not renewed their licences. As indicated in Table 1-10, applications for an additional eight sites are presently being reviewed by DFA, all of these applications are for mussel farming, with one exception (i.e. one firm has applied to add oyster farming activities to its existing mussel farming site on Merasheen Island).

None of the existing Atlantic cod grow-out operations are presently in commercial production and most have not had product sales for the past 3-4 years (J. Pevie and A. Walsh, pers comms., November 2006; A. Jones, D. Pomeroy, M. Hollett, P. Leonard, B. Norman and C. Moulton, pers comms., November 2006 and April 2007).

Licences for three of the cod sites (at Flat Island Harbour, Woody Island and Gaultoin's Cove) have either lapsed or have not been renewed. The licence status of two other cod farming sites is "uncertain", while the operator of another, currently-licenced cod site (at Jerseyman Island) is considering switching to Steelhead trout in 2008.

Consultations with licence holders indicate that cod farming has not proven to be economically feasible, and only one operator anticipates resuming his cod farming activities in the next year or two. Cod farmers report that a combination of factors - availability of growing stock, feed supply and costs and market conditions - have made it very difficult to produce and sell farmed cod on an economic basis. One or two operators remain optimistic that a special allocation of cod from DFO for grow-out stock might allow them to re-enter the aquaculture sector within the next few years.

In contrast, Placentia Bay mussel farmers are relatively optimistic about the future potential for their sector, and both of the current operations have plans to expand their production levels (J. Keating, pers comm., November 2006; C. Warren, pers comm., November 2006). As indicated in Table 1-9, DFA is now considering applications from one firm to develop five new mussel farming sites, and that applicant says he expects to have marketable product available in about two years. The owner of that company has also applied to expand his existing mussel farming operation at Big South West (on the west side of Merasheen Island).

Within the past year or so, Cook Aquaculture has expressed some interest in developing new cod and salmonid farming operations in Placentia Bay. However, company managers indicated that they are still in the process of collecting preliminary data and exploring potential sites and, as such, the company has no specific investment plans at this point (N. Halse, pers comm., April 2007).

Of the five, commercially-active mussel farms in Placentia Bay, three are situated near Crawley Island in Long Harbour and the other in St. Croix Bay; these three sites have been under active development since the late 1980s. The remaining two mussel producing sites are located in the central islands area of the bay; one is situated at Big South West on the west side of Merasheen Island and the other is on the east side of this island, just north of Dog Harbour, in the central channel between Merasheen Island and Long Island.

These five, commercuially-active mussel farming operations range in size from 3.5 hectares to 150 hectares and, together, have a 2006/2007production capacity of about 3.5 million pounds of marketable product. Their harvesting/sales season is from November to May/June, though one enterprise anticipates that most of its 2007 sales will take place during the January-April period. Total investment (all five sites) in production equipment and gear (ropes, buoys and collector socks, but excluding harvesting vessels) is estimated at about $1.2 million; based on the total area under production, this investment averages about $3,478 per hectare.

1.5. Fish Processing

1.5.1. Locations

The locations of fish processing plants in the Placentia Bay and adjacent areas for 2006 are shown in Figure 1-22, based on DFA (2007). The second map (Figure 1-23) shows locations in 2004 in Placentia Bay and the South Coast by plant classification, based on Dunne (2004). However, the ownership and operation of some plants in this area (and other areas) are in transition, and their future structure and numbers are not settled at present.

Figure 1-22:Placentia Bay Fish Processing Plant Locations 2006
(Source: DFA, 2007)

Figure 1-23:Southern Newfoundland Fish Processing Licence Locations by Category (Dec 2004)
(Source: Dunne, 2004)

Many of the existing processing plants in Placentia Bay have received significant portions of their raw material inputs from fishing enterprises and suppliers from fishing areas beyond UA 3PSc. For example, FPI's major Marystown facility has traditionally obtained >90% of its fish inputs (primarily flatfish species) from offshore sources, in fishing areas beyond Placentia Bay, and some from outside the DFO Region.

On the other hand, some of the fish harvested from 3PSc goes to plants outside Placentia bay for processing, even if it is landed there.

1.5.2. Processing Value

Most of the species sold to various processors and buyers are subsequently processed into a variety of final products and sold into various markets, at different prices which vary according to product type and mix, quality, exchange rates, market demand, and so on. Depending on its particular production costs, overhead structure, desired profit margin, etc., a processing firm may be able to sell its final output for a higher price compared to another operator, or at a higher profit margin. Also, large quantities of lobster are purchased directly from fishers and then resold again, without ever being "processed". Hence, a significant portion of the final value of several species is not captured in local plant production figures.

There is no reliable way to establish the final, or export, value of all of the fish caught in 3PSc. Some portion - or all - of most species sold to various processors and buyers are subsequently processed into a variety of final products and sold into various markets, at different prices which vary according to product type and mix, exchange rates, market demand, quality and so on. Depending on production costs, overhead structure, desired profit margin, and other factors, a processing firm may be able to sell its final output for a higher price compared to another operator, or at a higher profit margin than another processor.

Provincially, DFA calculates the value of fish after processing by applying average market prices to the quantity for the species; however, this excludes the value added through secondary processing.

A rough estimate of the value can be derived by assuming that primary processing adds an additional 65.26% of the landed value. This is based on recent average provincial-level data for landings and processing values for all species. Thus for 3PSc fish harvested by SS 30 based vessels averaged over the past four years (based on Table 1-2 above), the additional value added by processing (wherever it is eventually landed and processed) would be in the order of $1,564,804 (65.26% of $2,397,800), for a total of $3,962,604. Since not all landings data are linked to specific homeports, discussed above, the actual value would likely be higher.

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Appendix 1

Agencies and Persons Consulted
(Commercial Fisheries and Aquaculture Sector)

DFO

Max Eddy, Fisheries Officer, Arnold's Cove
Robin Smith, Acting Chief Resource Management, Grand Bank

Department of Fisheries and Aquaculture (2006 and 2007)

Mike Warren, Executive Director, Policy and Planning
Todd Budgell, Manager of Aquaculture Licencing and Inspections
Elizabeth Barlow, Salmonid Aquaculturalist
Claudette Laing, Aquaculture Licencing Administrator

Cook Aquaculture

Nell Halse, Director of Communications
Robert Sweeney, Consultant, St. Stephen NB

Placentia Bay Aquaculture Operators (2006 and 2007)

Ambrose Jones, Petite Forte
Peter Leonard, Southern Harbour
Bernard Norman, Rushoon
Mervin Hollett, Arnold's Cove
Don Pomeroy, Placentia
Andrew Walsh, St. John's
Joseph Pevie, Arnold's Cove
Calyton Moulton, Red Harbour
Joseph Keating, Holyrood
Christopher Warren, Arnold's Cove

Appendix C

Chemical Isotopic Analysis on Lichen from the Come-By-Chance Area

APPENDIX C: CHEMICAL AND ISOTOPIC ANALYSIS OF LICHEN FROM THE COME-BY-CHANCE AREA

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June 27, 2007

Introduction

Stable isotopic composition was measured along with the nitrogen, sulphur, and trace element content of lichen samples from the area surrounding the Come-by-Chance Refinery to examine the impact of the refinery on air pollution. The results show that at sites close to the refinery (Refinery Road, Come-by-Chance, and Sunnyside) there is evidence of an impact in terms of elevated sulphur, nitrogen, nickel, and vanadium concentrations as well as ^{34}S depleted isotopic compositions. At sites further from the refinery and to the west, there is only a small indication that the refinery emissions are having an impact.

Their wide geographic distribution, long-life, and their ability to absorb nutrients from the atmosphere have made lichen useful as monitors of atmospheric pollution (Richardson, 1992). Some species of lichen such as *Alectoria sarmentosa* get their nutrition solely from atmospheric sources including both wet and dry deposition. These lichen are also not able to discriminate against incoming nutrients as they possess no regulatory structures such as stomata ensuring that their composition should more closely reflect that of the ambient atmosphere.

Stable isotopes are useful as tools for investigating atmospheric pollution as natural variations in isotopic composition result from various inorganic and biological processes in the environment. The cycling of nutrients such as sulphur and nitrogen can then be traced using these characteristic isotopic signatures.

Isotope values are expressed in the δ–notation:

$$\delta X = [(R_{sample}/R_{standard}) - 1] \times 10^3$$

where X is either ^{34}S or ^{15}N and R is $^{34}S/^{32}S$ or $^{15}N/^{14}N$. Values are reported in permil (‰) units with respect to an international reference material. This is a troilite (FeS) from the Cañyon Diablo meteorite (VCDT) for sulphur and N_2 in air for nitrogen.

Generally, atmospheric sulphur reflects the isotopic composition of the various sulphur sources. Inputs from anthropogenic point sources such as power plants and refineries can be differentiated using stable isotopes because the sources have distinct $\delta^{34}S$ signatures. Combustion of fossil fuels tends to lead to lower $\delta^{34}S$ values. For example, Bunker C fuel has been found to range between -3.0‰ and +6.3‰ (Ennis, 1999). Higher $\delta^{34}S$ values are indicative of marine inputs either from seaspray sulphate (+21‰) or biogenic dimethylsulphide (DMS) (+16‰).

In Newfoundland, studies of precipitation sulphate have demonstrated that the sources of atmospheric sulphate include seaspray ($\delta^{34}S$=+21‰), long-range transported (anthropogenic) sulphate ($\delta^{34}S$~+4‰) and local primary anthropogenic sulphate ($\delta^{34}S$~+4‰) (Jamieson and Wadleigh, 2000). Work by Evans (1996) illustrated that lichen in the Bonavista and Come-by-Chance areas reflected the sulphur isotopic composition of precipitation sulphate and could therefore be used as a proxy for monitoring atmospheric pollution.

Evans (1996) was also the first to measure $\delta^{34}S$ values for lichen in the Come-by-Chance area. This study found an average $\delta^{34}S$ value of +8.82±0.15‰ (n=5) for *A. sarmentosa* from the Come-by-Chance and Sunnyside areas compared to an average value of +14.6±0.10‰ for the Bonavista area (n=5) clearly reflecting the difference in the relative importance of anthropogenic and marine sources in these areas.

From their large-scale survey of epiphytic lichen in insular Newfoundland, Wadleigh and Blake (1999) found that *A. sarmentosa* exhibited $\delta^{34}S$ values between +3.7‰ and +16.6‰ with S concentrations between 249 ppm and 787 ppm. They found that the island could be divided into three zones based on the relative importance of various sulphur sources. Zone 1 included urban areas and those adjacent to local point sources such as the Come-by-Chance refinery. Lichen in this zone were characterized by $\delta^{34}S$ values <10‰ and sulphur concentrations between 600 and 1100 ppm. Zone 2 consisted of inland sites with $\delta^{34}S$ values between +10 and +12‰ and low sulphur concentrations (<400 ppm). Coastal areas were placed in zone 3 which represents the input of seaspray sulphate and DMS with their higher $\delta^{34}S$ values. The sulphur isotope composition in this area was generally >+12‰ with intermediate sulphur concentrations (400 – 600 ppm). This study also points to the importance of combining $\delta^{34}S$ analysis with S concentration data for unraveling potential sulphur sources.

Yun (2003) carried out a comparison of older and younger lichen from Come-by-Chance and found that younger lichen had consistently lower $\delta^{34}S$ values ranging from +5.1 to +8.2‰ while older lichen ranged from +6.2 to +10.9‰. Generally, the younger lichen also had a higher S content ranging from approximately 480 to 2100 ppm compared to older lichen (approximately 147 to 637 ppm). This was believed to represent a stronger refinery input to the younger lichen. Wadleigh (2003) reviews a number of the lichen studies which have been carried out in Newfoundland.

The main sources of atmospheric nitrogen in Newfoundland likely include seaspray, biogenic emissions and combustion emissions (Eaton, 2003). Emissions from vehicle combustion sources have been found to be ^{15}N depleted while emissions from coal-fired power stations tended to be more ^{15}N enriched (>0‰) (Heaton, 1990). The use of lichen $\delta^{15}N$ values for pollution monitoring was explored by Eaton (2003). Lichen were collected from urban and rural locations as well as industrial areas including Come-by-Chance. Lichen from the Come-by-Chance area had an average $\delta^{15}N$ value of -5.6±0.2‰ (n=3) which was not distinguishable from a more remote, marine influenced area (-5.7±0.3‰; n=5). Lichen from the urban St. John's area were clearly distinguished with $\delta^{15}N$ values between approximately -7.8 and -13.6‰. This was a small study and it is possible that a closer examination of the Come-by-Chance area may reveal an anthropogenic influence on $\delta^{15}N$. Nitrogen concentrations have not been measured in previous studies.

Trace elements, including metals, can also be assessed in lichen as a measure of atmospheric sources. Two studies have examined the metal content in lichen around the Come-by-Chance area. Yun et al (2003) carried out a survey of lichen trace element composition from 35 sites across the island of Newfoundland including the Come-by-Chance refinery area. Their findings suggested that three major sources were contributing to trace metals in the lichen: Zn-Pb-Cu mining (Zn, Pb, Cd Ba), seaspray (Mg, Ca, Sr) and oil refining and combustion (V, Ni). Only one sample was taken from directly near the refinery, but this sample had high values for V (12.80 ppm) and Ni (6.89 ppm). These were the highest concentrations found in the province with all other samples falling below 1 ppm and 2.5 ppm for V and Ni respectively.

Another lichen survey was carried out by Crocker (2004) in the immediate vicinity of the refinery. This study examined the distribution of V and Ni as well as other trace elements and Pb isotopes. Again, the highest V and Ni concentrations were found closest to the refinery. Within 3 km of the refinery, V and Ni were found to be 23 ppm and 7 ppm respectively. The overall range was 0.18 to 23.11 ppm for V and 0.33 to 6.67 ppm for Ni. The geographic distribution of these elements also seemed to be influenced by the dominant wind direction (NW) from the refinery. No correlations were found with the

other heavy metals measured including Zn, As, Cd, and Pb. Lead isotopes showed that inputs of this metal were mainly from historic gasoline use and natural inputs from soil.

Methods

Sample Preparation
Twenty-seven lichen samples were analyzed in total. Twenty-four of these were *Alectoria sarmentosa* and three were *Lobaria sp.*

The preparation of the lichen samples was carried out using procedures based on those outlined in Yun (2003) and Eaton (2003). Air-dried and cleaned lichen samples were ground to a fine powder using an agate puck mill. Each sample was ground for approximately 2 minutes and the puck mill was cleaned with isopropanol after each sample. The lichen powder was then sieved with a -60 mesh polyethylene sieve. Lichen powder for trace element analysis was stored in plastic vials while lichen powder for isotopic analysis was stored in glass vials. All laboratory work was carried out wearing powder-free, vinyl gloves to minimize contamination. Samples were not washed prior to analysis.

Isotopic Analysis
Following the procedure outlined by Yun (2003), the lichen powder for isotopic analysis was oven-dried at 80°C for 8 hours to ensure removal of all water. The sulphur and nitrogen isotope analyses were carried out using a Carlo Erba 1500 elemental analyzer connected by a ConFlo-II interface to a Finnigan™ MAT 252 isotope ratio mass spectrometer in the Department of Earth Sciences, Memorial University.

Approximately 15 mg of lichen powder was used for the analysis of the sulphur isotopic composition and concentration. The samples were weighed into 10x10 ultralight tin capsules along with no less than 0.2 mg of V_2O_5 to aid combustion. Calibration of the mass spectrometer data was carried out using international reference materials. For sulphur isotopic analysis, IAEA-S-1 silver sulphide (-0.3‰) and IAEA-S-2 silver sulphide (+22.67‰) were used as calibration standards. Accuracy and precision of the isotope results were assessed by replicate analyses of the NBS 123 zinc sulphide standard (+17.44‰). The measured value for this standard was 17.9 ± 0.3‰ (1σ, n=4). Sulphur concentration was assessed in conjunction with the isotopic analysis using the BBOT ($C_{26}H_{26}N_2O_2S$; 7.44 %S) reference material as a calibration standard.

Two samples were prepared from lichen thalli collected from site LEC04. Analysis of these samples illustrates that there is some variability between plants at the same site. The $\delta^{34}S$ values for these two samples were 14.8±0.34‰ (n=3) and 15.63±0.22‰ (n=3) while sulphur concentration values were 462±5.5ppm and 515±4 ppm. The difference in $\delta^{34}S$ is not statistically significant (p = 0.064), but the difference in S content is significant (p = 0.002). These replicate measurements also illustrate that within a single powder sample, the results are reproducible.

For the nitrogen isotope and concentration analysis approximately 10 mg of lichen powder was weighed into 10x10 ultralight tin capsules. The reference materials USGS 25 ammonium sulphate (-30.25±0.38‰) and IAEA-N-2 ammonium sulphate (+20.32±0.09‰) were used to calibrate the nitrogen isotope data and IAEA-N-1 ammonium sulphate (+0.43±0.07‰) was used to assess accuracy and precision. The measured value for this reference material was +0.40±0.04‰ (n=3). Nitrogen concentration (%N) was again assessed simultaneously using the BBOT reference material ($C_{26}H_{26}N_2O_2S$; 6.51 %N).

As for sulphur, the two samples from site LEC04 were analyzed to assess precision and within-site variability. The $\delta^{15}N$ values were -4.59±0.05‰ (n=3) and -3.26±0.07‰ (n=3) for replicate analyses which indicates a small but significant difference (p = 0.000). For nitrogen concentration, the values were 0.30±0.002% and 0.32±0.003% which again is only a slightly significant difference (p = 0.002).

These values indicate that there are minor differences between plants at the same site and that the results are highly reproducible for both $\delta^{15}N$ and nitrogen concentration.

Trace Element Analysis

Lichen powder was prepared for trace element analysis using a modified method based on the procedures outlined in Crocker (2004). Approximately 200 mg of lichen powder was placed in Teflon screwcap jars and dissolved in 8N HNO_3. A hotplate was used to aid dissolution and the samples were allowed to digest for approximately three days. Additional aliquots of 8N HNO_3 were added as the samples evaporated. Hydrogen peroxide was added at the end to ensure complete dissolution of the organic material. The lichen solutions were analyzed on a Hewlett-Packard Model 4500plus inductively coupled plasma-mass spectrometer (ICP-MS) in the Department of Earth Sciences, Memorial University. A suite of 35 analytes were measured quantitatively for each sample including Li, Be, B, Mg, Al, Si, P, S, Cl, Ca, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Rb, Sr, Mo, Ag, Cd, Sn, Sb, Cs, Ba, La, Ce, Tl, Pb, Bi, and U. Semi-quantitative results were measured for Tl, Br, I, and Hg. Results are converted to ppm relative to dry weight.

Some of the measured elements will not be considered because their values were below the detection limit (DL) for all samples. These included Be, S, Cl, As, Br, Se, Ag, Cd, and Tl. Some of these elements tend to be volatile, such as As, Se, and Hg, the halogen elements (Cl, Br, and I) as well as S, and can be lost during digestion under open conditions. Hg is below detection in most samples and is at the detection limit for a few others and will therefore be omitted from the analysis. As the other halogens are not detected, it is likely that I, which was found in most samples, is underestimated.

Two standards were processed and analyzed along with the lichen samples. These were the IAEA 336 and CRM 482 lichen standards. Certified values were not available for all the elements analyzed, and for certain elements only informational or indicative values were available. Tables 1 and 2 summarize the relative difference (RD, %) between the certified/informational values and the measured values for the IAEA 336 and CRM 482 standards respectively.

It has been found in previous studies that concentrations of elements contained in aluminosilicate minerals (Al, Si, Ti, Cr, and Fe) may be underestimated and have poor precision because of their low solubility (Yun et al, 2003). Also P, As, Mo, Ag, Sn and Sb have low solubility in HNO_3. For both standards, Al had large negative RDs indicating that the measured values are lower than expected. Mo, Sn and Sb were also lower than expected for the CRM 482 standard. These elements will not be considered further. Of the elements of most interest in this study, V was approximately 37-38% below expected values, but the values for the standards are only informative and are not certified. Ni is somewhat higher than expected, but a certified value is only available for CRM 482. In most cases, the higher relative differences correspond with elements for which there are only informational/indicative values for the standards.

Repeat analyses were carried out on six of the lichen samples in order to assess reproducibility. A summary of these results is presented in Table 3 which reports the standard deviation ($\pm 1\sigma$) and the relative standard deviation (RSD, %) between the two analyses. Generally the RSD values are below 10%. One sample, LG03 appears to have high RSD values for most of the elements perhaps indicating that there was some contamination or inhomogeneity in this sample. The RSD values for Ni also tend to be a bit higher than the other elements although generally <15%.

As with the isotopic analyses, two replicate samples were analysed from site LEC04 to assess intra-site variability. These results are presented in Table 4. Most of the RSD values were below 5%. Some (V, Sr, La, Ce, and Pb) were <20%, Mn was approximately 23%, while Ca and Ba were over 30%. The variability in Ca may indicate some variation between plants, however in general, the RSD values are not out of line with those found for replicate analyses of individual samples.

For subsequent analysis of the data, statistics were carried out using MINITAB® Release 14. When necessary, reciprocals or log values of concentrations were used in order to conform to a normal distribution.

Results

Stable Isotopes, N and S concentrations

The isotope results and N and S concentration values are summarized in Table 5 along with descriptions of each of the sampling sites.

The average $\delta^{34}S$ value of *A. sarmentosa* for all sites was +14.1±2.1‰ ranging from +9.8‰ to +18.8‰. The *Lobaria* samples were ^{34}S depleted compared to *A. sarmentosa* with an average $\delta^{34}S$ value of +4.6±1.9‰ ranging from +2.9‰ to +6.7‰. The sulphur content of the two species was also different. The average for *A. sarmentosa* was 496±121ppm (n=24) while the average for Lobaria was 1884±104 ppm (n=3).

For nitrogen, there was also a strong difference between the two species although the range of values was much smaller. The *A. sarmentosa* samples had an average $\delta^{15}N$ value of -3.4±0.5‰ and ranged from -4.5‰ to -2.3‰. For *Lobaria sp.* the average $\delta^{15}N$ value was -0.9±0.3‰ ranging from -1.2‰ to -0.6‰. Nitrogen concentration had an average value of 0.35% for *A. sarmentosa* with a range of 0.23% to 0.60% and an average value of 2.12% for *Lobaria sp.* with a range of 1.83% to 2.40%. The data for *Lobaria* sp.will be omitted from most analyses because of these differences as well as the low sample number for this species.

Site means and ranges for the sulphur and nitrogen analyses are summarized in Tables 6 and 7 respectively. Considering only *A. sarmentosa*, site does seem to be a factor in the variation found in the $\delta^{34}S$ values. ANOVA analysis shows that there is a significant difference in the means between the sites (p = 0.010) with the Come-by-Change (LC), Refinery Road (LCT) and Sunnyside (LS) sites exhibiting lower $\delta^{34}S$ values than the other sites. Sulphur concentration also appears to be significantly different between sites (p = 0.004). In this case however, it is only one site that stands out from the others. The Refinery Road site (LCT) had an average sulphur concentration of 762±193 ppm (n=2) while the average for the other sites was 472±84 ppm (n=22).

There appears to be no significant relationship between site and $\delta^{15}N$ (p = 0.438). There is however a significant relationship between site and nitrogen concentration (p = 0.010) and it is again the Refinery Road samples which had elevated levels (0.51±0.13%; n=2).

Comparing the trends in the isotope composition and concentration data, there are significant relationships between $\delta^{34}S$ and sulphur concentration (Figure 1; p = 0.003; R^2 = 0.300) as well as sulphur concentration and nitrogen concentration (Figure 2; p = 0.000; R^2 = 0.846). The $\delta^{34}S$-S concentration correlation indicates that S concentration is not the only factor influencing $\delta^{34}S$. There is no strong correlation between $\delta^{15}N$ and nitrogen concentration (p = 0.932) or between $\delta^{34}S$ and $\delta^{15}N$ (p = 0.682) (Figures 3 and 4).

Trace Elements

Table 8 summarizes the trace element concentrations for all *A. sarmentosa* and *Lobaria* sp. samples. Although replicate analyses for sample LG03 had higher RSD values, this sample has been retained in the analysis as there does not appear to be a large discrepancy between the mean value for this sample and other samples from this site.

The species of lichen does seem to have an influence on the concentrations of trace elements. Comparing *Lobaria* samples with *A. sarmentosa* collected at the same site, generally the *Lobaria* had higher concentrations for most trace elements. The only exceptions seem to be Ca and Pb which were

lower in *Lobaria*, and Sr, La, and Ce which do not seem to differ from *A. sarmentosa*. Again, as there are only three *Lobaria* sp. samples, these will be omitted from further analysis to avoid adding a potential source of variation.

Tables 9 to 11 outline the site means and ranges for *A. sarmentosa* according to the elements which should reflect refinery emissions (V, Ni), seaspray (Mg, Ca, Sr), and Zn-Pb-Cu mining (Zn, Pb, Ba, Cd) respectively. Cd was below detection in all of the samples and is therefore omitted from Table 11.

Concentrations of Ni and V were found to vary a great deal from site to site. The average Ni concentration for *A. sarmentosa* was 2.64±5.15 ppm with a range from 0.57 to 24.56 ppm. Vanadium had an average concentration of 3.49±8.09 ppm with a range of 0.32 ppm to 39.96 ppm. Looking at the results for Ni, there appears to an anomalously high concentration in sample LEC01 (24.6 ppm). While having a very high Ni concentration, this sample had a very low V concentration (0.32 ppm). For the remaining samples however, there is a very strong relationship between Ni and V (Figure 5; p = 0.000; R^2 = 0.953) although most of the variation appears to be due to only a few samples with high concentrations (particularly LCT01). Omitting LEC01, the overall average for Ni becomes 1.68±2.22 ppm and the average for the LEC site is reduced from 6.85±11.81 ppm to 0.95±0.39 ppm with a range of 0.57 to 1.35 ppm.

The only other trace elements found to significantly correlate with Ni and V were La (Ni: p = 0.000, R^2 = 0.875; V: p = 0.000, R^2 = 0.872) and Ce (Ni: p = 0.004, R^2 = 0.327; V: p = 0.005, R^2 = 0.312). These are generally considered geogenic elements, but no relationship was found with Rb which is also considered geogenic (Yun et al, 2003).

Site appears to be an important factor to explain inter-site variability in trace element composition. ANOVA analysis shows that the differences between the sites are significant for V (p = 0.000). Pairwise comparisons show that sites CXC, LEC, and LHC, with the lowest mean V values (<1 ppm) are significantly different from sites LC, LCT, and LS, which have the highest mean V values (>4 ppm). The site means were not significantly different for Ni (p = 0.108 with LEC01 omitted) although pairwise comparisons indicate that site LCT (Refinery Road) is distinct from sites CXC, LEC, LHC, and LG. This site had the highest average values for both V (24.61±21.72 ppm) and Ni (7.61±5.32 ppm) and sample LCT01 had the highest values of any of the samples measured (V: 39.96 ppm; Ni: 11.4 ppm).

There was also a wide variation in the concentrations of the seaspray elements (Mg, Ca, Sr) between the sites. The overall average Mg concentration was 482±198 ppm with a range of 220 to 975 ppm. For Ca, the overall average was 774±511 ppm ranging from 143 ppm to 1968 ppm and for Sr the average was 5.31±2.78 ppm with a range of 1.82 ppm to 10.43 ppm. Strong linear relationships were found between these three elements (Figures 6, 7, and 8). For each pair of elements the regression fit is significant and explains most of the observed variation: Mg-Ca (p = 0.000, R^2 = 0.658); Mg-Sr (p = 0.000, R^2 = 0.859); and Ca-Sr (p = 0.000, R^2= 0.880).

It appears that the sites can be separated into two groups based on the seapray elements. Sites CXC, LEC and LHC (all sites on the headland west of Come-by-Chance) had higher mean concentrations for each element (Mg >500 ppm; Ca >1000 ppm; and Sr >7 ppm) while sites LC, LCT, LS and LG had lower mean concentrations (Mg <400 ppm; Ca <450 ppm; and Sr <4 ppm). ANOVA analysis showed that this relationship was significant for Mg (p = 0.000), Ca (p = 0.000) and Sr (p = 0.000).

The average concentrations for Zn, Pb, and Ba in *A. sarmentosa* were 28.7 ± 7.9 ppm, 1.24 ± 0.78 ppm, and 1.60 ± 1.22 ppm respectively. The variation between the mean values for each of the sites was relatively small and statistics revealed that these differences were not significant (Zn: p = 0.697; Pb: p = 0.826; Ba: p = 0.554). There were also no significant relationships between these elements.

No relationships were found for Cu and the other trace elements. While there is some variation between samples (ranging from 0.7 to 5 ppm), this does not appear to be related to site (p = 0.062).

The results for Cs, Bi and U were generally at the detection limit and there were too few points to make use of this data. .

Comparisons between the trace element data and the $\delta^{34}S$ and major element (S, N) data also revealed correlations. The strongest relationships were found with Ni and V. Although considered significant, it is clear looking at the Figures 9 to 14 that the trends are largely controlled by a few high concentration samples. It also appears that these relationships are not generally linear. For some of these trends, the best fit is either a log or a polynomial function. In general, the samples with high Ni and V concentrations have correspondingly high concentrations of S, N and have low $\delta^{34}S$ values. Both La and Ce display similar behaviour to Ni and V and exhibit similar correlations.

There also appear to be significant linear correlations between $\delta^{34}S$ values and Mg (p = 0.000, R^2 = 0.595), Ca (p = 0.001, R^2 = 0.396), and Sr (p = 0.000, R^2 = 0.539). In each case, higher concentrations are correlated with higher $\delta^{34}S$ values. The Mg and Sr correlations seem to explain more of the variation in $\delta^{34}S$ than Ca. The correlations with sulphur and nitrogen concentration are not as strong, although they are moderately significant for Ca-S (p = 0.034, R^2 = 0.188), Ca-N (p = 0.011, R^2 = 0.261), and Sr-N (p = 0.018, R^2 = 0.228). No correlations were evident for Pb or Ba however Zn was moderately correlated with $\delta^{34}S$ (p = 0.030, R^2 = 0.196), S concentration (p = 0.019, R^2 = 0.226), and N concentration (p = 0.022, R^2 = 0.215).

Discussion

The strong relationships between $\delta^{34}S$, S concentration, and N concentration together point to an anthropogenic influence within the Project Area. A decrease in $\delta^{34}S$ coupled with increasing S and N content within the area of the refinery are indicative of a pollution input. Nickel and vanadium are considered indicators of refinery emissions and their correlation with S and N, together with the occurrence of high concentrations at sites proximate to the refinery, support this interpretation.

The site closest to the refinery, Refinery Road (LCT), and those to the northeast (LS and LC), seem to experience the greatest influence from the refinery emissions. These sites are distinctive based on their overall high concentrations of S (615±136 ppm), N (0.42±0.09%), Ni (3.19±3.72 ppm) and V (10.11±13.35 ppm) along with the low average $\delta^{34}S$ value (11.9±1.5‰) compared to the other sites. Overall the average concentrations of Ni and V measured at these three sites were higher than those found by Crocker (2004) (Ni: 1.96 ppm; V: 6.13 ppm; n=25). This may however be partly due to differences in the distribution and number of sampling sites.

The Refinery Road area in particular seems to be the most heavily impacted site. Sample LCT01 has the highest measured concentrations of S, N, Ni and V as well as the lowest $\delta^{34}S$ value. The LCT site is also the only one at which both samples had measurable amounts of Co. The concentrations of V (39.96 ppm) and Ni (11.37 ppm) found in sample LCT01 are much higher than those found in previous studies of the area. Crocker (2004) measured a high value of 23.11 ppm for V and 6.67 ppm for Ni while Yun et al (2003) measured one sample in the area which had a V concentration of 12.8 ppm and a Ni concentration of 6.9 ppm.

Interestingly, if Ni/V ratios for each site are compared with the value of 0.38 cited by Crocker (2004) as the signature of refinery emissions, the LC (0.34±0.11), LCT (0.35±0.09), and LS (0.37±0.15) sites closely approach this value while the other sites have ratios approximately 4 times higher (>1.2). This strengthens the argument that the compositional differences at these sites are due to refinery emissions.

Sites further from the refinery, including Goobies (LG) and all of the sites on the headland to the west of Come-by-Chance (CXC, LEC, and LHC) seem to show less influence from refinery emissions. The

average S concentration (447±74 ppm) and N concentration (0.32±0.06%) values were lower and the average $\delta^{34}S$ value was higher (15.1±1.5‰; n=17) at these sites. These are similar to the values for the coastal zone proposed by Wadleigh and Blake (1998) and is consistent with an influence from Placentia Bay.

The western headland sites also had the lowest measured Ni and V concentrations. The averages for these three sites were 0.96±0.36 ppm (n=11; excluding LEC01) and 0.64±0.27 ppm (n= 12) respectively. The lowest measured V value in this study was 0.32 ppm from the LEC site. Yun et al (2004) found that in Newfoundland, remote sites had values approaching 0.03 ppm for V and 0.35 ppm for Ni. This would seem to indicate that all samples in this study have somewhat elevated concentrations. Nickel and vanadium have also been found to be mildly elevated in urban areas. Samples from St. John's were found to have V concentrations up to 0.45 ppm while those around pulp and paper mills were found to be between 0.25 and 0.43 ppm (Yun et al, 2004). It is possible that some minor background influence may be felt in the Project Area from the TransCanada Highway or the surrounding communities.

Lanthanum and cerium were also found to correlate with Ni, V, S and N. In previous studies La and Ce were considered geogenic elements (Yun et al, 2004). Again, sample LCT01 exhibits very high concentrations compared to the all other samples (La: 1.26 ppm; Ce 1.14 ppm) indicating that these elements are likely contributed by refinery emissions. The same site differences also seem to be evident for these elements (La: $p = 0.000$; Ce: $p = 0.018$), but are largely driven by the high concentrations at the LCT site.

Another factor identified by Yun et al (2003) as an influence on the composition of lichen in Newfoundland was seaspray. This influence can be clearly identified in the present samples using the trace element data (Mg, Ca, and Sr) along with the $\delta^{34}S$ values. Inputs of seaspray sulphate, with its high $\delta^{34}S$ signature (+21‰), leads to ^{34}S enrichment in lichen along with high concentrations of Mg, Ca, and Sr. It appears that seaspray together with S concentration (refinery emissions) account for most of the total variation in $\delta^{34}S$. The sites most influenced by seaspray input are those on the western headland (CXC, LEC, and LHC). Results from the sites close to the refinery (LC and LCT) as well as from Sunnyside and Goobies indicate that seaspray input is less important in these areas.

The third factor identified by Yun et al (2004) was the influence of Zn-Pb-Cu mining. This factor is not evident in the present study. Zinc, lead and barium, which were considered indicators of this factor, show no indication of variation between the sites or enrichment in the Project Area. This is not a surprising result as it would be expected that this influence would be relatively local in extent and there are no mines in the direct vicinity of the Project Area.

While the isotopic results are generally in accord with previous studies of the area (Evans, 1996; Wadleigh and Blake, 1998; Yun, 2003), they may indicate that the magnitude of the anthropogenic influence is not as pronounced as in the past. The sites closest to the refinery clearly have lower $\delta^{34}S$ values and higher S and N concentrations, but the values do not generally reach the level of zone 1 as defined by Wadleigh and Blake (1998). Of the samples collected close to the refinery, three have values above 600 ppm for sulphur and only one falls below 10‰ for $\delta^{34}S$.

This may be partially explained by differences in the methods employed in analyzing the sulphur isotope composition and sulphur content of the lichen. Previous studies have relied on older methods for these analyses (Evans, 1996; Wadleigh and Blake, 1998). A comprehensive study by Yun (2003) however found that newer online methods (also used in this study) give highly comparable results for $\delta^{34}S$. It is also possible that there is some seasonal variation although very little is known about this type of effect. Seasonal variations have been shown to occur for $\delta^{34}S$ values of lichen (Cousineau, 2003). It is also possible that differences in the sampling distribution may influence the results although care was taken to try and sample in the same areas as these previous studies.

Some intra-site variability may also contribute to the disparity, but it is also possible that the composition of the lichen may change to reflect differences in the output from the refinery. Studies have suggested that it may take up to four years for lichen to respond to decreases in S output (Wiseman and Wadleigh, 2002; Cousineau, 2003) and depending on the growth rate, bulk analyses may more closely reflect older atmospheric conditions. Further studies to compare older and younger lichen samples may be required to distinguish these effects. The trace element analysis does seem to indicate that all of the sites in this study have experienced some input from the refinery and the high concentrations measured at the LCT site point toward a continued input.

While nitrogen concentration analysis has proved useful, $\delta^{15}N$ analysis has not aided in distinguishing between nitrogen sources in this area. It should be pointed out however, that the $\delta^{15}N$ values measured in this study were noticeably ^{15}N enriched (-3.4±0.5‰ for *A. sarmentosa*) as compared to previous measurements by Eaton (2003) (-5.6±0.2‰) from the same area. The reason for this difference is unclear. It might be expected that increased refinery inputs might lead to higher $\delta^{15}N$ values, but this is not consistent with the $\delta^{34}S$ and concentration data. It is also possible that this may be related to unknown seasonal variations. It is not clear from Eaton (2003) when during the year samples were collected.

Three samples of *Lobaria sp.* were also analyzed during the course of this study. The values for these samples proved to be very different from those of the *A. Sarmentosa* making comparisons impossible. The relatively high $\delta^{15}N$ values are likely explained by the fact that *Lobaria sp.* are known to carry out nitrogen fixation. This usually leads to $\delta^{15}N$ values of around 0‰ reflecting the N_2 in air (Hoefs, 1987). Overall the $\delta^{34}S$, S and N concentration values are much higher than *A. Sarmentosa*. This was also largely true of the trace element data. It is possible that this means that Lobaria is absorbing more air pollution, however the samples collected were all from sites which were thought to be relatively unaffected by the refinery. Analysis of *Lobaria sp.* from sites closer to the refinery would shed more light on this question.

Conclusions

Together, the stable isotope and element concentration data indicate that emissions from the Come-by-Chance refinery are influencing the surrounding area. This influence is most strongly felt in the area immediately around the refinery at the Refinery Road site. Sites to the northeast, including Come-by-Chance and Sunnyside, also experience some impact as evidenced by higher concentrations of trace elements in the lichen as well as lower $\delta^{34}S$ values. Sites further from the refinery and on the headland immediately to the west in Placentia Bay seem to experience little influence from the refinery emissions based on their low trace element concentrations along with higher $\delta^{34}S$ values. The Ni and V concentrations at these sites are not as low as might be expected in the absence of refinery emissions indicating that there is some influence even at these more distant and/or upwind sites. Based on comparison with previous studies, there may be some indication of a decreasing input of refinery emissions to the surrounding area however the evidence is ambiguous and further study would be needed to confirm this interpretation.

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Tables for Appendix C

Table 1. Sulphur and Nitrogen Stable Isotope and Trace Metal Analyses of Lichen Collected in the Area of Come By Chance, Sunnyside, Goobies and Southern Head, Placentia Bay Newfoundland 2007.

Table 1. Comparison between certified/information values and measured values for the IAEA 336 lichen standard.

	Al	V	Cr	Mn	Fe	Co	Cu	Zn	Rb	Sr	Sb	Cs	Ba	La	Ce	Pb
Measured	238	0.92	0.71	65	351	0.24	3.3	30.7	1.10	8.4	DL	0.075	4.7	0.37	0.84	4.6
Certified Value				63	430	0.29	3.6	30.4		9.3	0.073	0.110	6.4	0.66	1.28	
Information Value	680	1.47	1.06						1.76							4.9
Confidence Interval	570-790	1.25 - 1.69	0.89 - 1.23	56 - 70	380 - 480	0.24 - 0.34	3.1 - 4.1	27.0 - 33.8	1.54 - 1.98	8.2 - 10.4	0.063 - 0.083	0.097 - 0.123	5.3 - 7.5	0.56 - 0.76	1.11 - 1.45	4.3 - 5.5
RD (%)	-65	-37	-33	3	-18	-19	-10	0.9	-38	-10		-32	-26	-45	-35	-6

Notes: RD = relative difference; all values are in ppm except where indicated.

Table 2. Comparison between certified/indicative and measured values for the CRM 482 lichen standard.

	Al	V	Ca	Cr	Mn	Fe	Co	Ni	Cu	Zn	Mo	Sn	Sb	Ba	Pb
Measured	268	2.30	1714	1.19	24.0	533	0.17	4.34	7.09	82.0	0.31	2.22	0.18	8.7	32.2
Certified Value	1103			4.12				2.47	7.03	100.6					40.9
Indicative Value		3.74	2624		33.0	804	0.32				0.85	1.31	0.35	14.9	
Uncertainty	24	0.61	180	0.15	0.5	160	0.03	0.07	0.19	2.2	0.01	0.10	0.09	2.4	1.4
RD (%)	-76	-38	-35	-71	-27	-34	-48	76	0.8	-18	-63	69	-49	-42	-21

Notes: RD = relative difference; all values are in ppm except where indicated.

Table 3. Summary of results for lichen replicate analyses by ICP-MS. Units are in ppm unless otherwise indicated.

	Mg	Ca	V	Mn	Ni	Cu	Zn	Rb	Sr	Ba	La	Ce	Pb	Bi	U
LC01 mean*	292	245	3.78	28.4	1.59	DL	31.0	2.85	2.42	4.29	0.38	0.40	0.78	DL	DL
Std	9	5	0.01	1.4	0.19		0.58	0.08	0.11	3.67	0.02	0.01	0.03		
RSD (%)	3.2	1.9	0.2	4.8	11.9		1.9	2.9	4.6	85.6	6.0	1.9	3.9		
LG03 mean	390	327	1.49	27.5	0.76	DL	27.7	0.89	3.47	0.55	0.14	0.13	0.80	DL	DL
Std	17	57	0.53	17.5	0.11		1.40	0.25	0.03	0.26	0.08	0.08	0.36		
RSD (%)	4.3	17.4	35.6	63.9	13.9		5.1	28.3	0.8	47.1	54.4	58.9	44.6		
CXC01-A mean	425	1352	0.62	29.8	1.00	DL	24.4	1.33	8.23	4.32	0.13	0.11	1.29	DL	DL
Std	2	1.5	0.02	0.1	0.01		0.29	0.02	0.18	0.12	0.00	0.00	0.01		
RSD (%)	0.5	0.1	2.4	0.4	0.8		1.2	1.7	2.1	2.8	0.0	0.0	0.6		
CXC04 mean	696	931	0.96	28.9	0.88	1.24	26.7	1.43	7.46	0.49	0.12	0.09	0.82	0.02	0.01
Std	10	2.3	0.04	0.4	0.12	0.05	0.51	0.01	0.06	0.02	0.01	0.01	0.02	0.00	0.00
RSD (%)	1.5	0.2	4.0	1.2	13.8	4.3	1.9	0.5	0.8	4.7	6.2	8.3	2.8	0.0	0.0
LHC03 mean	710	1217	0.36	35.0	0.57	0.78	19.8	0.49	7.60	0.56	0.06	0.07	1.40	DL	DL
Std	36	74	0.06	1.8	0.13	0.15	0.30	0.03	0.29	0.11	0.00	0.01	0.08		
RSD (%)	5.1	6.1	16.6	5.1	22.5	19.4	1.5	6.2	3.8	20.2	0.0	10.9	5.4		
LDC01 mean	503	339	3.15	25.3	1.87	3.37	32.7	1.99	3.78	4.03	0.12	0.12	0.63	0.01	0.01
Std	11	2	0.13	0.7	0.06	0.05	0.11	0.02	0.04	0.25	0.00	0.00	0.02	0.00	0.00
RSD (%)	2.20	0.4	4.1	2.7	3.2	1.3	0.3	1.1	1.0	6.2	0.0	0.0	3.6	0.0	0.0

Notes: *All means are based on two analyses. Std = standard deviation, RSD = relative standard deviation, DL = below detection limit

Table 4. Results for replicate samples from site LEC04. All values are in ppm except where noted.

Sample ID	Mg	Ca	V	Mn	Ni	Cu	Zn	Rb	Sr	Ba	La	Ce	Pb	Bi	U
LEC04a	706	1497	0.40	47.5	0.56	0.70	29.7	0.85	9.22	1.69	0.05	0.06	1.51	DL	DL
LEC04b	727	2439	0.33	65.9	0.59	0.72	31.4	0.90	11.63	0.99	0.06	0.08	1.18	0.01	DL
Mean	717	1968	0.36	56.7	0.57	0.71	30.6	0.87	10.43	1.34	0.06	0.07	1.35	DL	DL
Std	15	666	0.05	13.0	0.02	0.02	1.2	0.04	1.70	0.50	0.01	0.01	0.23		
RSD (%)	2.0	33.8	12.4	22.9	4.1	2.3	4.0	4.5	16.4	37.2	13.0	11.0	17.3		

Notes: Std = standard deviation; RSD = relative standard deviation

Table 5. $\delta^{34}S$, $\delta^{15}N$, S concentration and N concentration results for lichen analyses along with site descriptions.

Sample	$\delta^{34}S$ (‰, VCDT)	$\delta^{15}N$ (‰, Air N_2)	S (ppm)	N (%)	Species	Notes
LC01	11.4	-3.1	544	0.38	Alectoria	Come by Chance
LC02	12.1	-3.3	566	0.4	Alectoria	Come by Chance
LCT01	9.8	-3.8	898	0.6	Alectoria	Refinery Road
LCT02	13.5	-3.0	625	0.41	Alectoria	Refinery Road
LS01	10.2	-3.3	648	0.43	Alectoria	Sunnyside
LG01	13.7	-3.5	476	0.34	Alectoria	Goobies
LG02	15.1	-2.3	543	0.41	Alectoria	Goobies
LG03	14.2	-3.0	449	0.31	Alectoria	Goobies
LG04	14.3	-3.2	507	0.35	Alectoria	Goobies
LG05	13.7	-3.5	480	0.34	Alectoria	Goobies
LS02	13.1	-3.7	494	0.33	Alectoria	South of Sunnyside
LS03	13.2	-3.4	530	0.38	Alectoria	South of Sunnyside
CXC01-A	14.2	-2.3	397	0.23	Alectoria	CBC Head East
CXC01-L	2.9	-0.6	1777	1.83	Lobaria	CBC Head East
CXC02	13.6	-4.3	434	0.3	Alectoria	CBC Head East
CXC03	17.2	-2.6	458	0.35	Alectoria	CBC Head East
CXC04	14.0	-3.3	495	0.44	Alectoria	CBC Head East
LEC01	18.8	-4.5	549	0.31	Alectoria	CBC Head West
LEC02	14.6	-3.4	345	0.25	Alectoria	CBC Head West
LEC03	14.4	-3.5	383	0.29	Alectoria	CBC Head West
LEC04	15.2	-3.9	447	0.31	Alectoria	CBC Head West
LDC01	4.3	-0.8	1985	2.40	Lobaria	CBC Head South
LHC01	15.2	-3.6	573	0.35	Alectoria	CBC Head South Hollett's Cv
LHC02	14.6	-3.4	331	0.25	Alectoria	CBC Head South Hollett's Cv
LHC03	17.5	-3.5	381	0.27	Alectoria	CBC Head South Hollett's Cv
LHC04	16.0	-3.5	354	0.26	Alectoria	CBC Head South Hollett's Cv
LHC05	6.7	-1.2	1890	2.13	Lobaria	CBC Head South Hollett's Cv

Table 6. Summary of lichen $\delta^{34}S$ and S concentration data by site.

	$\delta^{34}S$ (permil, VCDT)			S (ppm)		
Site	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
CXC	14.7 ± 1.7	13.6	17.2	446 ± 41	397	495
LC	11.8 ± 0.5	11.4	12.1	555 ± 16	544	566
LCT	11.6 ± 2.6	9.8	13.5	762 ± 193	625	898
LEC	15.7 ± 2.0	14.4	18.8	431 ± 89	345	549
LG	14.2 ± 0.6	13.7	15.1	491 ± 36	449	543
LHC	15.8 ± 1.3	14.6	17.5	410 ± 111	331	573
LS	12.2 ± 1.7	10.2	13.2	557 ± 81	494	648

Table 7. Summary of lichen $\delta^{15}N$ and N concentration data by site.

	$\delta^{15}N$ (per mil, N_2 in air)			N (%)		
Site	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
CXC	-3.1 ± 0.9	-4.3	-2.28	0.33 ± 0.09	0.23	0.44
LC	-3.2 ± 0.1	-3.3	-3.13	0.39 ± 0.01	0.38	0.4
LCT	-3.4 ± 0.5	-3.76	-3.01	0.51 ± 0.13	0.41	0.6
LEC	-3.8 ± 0.5	-4.49	-3.39	0.29 ± 0.03	0.25	0.31
LG	-3.1 ± 0.5	-3.49	-2.34	0.35 ± 0.04	0.31	0.41
LHC	-3.5 ± 0.1	-3.64	-3.35	0.28 ± 0.05	0.25	0.35
LS	-3.4 ± 0.2	-3.68	-3.25	0.38 ± 0.05	0.33	0.43

Table 8. Concentrations (ppm) of trace elements in *Alectoria sarmentosa* and *Lobaria* sp. lichen samples.

Sample	Mg	Ca	V	Co	Ni	Cu	Zn	Rb	Sr	Cs	Ba	La	Ce	Pb	Bi	U
LC01*	292	245	3.78	DL	1.6	DL	31	2.85	2.4	DL	4.3	0.38	0.40	0.78	DL	DL
LC02	253	225	5.41	DL	1.4	DL	25	1.16	2.0	DL	0.9	0.19	0.12	0.69	DL	DL
LCT01	341	238	39.96	0.23	11.4	0.9	44	1.05	2.5	DL	2.3	2.03	0.65	1.80	0.01	0.01
LCT02	367	555	9.25	0.18	3.8	1.1	28	1.00	3.7	0.04	3.0	1.26	1.14	1.20	0.01	0.01
LS01	257	143	6.42	DL	1.4	0.8	29	1.21	1.8	DL	0.9	0.34	0.32	1.54	DL	0.01
LS02	220	212	2.87	DL	1.1	DL	24	0.60	1.8	DL	1.3	0.24	0.28	0.96	0.01	0.01
LS03	333	392	3.06	DL	1.6	0.9	50	0.74	3.4	DL	1.4	0.19	0.10	0.97	0.01	0.01
LG01	431	560	1.35	DL	0.8	DL	29	0.83	4.2	DL	0.7	0.13	0.11	4.57	0.01	DL
LG02	375	361	1.08	DL	1.8	0.9	28	0.70	3.4	DL	1.1	0.09	0.09	0.57	DL	DL
LG03*	390	327	1.49	DL	0.8	DL	28	0.89	3.5	DL	0.5	0.14	0.13	0.80	DL	DL
LG04	347	345	0.67	DL	0.6	1.5	21	0.90	2.8	DL	0.9	0.10	0.13	1.05	DL	DL
LG05	383	536	0.83	DL	1.8	1.1	30	2.42	4.5	DL	3.8	0.10	0.13	0.55	DL	DL
CXC01-A*	425	1352	0.62	DL	1.0	DL	24	1.33	8.2	DL	4.3	0.13	0.11	1.29	DL	DL
CXC01-L	388	568	2.96	DL	1.5	3.4	52	9.37	5.1	1.18	10.3	0.11	0.07	0.35	DL	DL
CXC02	546	1407	1.24	DL	1.1	DL	26	0.84	5.9	DL	1.2	0.12	0.10	1.03	0.01	DL
CXC03	597	1090	0.52	DL	0.7	1.4	22	0.70	6.8	DL	1.3	0.26	0.46	1.46	0.01	0.01
CXC04*	696	931	0.96	DL	0.9	1.2	27	1.43	7.5	DL	0.5	0.12	0.09	0.82	0.02	0.01
LEC01	975	1231	0.32	DL	24.6	0.8	18	0.43	10.3	DL	3.5	0.11	0.18	1.52	DL	0.01
LEC02	452	1015	0.72	DL	0.9	0.7	26	0.77	5.7	DL	0.9	0.09	0.05	1.05	DL	DL
LEC03	506	771	0.68	DL	1.4	1.0	29	0.69	5.6	DL	0.8	0.09	0.08	1.21	DL	DL
LEC04*	717	1968	0.36	DL	0.6	0.7	31	0.87	10.4	DL	1.3	0.06	0.07	1.35	DL	DL
LHC01	795	1607	0.80	DL	0.6	0.9	47	0.45	9.9	DL	1.1	0.08	0.10	0.88	0.01	0.01
LHC02	419	716	0.50	DL	1.1	1.0	24	0.43	5.0	DL	1.0	0.09	0.10	1.28	0.01	DL
LHC03*	710	1217	0.36	DL	0.6	0.8	20	0.49	7.6	DL	0.6	0.06	0.07	1.40	DL	DL
LHC04	734	1131	0.56	DL	1.7	0.9	28	0.46	8.7	DL	0.8	0.06	0.06	1.05	DL	DL
LHC05-L	723	572	1.91	DL	1.5	5.0	37	2.80	6.7	0.03	4.7	0.07	0.10	0.64	0.01	0.03
LDC01-L*	503	339	3.15	DL	1.9	3.4	33	1.99	3.8	DL	4.0	0.12	0.12	0.63	0.01	0.01

Notes: *Results represent the mean of two replicates (see Table 3); L = *Lobaria*; DL = below detection limit.

Table 9. Mean site concentrations of V and Ni in *A. sarmentosa*.

	V (ppm)			Ni (ppm)		
Site	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
CXC (4)	0.84 (0.33)	0.52	1.24	0.92 (0.21)	0.65	1.14
LC (2)	4.60 (1.15)	3.78	5.41	1.50 (0.13)	1.40	1.59
LCT (2)	24.61 (21.72)	9.25	39.96	7.61 (5.32)	3.85	11.37
LEC (4)	0.52 (0.21)	0.32	0.72	6.85 (11.81)	0.57	24.56
LG (5)	1.08 (0.34)	0.67	1.49	1.17 (0.60)	0.64	1.83
LHC (4)	0.56 (0.18)	0.36	0.80	1.01 (0.53)	0.57	1.72
LS (3)	4.12 (2.00)	2.87	6.42	1.37 (0.24)	1.10	1.57

Note: Numbers in parentheses indicate the number of samples included for each site.

Table 10. Mean site concentrations for Mg, Ca, and Sr in *A. sarmentosa*..

	Mg (ppm)			Ca (ppm)			Sr (ppm)		
Site	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
CXC (4)	566 (112)	425	696	1195 (224)	931	1407	7.11 (0.98)	5.93	8.23
LC (2)	273 (27)	253	292	235 (14)	225	245	2.20 (0.32)	1.97	2.42
LCT (2)	354 (18)	341	367	397 (224)	238	555	3.08 (0.85)	2.48	3.68
LEC (4)	663 (237)	452	975	1246 (516)	771	1968	8.00 (2.73)	5.55	10.43
LG (5)	385 (30)	347	431	426 (112)	327	560	3.67 (0.65)	2.82	4.45
LHC (4)	665 (168)	419	795	1168 (366)	716	1607	7.80 (2.05)	5.05	9.87
LS (3)	270 (57)	220	333	249 (128)	143	392	2.34 (0.88)	1.82	3.36

Note: Numbers in parentheses indicate the number of samples included for each site.

Table 11. Mean site concentrations for Zn, Pb and Ba in *A. sarmentosa*.

Site	Zn (ppm)			Pb (ppm)			Ba (ppm)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
CXC (4)	24.8 (1.9)	22.4	26.3	1.15 (0.28)	0.82	1.46	1.84 (1.70)	0.49	4.32
LC (2)	28.1 (4.1)	25.2	31.0	0.74 (0.06)	0.69	0.78	2.62 (2.37)	0.94	4.29
LCT (2)	36.0 (11.8)	27.7	44.3	1.50 (0.42)	1.20	1.80	2.64 (0.44)	2.33	2.95
LEC (4)	25.8 (5.9)	17.5	30.6	1.28 (0.20)	1.05	1.52	1.65 (1.28)	0.82	3.54
LG (5)	27.0 (3.5)	20.9	29.7	1.51 (1.72)	0.55	4.57	1.39 (1.33)	0.55	3.75
LHC (4)	29.8 (12.0)	19.8	47.1	1.15 (0.23)	0.88	1.40	0.87 (0.26)	0.56	1.14
LS (3)	34.6 (13.7)	24.4	50.1	1.16 (0.33)	0.96	1.54	1.20 (0.30)	0.87	1.44

Note: Numbers in parentheses indicate the number of samples included for each site.

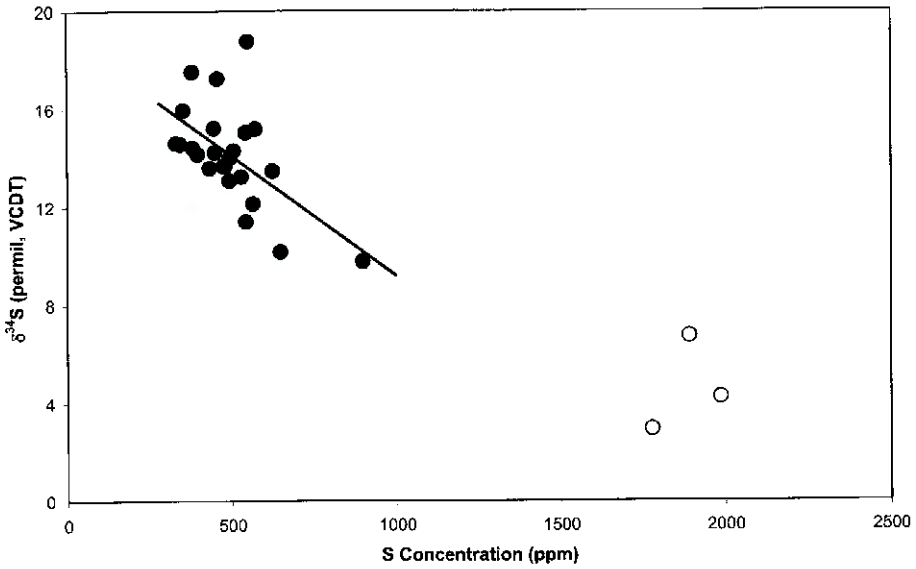

Figure 1. δ^{34}S versus S concentration for *A. sarmentosa* (closed circles) and *Lobaria* sp. (open circles). The linear regression only includes *A. sarmentosa* ($R^2 = 0.300$).

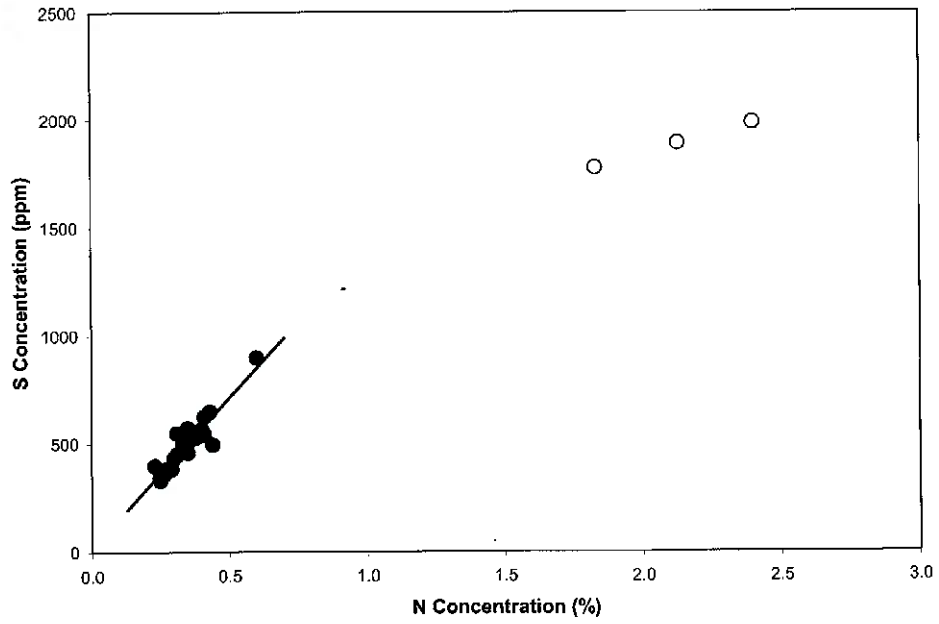

Figure 2. S concentration versus N concentration for *A. sarmentosa* (closed circles) and *Lobaria* sp. (open circles). The regression only includes *A. Sarmentosa* ($R^2 = 0.846$).

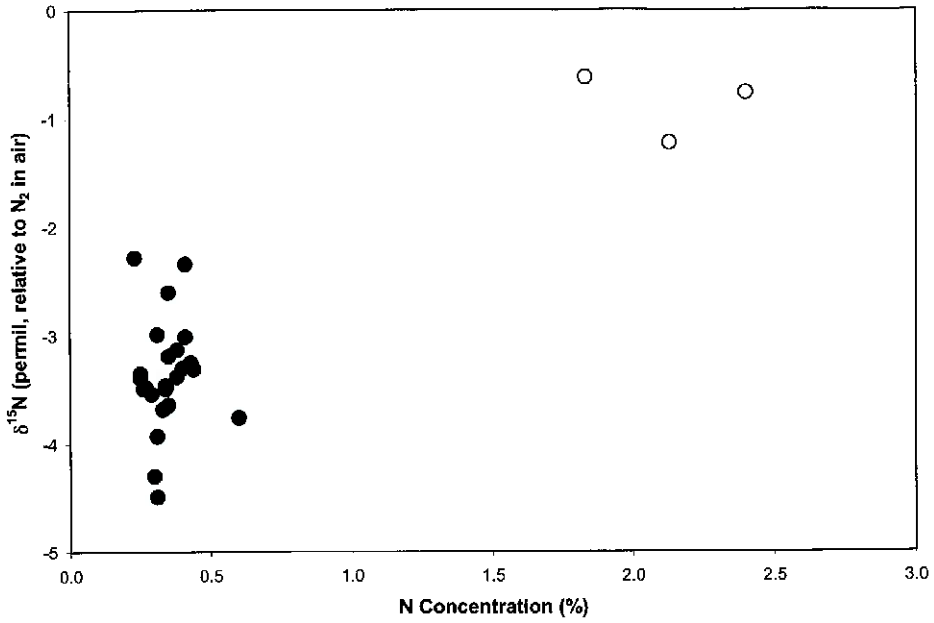

Figure 3. $\delta^{15}N$ versus N concentration for *A. sarmentosa* (closed circles) and *Lobaria* sp. (open circles).

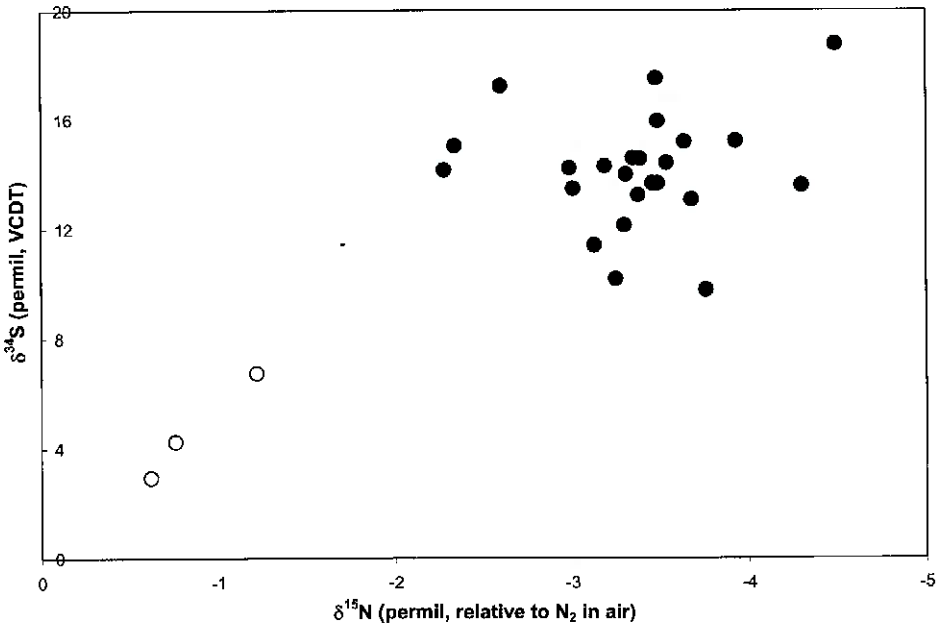

Figure 4. $\delta^{34}S$ versus $\delta^{15}N$ for *A. sarmentosa* (closed circles) and *Lobaria* sp. (open circles).

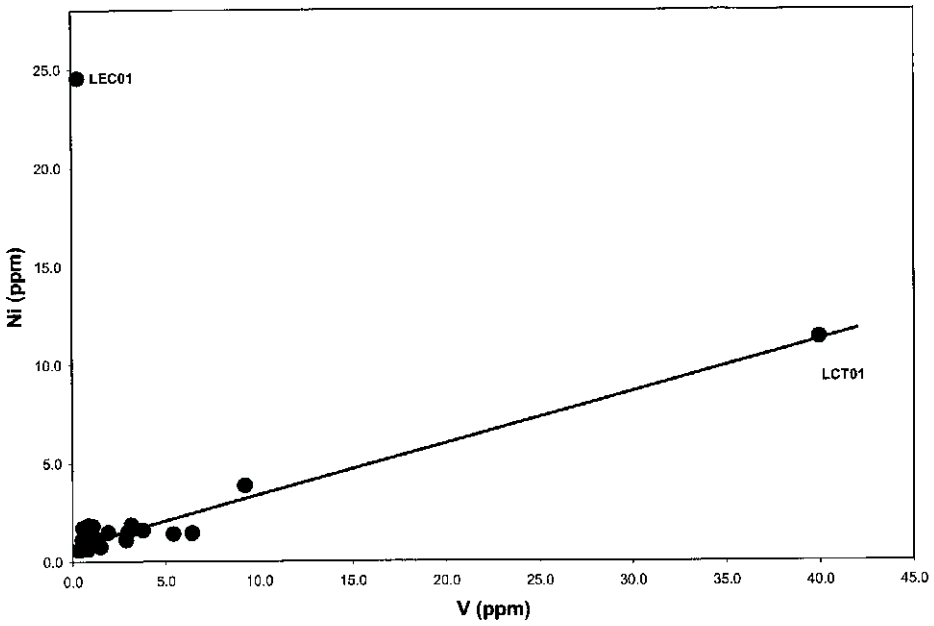

Figure 5. Ni concentration versus V concentration for *A. sarmentosa*. Sample LEC01 has been omitted from the linear regression (R^2 = 0.953).

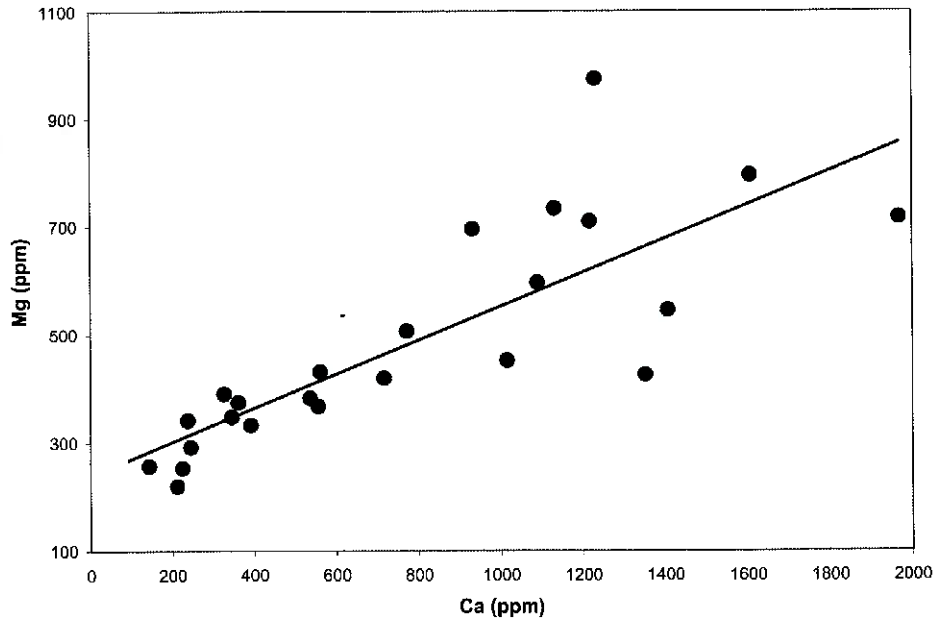

Figure 6. Mg concentration versus Ca concentration for *A. sarmentosa* (R^2 = 0.658).

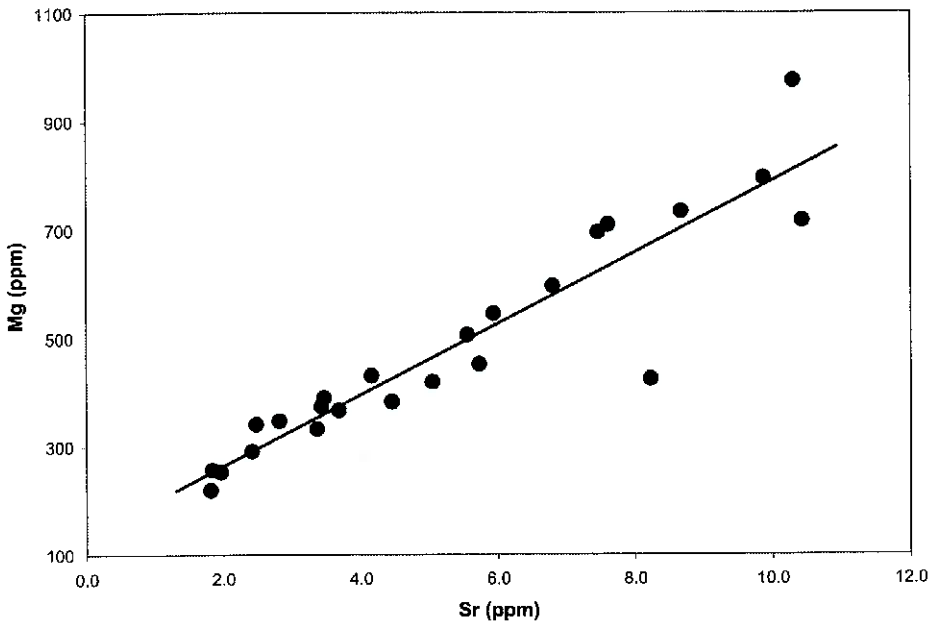

Figure 7. Mg concentration versus Sr concentration for *A. sarmentosa* (R^2 = 0.859).

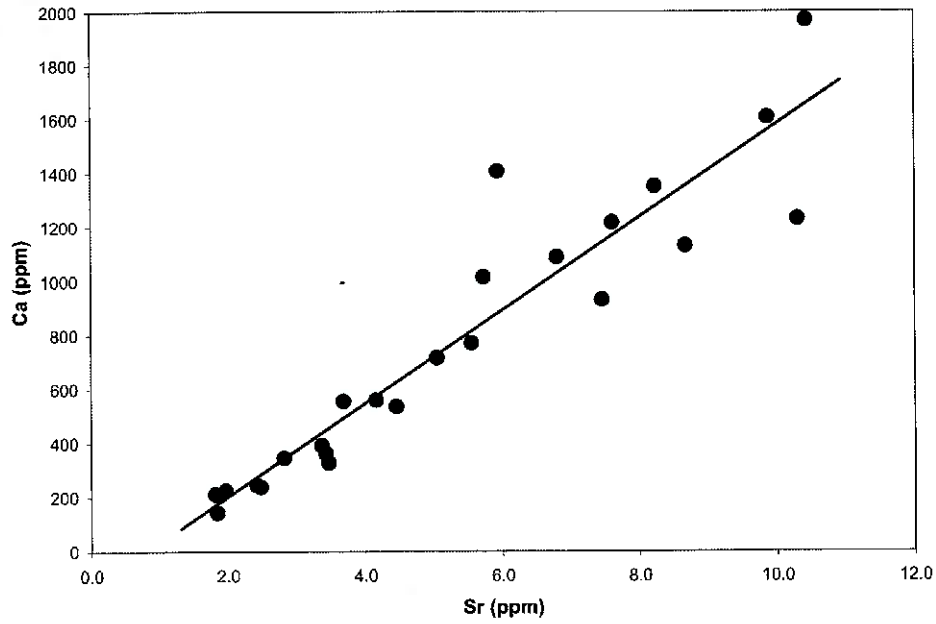

Figure 8. Ca concentration versus Sr concentration for *A. sarmentosa* (R^2 = 0.880).

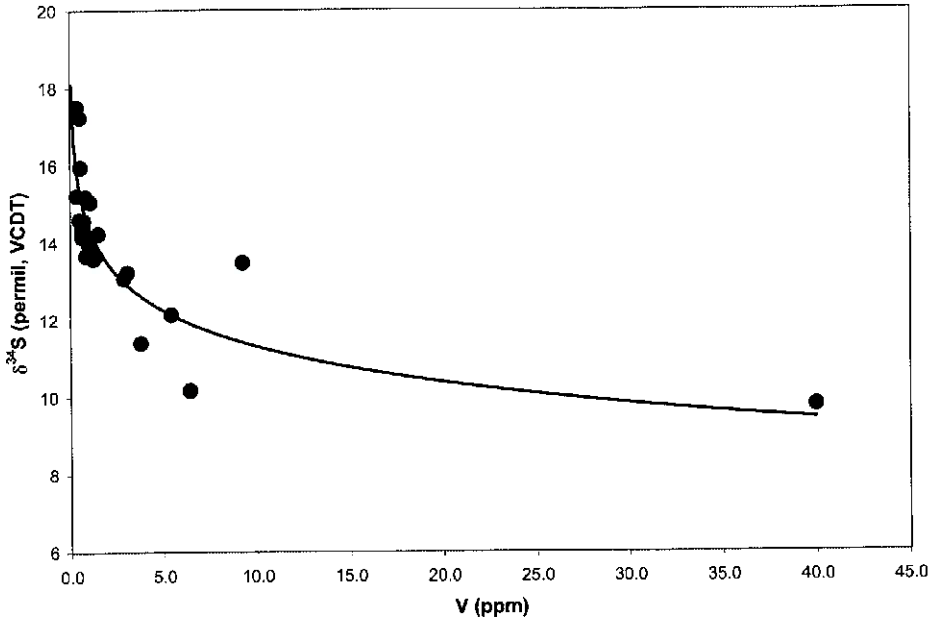

Figure 9. $\delta^{34}S$ **versus V concentration for *A. sarmentosa* (R^2 = 0.722).**

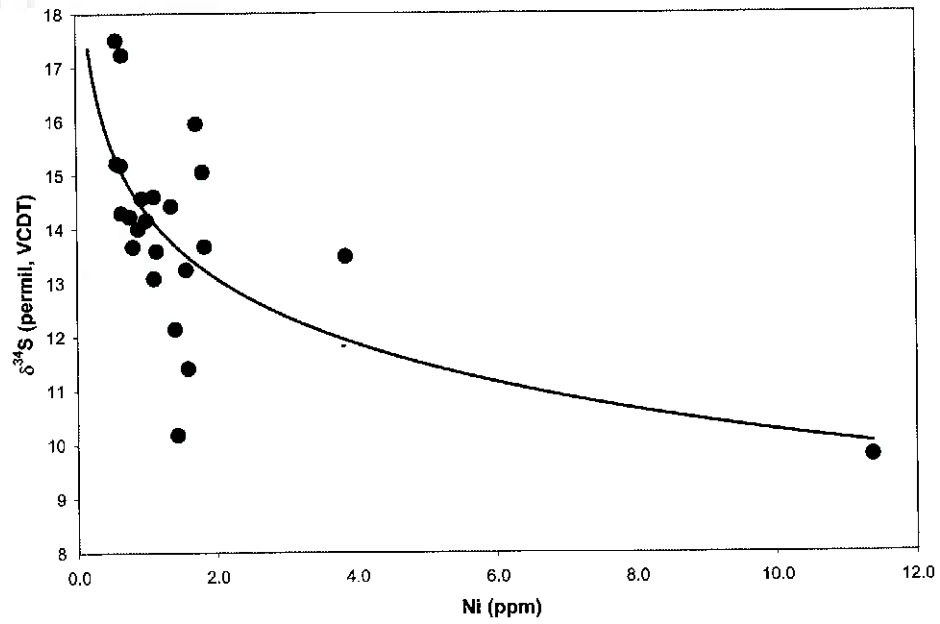

Figure 10. $\delta^{34}S$ **versus Ni concentration for *A. sarmentosa* (LEC01 omitted; R^2 = 0.401).**

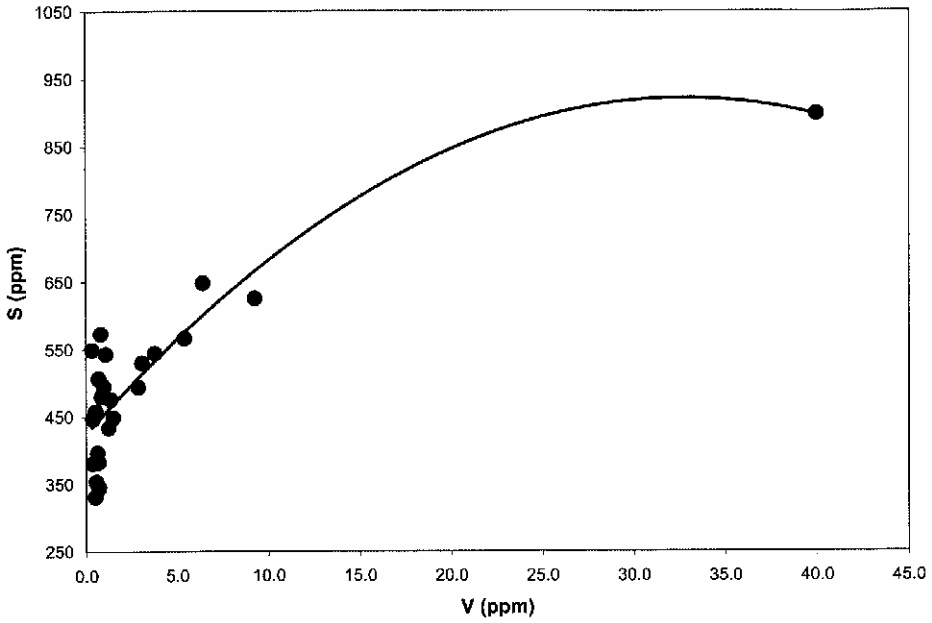

Figure 11. S concentration versus V concentration for *A. sarmentosa* (R^2 = 0.780).

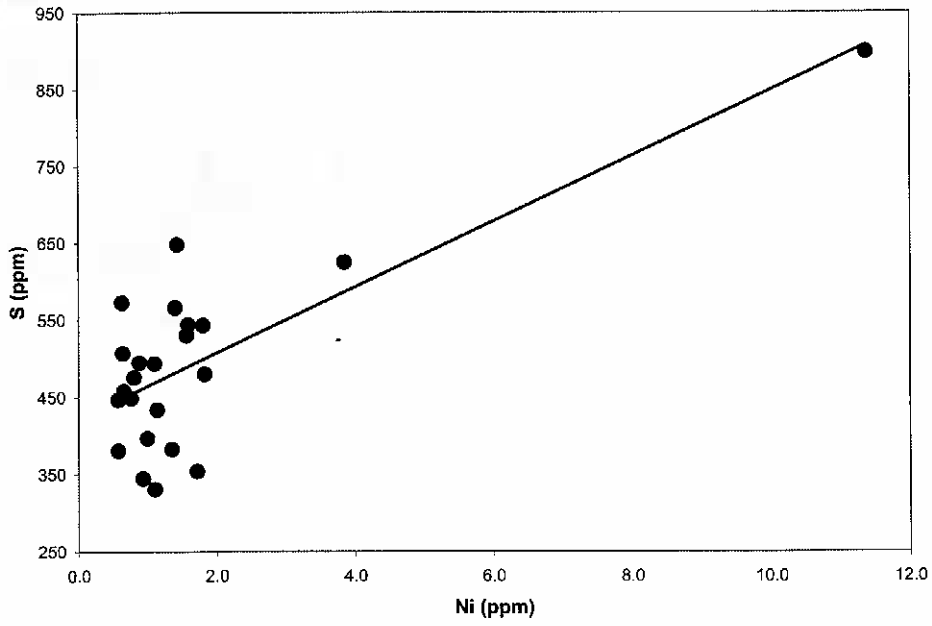

Figure 12. S concentration versus Ni concentration for *A. sarmentosa* (LEC01 omitted; R^2 = 0.593).

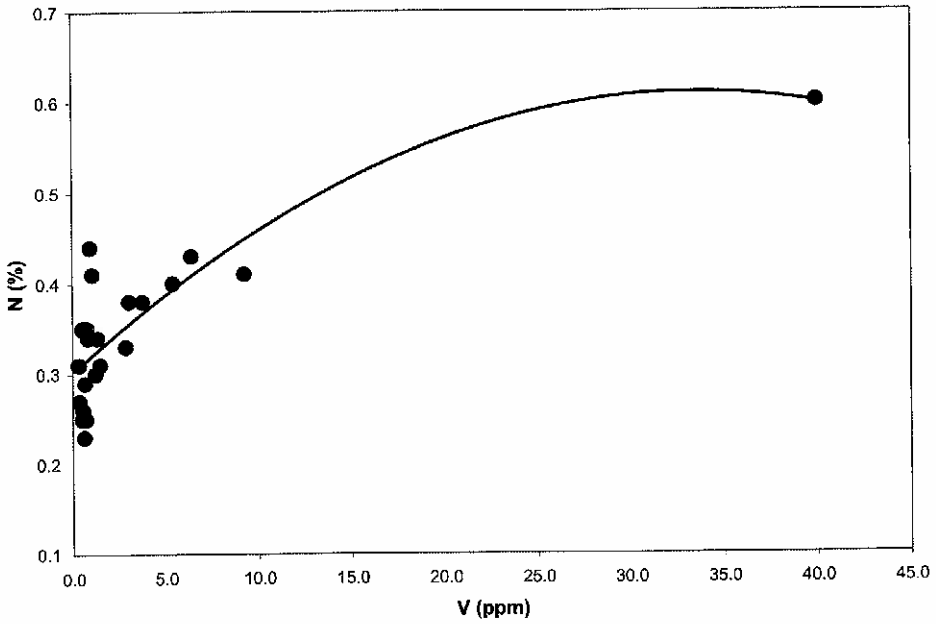

Figure 13. N concentration versus V concentration for *A. sarmentosa* (R^2 = 0.654).

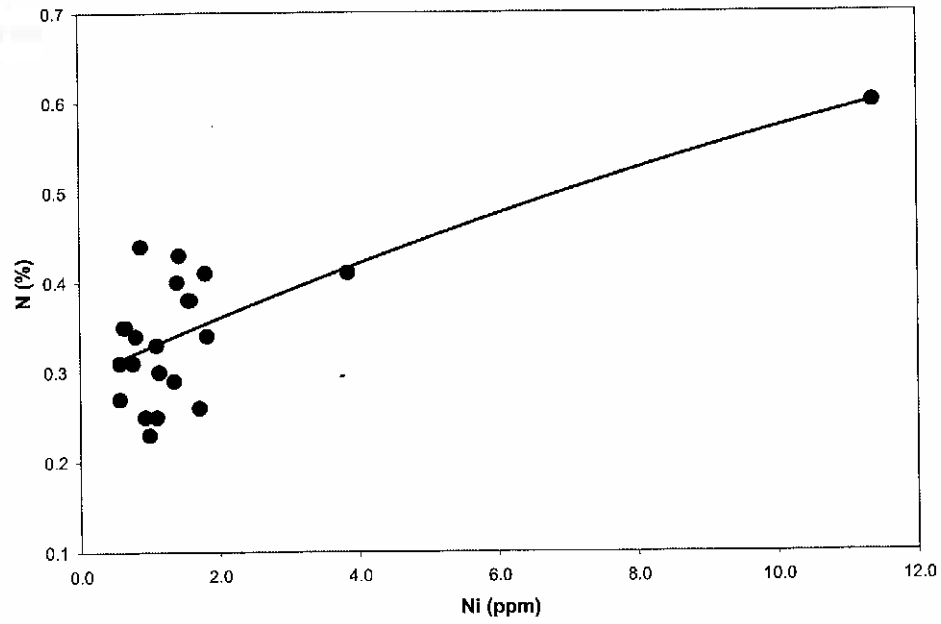

Figure 14. N concentration versus Ni concentration for *A. sarmentosa* (LEC01 omitted; R^2 = 0.524).

Appendix D

Relevant Federal and Provincial Legislation
and Permit List

RELEVANT LEGISLATION (PROVINCIAL)

Environmental Protection Act (2002)

Storage and Handling of Gasoline and Associated Products Regulations (2003)

Gasoline and associated products are to be stored, transferred and disposed so that releases to the environment are prevented.

Used oil shall be collected in a tank or closed container, which is emptied regularly and disposed of in a manner that does not cause pollution.

Used Oil Control Regulations (2002)

Bans unacceptable disposal methods for used oil and used oil filters, controls the storage of used oil and provides for the proper return of used oil and lubricants.

Waste Management Regulations (2003)

Part I – Designates the Multi Materials Stewardship Board as the authority responsible for the implementation and operation of waste management programs.

Part II – Controls beverage container deposits, depots and refunds.

Part III – Prohibits inappropriate disposal of used tires and controls the tire levy.

Air Pollution Control Regulations (2004)

Governs important issues such as Ambient air quality standards, Incineration prohibition, Good engineering stack height, Best available control technology, and Sulphur dioxide emission cap.

Water Resources Act (2004)

Sections 39,4(a) and 61,2(a) - Prohibits the placement, disposal, discharge or presence of any material that may adversely affect a public water supply, including groundwater and well fields.

Environmental Control Water and Sewage Regulations (2003)

Section 4 – Prohibits the discharge of sewage or other effluent into a public sewer or sewer leading into a public sewer containing materials such as oils or oil by-products, flammable, explosive, toxic or poisonous liquids, solids or gases, fats, congealing materials and other substances in quantities that will interfere with free flow within the public sewer.

Section 7 – Prohibits the discharge of pollutants into a body of water.

Dangerous Good Transportation Act (1990)

Requires the implementation of safety standards and labelling during handling and transport of dangerous goods. These requirements are also subject to inspection. The Act reinforces the requirements and prohibitions of the federal *Transportation of Dangerous Goods Act (1992)*.

RELEVANT LEGISLATION (FEDERAL)

Canadian Environmental Protection Act (CEPA) (1999)

Calls for the submission and implementation of pollution prevention plans, when requested by the Minister of the Environment. Regulates the release of toxic substances and calls for the virtual elimination of materials that demonstrate severe negative environmental effects. Controls the disposal of wastes and other materials at sea. Defines restrictions on the movement of hazardous waste, hazardous recyclables, and other non-hazardous materials internationally and interprovincially.

Benzene in Gasoline Regulations (SOR/97-493)

These regulations set limits for the amount of benzene in gasoline and for the benzene emissions number, a calculated parameter that relates gasoline composition to predicted emissions of benzene from vehicles. Manufacturers, blenders and importers of gasoline may opt for limits based on either a batch or on a yearly pool average. The Regulations also prohibit the sale of gasoline with a concentration of more than 1.5% benzene by volume.

Contaminated Fuel Regulations (SOR/91-486)

These regulations prohibit the import and export of contaminated fuel except for the purpose of destruction, disposal and recycling in accordance with applicable federal or provincial law. Potential contaminants in fuel include chlorinated hydrocarbons, including PCBs; heavy metals, including lead, chromium, cadmium, nickel, vanadium, and zinc; sulphur and phosphate.

Environmental Emergency Regulations (SOR/2003-307)

The Environmental Emergency Regulations aim at enhancing the protection of the environment and human health in environmental emergency situations by promoting prevention and ensuring preparedness, response and recovery. They will mandate persons who own or manage specified toxic and hazardous substances at or above the specified thresholds to provide required information on the substance(s), their quantities and to prepare and implement environmental emergency plans.

Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149)

The purpose of the Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations adopted under section 191 of the CEPA 1999 is to protect Canada's environment and the health of Canadians from the risks posed by the transboundary movement of hazardous wastes and hazardous recyclable materials through exports from, imports into, and transit through Canada and to implement Canada's international obligations. The Regulations came into force on November 1, 2005. They revoke and replace the former Export and Import of Hazardous Wastes Regulations (EIHWR) adopted in 1992 under the authority of the former Canadian Environmental Protection Act.

Fuels Information Regulations, No. 1 (SOR/C.R.C., c. 407)

The Fuels Information Regulations, No. 1 were adopted in 1977 to provide EC with information regarding liquid fuel composition, particularly concerning SO2 emissions from combustion. These regulations require annual reporting on sulphur levels in fuels and one-time reporting on non-lead fuel additive content. Additional reporting of additives is required when there are changes. The regulations apply to all fuels in liquid form that originate from crude oils, coal or bituminous sands.

These regulations limit the concentration of lead in gasoline that is produced, imported, sold or offered for sale in Canada and limit the concentration of phosphorus in unleaded gasoline. The Regulations also specify the acceptable analytical methods for determining the concentration of lead and phosphorus in gasoline and impose record keeping and reporting obligations for leaded gasoline.

Gasoline Regulations (SOR/90-247)

The Fuels Information Regulations, No. 1 were adopted in 1977 to provide EC with information regarding liquid fuel composition, particularly concerning SO2 emissions from combustion. These regulations require annual reporting on sulphur levels in fuels and one-time reporting on non-lead fuel additive content. Additional reporting of additives is required when there are changes. The regulations apply to all fuels in liquid form that originate from crude oils, coal or bituminous sands.

These regulations limit the concentration of lead in gasoline that is produced, imported, sold or offered for sale in Canada and limit the concentration of phosphorus in unleaded gasoline. The Regulations also specify the acceptable analytical methods for determining the concentration of lead and phosphorus in gasoline and impose record keeping and reporting obligations for leaded gasoline.

Interprovincial Movement of Hazardous Waste Regulations (SOR/2002-301)

The goal of the Interprovincial Movement of Hazardous Waste Regulations (hereinafter referred to as the Interprovincial Regulations) is to ensure that the Canadian manifest tracking and hazards classification conditions for waste, formerly set out in the Transportation of Dangerous Goods Regulations, are maintained for the interprovincial movements of hazardous wastes.

The Interprovincial Regulations were required as a consequence of the new Transportation of Dangerous Goods Regulations (TDG Regulations), made pursuant to the Transportation of Dangerous Goods Act, 1992. These new TDG Regulations, which came into force on August 15, 2002, no longer included provisions for manifest tracking of hazardous waste.

New Substances Notification Regulations (Chemicals and Polymers) (SOR/2005-247)

The New Substances Notification Regulations (Chemicals and Polymers) are the culmination of an extensive stakeholder consultation on the chemicals and polymers portion of the existing New Substances Notification Regulations (NSNR) and the New Substances Program (NS Program). The purpose of the New Substances Notification multi-stakeholder consultative process was to use the experience of stakeholders to improve the effectiveness and efficiency of the new substances notification and assessment process for chemicals and polymers, while maintaining high standards in the protection of the environment and human health. The Regulations implement consensus-based recommendations from these consultations. The existing NSNR will be repealed and replaced with these Regulations and the New Substances Notification Regulations (Organisms) pursuant to subsections 89(1) and 114(1) of CEPA 1999.

New Substances Notification Regulations (Organisms) (SOR/2005-248)

The purpose of the New Substances Notification Regulations (Organisms) is to implement part of a new regulatory structure for new substances notification under the CEPA. The regulatory structure carves out the provisions related to organisms in the previous New Substances Notification Regulations (NSNR).

Sulphur in Diesel Fuel Regulations (SOR/2002-254)

The goal of the Sulphur in Diesel Fuel Regulations is to ensure that the level of sulphur in diesel fuel used in on-road vehicles in Canada will not impede the effective operation of advanced emission control technologies planned to be introduced on 2007 and later model year vehicles (i.e., in mid-2006) to comply with stringent new exhaust emission standards. This is accomplished by reducing the maximum allowable limit for sulphur in on-road diesel fuel to 15 mg/kg of the fuel, which is equivalent to 15 ppm, commencing June 1, 2006.

Sulphur in Gasoline Regulations (SOR/99-236)

These regulations set limits on the amount of sulphur in gasoline produced, imported or sold. The Regulations limit sulphur in gasoline to an average level of 30 mg/kg with a never-to-be-exceeded maximum of 80 mg/kg.

Transportation of Dangerous Goods Act (TDGA) (1992)

The Act and Regulations require identification of all goods under one of nine categories (Class 1-9), appropriate containers and packaging, and training for all individuals involved in handling dangerous goods.

Section 5 – Prohibits handling, transport or import of goods unless they comply with safety requirements, have the necessary safety marks and are accompanied by applicable documentation.

Section 7 – Requires an appropriate emergency response assistance plan prior to the transport or import of dangerous goods.

Fisheries Act (1985)

Section 35 (2) – Contains a prohibition (HADD) with respect to the "harmful alteration disruption or destruction "of fish habitat. Section 35(2) permits the Minister to issue an Authorization which will permit a "HADD" to occur. The issuance of an Authorization is at the discretion of the Minister; however the "rules" for issuing an Authorization are well established.

Section 36 – Prohibits the discharge of deleterious substances into any type of water frequented by fish.

Petroleum Refinery Liquid Effluent Regulations

Regulations respecting deleterious substances in liquid effluent from petroleum refineries. These regulations fall under the Fisheries Act and apply to every refinery that has not commenced the processing of crude oil prior to November 1, 1973 and that commences processing of crude on or after that date.

Canada Shipping Act (CSA) (1985)

Part XV – Garbage Pollution Prevention Regulations – prohibits the discharge of garbage including solid galley waste, food waste, paper, rags, plastics, glass, metal, bottles, crockery, junk or similar refuse.

Part XV – Oil Pollution Prevention Regulations – Requires that vessels have an installation capable of retaining oil residues on board for subsequent discharge to a reception facility and equipment that meets oily mixture discharge requirements set out in Sections 31 and 33.

Vessel Traffic Services Zones Regulations – Requires that before a ship of a certain size enters a Vessel Traffic Service Zone set out in the regulation the master of a ship shall ensure that a report is made to a marine traffic regulator at least 15 minutes before the ship enters a Vessel Traffic Services Zone.

Migratory Birds Convention Act (1994)

Section 35 – Migratory Birds Regulations – Prohibits the deposit of oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds.

Hazardous Products Act (1985)

The basis for the Workplace Hazardous Materials Information System (WHMIS), which promotes proper labelling of controlled products and requires workers to receive education and training regarding safe storage, use and handling of controlled products.

Marine Security – International Ship and Port Facility Security Code (2004)

Transport Canada has implemented the ISPS Code through the Marine Transportation Security Regulations, which apply to commercial vessels of 500 tons (gross tonnage) or more, or carrying more than 12 passengers and travelling between countries, and marine facilities and ports serving such vessels. The regulations require such things as the completion of security assessments and security plans, and the designation of security officers.

Parks Canada Agency Act

Government of Canada wishes to establish an Agency for the purpose of ensuring that Canada's national parks, national historic sites and related heritage areas are protected and presented for this and future generations and in order to further the achievement of the national interest as it relates to those parks, sites and heritage areas and related programs.

Atlantic Pilotage Authority Non-compulsory Area Regulations

Regulations respecting the establishment, operation and administration of pilotage services within certain of the non-compulsory waters of the atlantic pilotage authority region.

Species at Risk Act

The Species at Risk Act (SARA) was created to protect wildlife species from becoming extinct by providing for the recovery of species at risk due to human activity and by ensuring through sound management that species of special concern don't become endangered or threatened. The act includes prohibitions against killing, harming, harassing, capturing or taking species at risk, and against destroying their critical habitats.

Navigable Waters Protection Act

The Navigable Waters Protection Act governs the federal government's duty to protect the public right of free navigation in Canadian waters. The Act was first passed in 1882, and has not been significantly amended since 1969. The Act prohibits the building or placement of any work in, upon, over, through, or across navigable waters without approval of the Minister of Transport Canada.

Appendix A

Potentially Applicable Provincial and Municipal Authorizations

Regulatory Agency	Permit and/or Regulatory Approval	Activity Requiring Regulatory Approval	Legislation Requiring Compliance
Department of Environment and Conservation			
Environmental Assessment Division	Release from Environmental Assessment	General	Environmental Protection Act • Environmental Assessment Regulations
Pollution Prevention Division	Certificate of Approval for the Construction and Operation of a Refinery	General	Environmental Protection Act
Water Resources Division	Alteration to a Body of Water (Schedule A to H). This application form is required as well as the appropriate Schedule application form (see below).	Any activity in or near any body of water Permit required for any infilling of any water bodies including marine infilling.	Water Resources Act
Water Resources Division	Schedule A - Environmental Approval of Culverts	New road construction	Water Resources Act
Water Resources Division	Schedule B - Environmental Approval of Bridges	New road construction	Water Resources Act
Water Resources Division	Schedule D - Environmental Approval of Fording	Power Line Construction	Water Resources Act
Water Resources Division	Schedule E - Environmental Approval of Pipe Crossing – Water Intake		Water Resources Act

Regulatory Agency	Permit and/or Regulatory Approval	Activity Requiring Regulatory Approval	Legislation Requiring Compliance
Water Resources Division	Schedule F - Environmental Approval of Stream Modification or Diversion	New road construction	Water Resources Act
Water Resources Division	Schedule G - Environmental Approval of Small Bridges	New road construction	Water Resources Act
Water Resources Division	Schedule H - Environmental Approval of Other Alterations	Other works within 15 meters of a Body of Water.	Water Resources Act
Water Resources Division	Certificate of Approval for Site Drainage	Water run-off from the project site.	Water Resources Act
Water Resources Division	Water Use Authorization	Water withdrawal for use during construction and/or operation	Water Resource Act
Water Resources Division	Certificate of Approval – Water & Sewer Distribution System		Water Resources Act • Environmental Control Water and Sewage Regulations
Water Resources Division	Certificate of Approval for Temporary AGM (ARD) Storage		Water Resources Act
Pollution Prevention Division	Certificate of Approval for Industrial Facilities or Processing Work	A certificate of Approval may be required for any industrial or processing works.	Environmental Protection Act
Pollution Prevention Division	Certificate of Approval – Waste Disposal Facility		
	Environmental Protection Plan (EPP) – Construction	Construction, Operation and Decommissioning	
	Emergency Response Plan	Construction, Operation and Decommissioning	
	Environmental Effects Monitoring Plan	Also has to be submitted to Department of Fisheries and Oceans.	

Regulatory Agency	Permit and/or Regulatory Approval	Activity Requiring Regulatory Approval	Legislation Requiring Compliance
Department of Natural Resources			
Forestry Resources Branch	Commercial Cutting/ Operating Permit	Site Clearing and Construction Activities	Forestry Act • Cutting of Timber Regulations
Forestry Resources Branch	Burning Permit	Site Clearing and Construction Activities	Forestry Act • Forest Fire Regulations
Mines and Energy Branch	Magazine Licence		Explosives Act
Mines and Energy Branch	Explosives Transportation Permit		Explosives Act
Mines and Energy Branch	Application for Exploration Approval and Notice of Planned Mineral Exploration Work		Mineral Act
Mines and Energy Branch	Quarry Permit	Quarry Construction and Operation	Quarry Materials Act and Regulations
Mines and Energy Branch	Reclamation Plan (Including Financial Assurance)		Mineral Exploration Standards Regulations
Department of Government Services			
Government Services	Licence to Occupy Crown Land		Lands Act
Government Services	Certificate of Approval – Sewage Treatment Plant	Effluent Discharge	Water Resources Act • Environmental Control Water and Sewage Regulations
Government Services	Certificate of Approval – Water Supply >4,500 L/day		Water Resources Act

Regulatory Agency	Permit and/or Regulatory Approval	Activity Requiring Regulatory Approval	Legislation Requiring Compliance
Government Services	Certificate of Approval – Storage and Handling of Gasoline and associated products.		Environmental Protection Act • Storage and Handling of Gasoline and Associated Products Regulations
Government Services	Permit for Flammable and Combustible Liquid Storing and Dispensing (Above or Below Ground) and for Bulk Storage (above ground only)		Environmental Protection Act • Storage and Handling of Gasoline and Associated Products Regulations
Government Services	Storage Tank System Application	All Storage Tanks on Site Including Waste Oil Tanks.	Environmental Protection Act • Storage and Handling of Gasoline and Associated Products Regulations
Government Services	Compliance Standards – National Fire Code, National Building Code and Life Safety Code	All Buildings on Site.	Building Accessibility Acts and Regulations
Government Services	Building Accessibility Exemption	All Building on Site	Building Accessibility Acts and Regulations

Regulatory Agency	Permit and/or Regulatory Approval	Activity Requiring Regulatory Approval	Legislation Requiring Compliance
Government Services	Statutory Declaration for Registration of Boiler and Pressure Vessel Fittings Fabricated in Newfoundland and Labrador		Public Safety Act • The Boiler, Pressure Vessel and Compressed Gas Regulations
Government Services	**Certificate of Plant Registration** for Power, Heat, Refrigeration, Compressed Gas or Combined Plant		
Government Services	Contractor's Licence – Pressure Piping System		
Government Services	Examination and Certification of Welders and Blazers		
Government Services	Examination and Certification of Propane System Installers		
Government Services	Food Establishment Licence	If a cafeteria is located on site.	Food and Drug Act • Food Premises Regulations
Government Services	Waste Management Plan	General	
Department of Transportation and Works			
Transportation and Works	Compliance Standard – Storing, handling and transporting dangerous goods	General	Dangerous Goods Transportation Act and Regulations
Department of Human Resources Labour and Employment			
Human Resources Labour and Employment	Compliance Standard – Occupational Health and Safety	Project-related employment	Occupational Health and Safety Acts and Regulations

Regulatory Agency	Permit and/or Regulatory Approval	Activity Requiring Regulatory Approval	Legislation Requiring Compliance
Department of Tourism, Culture and Recreation			
Tourism, Culture and Recreation	Compliance Standard – Historic Resources Act	Construction and operation.	Historical Resources Act
Tourism, Culture and Recreation	Archaeological Investigation Permit		Historical Resources Act
Department of Human Resources, labour and Employment			
Human Resources, Labour and Employment	Occupational Health and Safety Manual	General	Occupational Health and Safety Act and Regulations
Town of Come By Chance			
Town of Come By Chance	Compliance Standard/ Development Plan	Project Construction and Operation	Urban and Rural Planning Act
Town of Come By Chance	Approval for Waste Disposal	Waste Disposal	Urban and Rural Planning Act

Potentially Applicable Federal Authorizations

Regulatory Agency	Permit and/or Regulatory Approval	Activity Requiring Regulatory Compliance	Legislation Requiring Compliances
Transport Canada			
Transport Canada	Permit to Store, Handle and Transport Dangerous Goods	Storage, Handling and Transportation of fuel and chemicals	Transportation of Dangerous Goods Act
Transport Canada	Navigable Waters Protection Act (NWPA)	Wharf Construction or any activity affecting navigable waters.	Navigable Waters Protection Act
Transport Canada	Letter of Assessment for Stream Crossings (NWPA)	(any stream crossings)	Navigable Waters Protection Act
Transport Canada	Oil Pollution Emergency Plan	Oil Handling Facility	Canada Shipping Act, Part 8
Department of Fisheries and Oceans			
Marine Environment and Habitat Management Division	Authorization for Harmful Alteration, Disruption or Destruction (HADD) of Aquatic Habitat	Marine - Wharf and Jetty construction and marine infilling. Freshwater - any in-stream or pond work that will impact fish habitat.	Fisheries Act, Section 35(2)
Marine Environment and Habitat Management Division	Letter of Advice	All works affecting fish habitat, i.e., stream crossings, wharf etc.	Fisheries Act
Marine Environment and Habitat Management Division	Project Referral	All works affecting fish habitat, i.e., stream crossings, wharf etc.	Fisheries Act
Department of Fisheries and Oceans	Environmental Effects Monitoring Plan	Also has to be submitted to Department of Environment and Conservation.	

Regulatory Agency	Permit and/or Regulatory Approval	Activity Requiring Regulatory Compliance	Legislation Requiring Compliances
Environment Canada			
Environment Canada	Petroleum Refinery Liquid Effluent Regulations	Authorization of the deposit of a deleterious substance (i.e. Outfall)	Fisheries Act
Environment Canada	Compliance Standard – *Fisheries Act*, Section 36(3), Deleterious Substances	Any project-related water run-off or discharge	Fisheries Act
Environment Canada	Scientific Research Permit (Wildlife Permit)		
Canadian Wildlife Service	Compliance Standard, Migratory Birds Convention Act and Regulations	Any activities which could result in the mortality of migratory birds and endangered species and any species under federal authority.	Migratory Birds Convention Act and Regulations
Industry Canada			
Industry Canada	Communications Licence	General	
Industry Canada	Radio Station Licence	Use of radios on site	

Appendix E

Comments from NLEA and FFAW

07-09-10 Sas For Acknowledgment And Action. Bill — John please do. For Actioning Asp. 14/9/07

Newfoundland and Labrador Environmental Association Inc.
Ship Cove, Placentia Bay, NL
A0B 2Y0 Ph. 709-227-1894

Honourable Clyde Jackman
Minister of Environment and Conservation
Government of Newfoundland and Labrador

September 10, 2007

Dear Minister:

RE: Comments on Proposed New Oil Refinery EIS

The Newfoundland and Labrador Environmental Association (NLEA) wished to respond to your request for public input into the Environmental Impact Statement for the proposed new refinery at Come By Chance head, Placentia Bay.

Overall, we acknowledge that there has been significant work to examine the possible environmental effects of this project. Many of the possible negative effects will require ongoing studies in order to monitor the environment of the Placentia Bay area. Therefore NLEA is requesting that you require the proponent to continue the in-depth studies of marine birds that have been initiated in order that the environmental sustainability of this project can be carefully monitoring. In some cases we envision that this could require the initiation of new studies on species such as seabirds and sea ducks. It is critical that a strong pre-development database is amassed before this development initiates so that pre- and post-development comparisons will be possible.

Thank you for considering our concerns for the environment of this province.

Sincerely,

Stanley F. Tobin
President

Newfoundland Labrador

Government of Newfoundland and Labrador
Department of Environment and Conservation

Environmental Assessment Division

FACSIMILE INFORMATION PAGE

DATE: October 10, 2007

NUMBER OF PAGES INCLUDING COVER: 4

TO: Leslie Grattan

FAX NUMBER: 758-0179

FROM: John Eason

FAX NUMBER: (709) 729-5518

PHONE NUMBER: 1(709) 729-5706

Hi Leslie,

Here, for your information are the comments on the NL Refinery EIS from the FFAWU & Stan Tobin.

Thanks.

Eason

President

FFAW CAW
FISH, FOOD AND ALLIED WORKERS

EARLE McCURDY
President

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DAVID DECKER
Secretary-Treasurer

September 15, 2007

Honourable Clyde Jackman, MHA
Minister of Environment and Conservation
West Block, Confederation Building
P.O. Box 8700
St. John's, NL, A1B 4J6

Re: Comments on the Environmental Impact Statement for Newfoundland and Labrador Refinery Project

Dear Minister Jackman:

Please review the following comments from the Fish, Food and Allied Workers on the Environmental Impact Statement for the proposed Newfoundland and Labrador Refinery Project. Representing the fish harvesters in Placentia Bay, the FFAW have repeatedly expressed their concerns of the potential expansion of industrial development, such as a new refinery.

Fish harvesters are currently forced to deal with heavy marine traffic in Placentia Bay. Contrary to the views of proponents of new developments, the bay is already exceptionally busy. There are over six hundred commercial fishing licenses attempting to continue their traditional livelihood, as they harvest a variety of species throughout the bay.

Fishers are continuously being displaced for new projects in the entire bay through the loss of prime fishing grounds from jetties, docks, anchorages and traffic lanes. They are forced to change their fishing patterns and their routes to their prime fishing grounds because of the shipping traffic in the bay. As a result, the harvesters themselves are faced with the economic losses.

The increase of up to 450 more tankers visiting Placentia Bay, along with the associated tugs and pilot boat activity, would exponentially raise the level of risk on fish harvesters. The bay would be much more susceptible to an accident or catastrophic event.

Environmentally, the increase in vessel traffic would add to probability of a major oil spill, raise the level of pollution of all types and enhance the exposure to *Aquatic Invasive Species*. This issue of Aquatic Invaders has gained some attention recently, due to the identification of Green Crab, although it has been inevitable with the amount of domestic and foreign going vessels to this busy port. From a safety perspective, some harvesters don't fish or navigate the way as they did traditionally. Harvesters cannot fish as effectively or aggressively because of the fear of collisions and gear loss with oil tankers.

The overall cumulative effects these types of developments need to be considered before approval can be issued. Any additional disturbance to the marine ecosystem in Placentia Bay has great potential to adversely affect the diverse fishery that exists today. It is critical to assess the effects of a project such as a refinery in the long-term on the marine environment, combined with the existing activities in the area.

Fish harvesters have navigated the waters of the bay for centuries and must be accommodated before their livelihoods are impacted any further. This will be pertinent in achieving co-existence in the same marine environment.

The Fish, Food and Allied Workers appreciates the opportunity to express the views of their members of Placentia Bay and anticipate these concerns to be addressed.

Sincerely,

Jamie Coady
Fisheries Liaison Co-ordinator

Appendix F

Information Regarding NLRC Fish Habitat Compensation Strategy
Letter to DFO: September 23, 2007
Letter to DFO: October 5, 2007
Compensation Strategy: September 20, 2007

NEWFOUNDLAND AND LABRADOR
REFINING CORPORATION

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September 25, 2007

Environmental Assessment and Major Projects
Oceans and Habitat Management Branch
Fisheries and Oceans Canada
P.O. Box 5667
St. John's NL
A1C 5X1

Attention: Mr. Marvin Barnes, Regional Manager

Dear Mr. Barnes,

RE: NLRC Refinery Project - Freshwater and Marine Fish Habitat Quantification and Compensation Strategy

We are pleased to provide the *Newfoundland and Labrador Refinery Project, Southern Head, Placentia Bay NL Fish Habitat Compensation Strategy* in support of the proposed Development Proposal at Southern Head, which includes a crude oil refinery, a marine terminal and associated infrastructure.

The document reflects the recent discussions with you, Michelle Roberge and others in the Habitat Management Branch and follows the Informational Requirements for the Development of a Compensation Strategy and Plan, as issued by your group in September 2004. The Strategy addresses both freshwater and marine fish and fish habitat. The Strategy document has been prepared based on extensive field surveys, using DFO protocols, in both the freshwater and marine areas that will be potentially affected by the Development Proposal.

As well, during the review of the Southern Head Marine Terminal environmental assessment documents, one of the clarifications sought by your staff included the links, if any, between the information provided from the Fish Habitat Compensation characterization and quantification surveys and the maps of fishing grounds produced by Newfoundland and Labrador Refining Corporation in conjunction with the Fish, Food and Allied Workers union (FFAW).

During discussions between NLRC and fish harvesters during the winter months of 2007, it was recognized by both parties that it would be useful to the assessment of potential effects of the proposed marine terminal on fishing activity to have the fishers' descriptions of the fishing grounds for various species to augment the information available from DFO's geo-referenced data set.

NLRC contracted with FFAW to provide information from the fish harvesters. Anecdotal information was collected by FFAW working with groups of fishers throughout Placentia Bay and outlined on charts of Placentia Bay. NLRC transferred this (hand drawn) information from fishers into digital maps using GIS to provide the maps illustrating the various fishing grounds for several species that are included in the Environmental Impact Statement. The maps do not give information on frequency

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or intensity of use of areas within the overall depiction of fishing grounds. Their purpose was to provide an overall picture of fishing areas, especially as they interact with the traffic lane.

The Fish Habitat Compensation surveys were scientific surveys based on a stringent protocol developed specifically for the characterization and quantification of marine fish habitat. The surveys by divers and by Remotely Operated Vehicle provided statistically sound information on habitat and marine organisms in the area that will be affected by the marine terminal. This information has been provided to DFO and is in the *Marine Fish and Fish Habitat Component Report.*

Fisher harvesters from the Project area have stated that the area directly affected by the marine terminal is fished commercially only for lobster, both historically and currently (EIS, Volume 4, Section 5.3: *Marine Fish and Fish Habitat Component Report*, 2007). This assertion is supported by the information collected during the Coastal Community Resource Inventories facilitated by DFO over the past several years (e.g., the poster for Integrated Management Planning in Placentia Bay). NLRC has committed to working with FFAW and the fishers directly affected by the marine terminal to determine what financial compensation is necessary.

While both sets and types of information are useful to the assessment, they serve different uses and are based upon different objectives, approaches and certainty.

We hope this information provides the information necessary for clarification.

We appreciate the guidance from DFO in developing the Fish Habitat Compensation Strategy and look forward to the further work on the associated Plan.

Yours Truly,
Newfoundland and Labrador Refining Corporation

Bassem Eid, P.Eng., Ph.D.
Manager, Environmental Assessment
Newfoundland and Labrador Refinery Project

Cc: Nick Gillis, Project Manager, SNC-Lavalin
Kjell Rustad, Project Director, NLRC

Attachment

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October 5, 2007

Marine Environment and habitat Management Division
Oceans and Habitat Management Branch
Fisheries and Oceans Canada
P.O. Box 5667
St. John's NL
A1C 5X1

Attention: Mr. Marvin Barnes, Regional Manager

Dear Mr. Barnes,

RE: NLRC Refinery Project - Freshwater and Marine Fish Habitat Quantification and Compensation Strategy - Further Clarification of Commercial Fishing and Fisheries Resources Related to the Marine Footprint of the Project.

This letter provides further clarification requested by DFO regarding NLRC proposed HADD quantification and compensation Strategy. At the September 13, 2007 meeting between DFO (Oceans and Habitat Management Branch) and Newfoundland and Labrador Refining Corporation (NLRC), some concerns were raised with respect to the commercial fisheries information provided within the EIS Document (Volume 4, Section 5.3, and Marine Fish and Fish Habitat Component Study Report, 2007).

The concerns were summarized in a letter dated September 24th, 2007 from Oceans and Habitat Management Branch to BAE-Newplan Group Limited in the following statement:

"With respect to commercial fisheries, information provided to date indicates that a traditional lobster fishery is the only fishery in the area, and that based on conversation with local fishers no commercial fisheries for lumpfish, capelin or scallop are being prosecuted within the boundaries of the project. According to FFAW harvesting data provided to DFO by NLRC during a July 3, 2007, meeting, harvesting of other species – including cod, capelin, blackback flounder, lumpfish, mackerel, herring, squid, scallop, and urchin – may also occur within the area. More detail as to the method and the nature of consultation undertaken to determine key fishing activities within the project area should be provided."

Clarification with respect to the previously submitted commercial fisheries information (particularly the context of the FFAW supplied information) was provided in a September 25, 2007 letter from NLRC to Oceans and Habitat Management Branch. An email response from Oceans and Habitat Management Branch to the aforementioned letter (email from J. Kelly, September 28th, 2007) indicated that additional clarification with respect to commercial fisheries within the projects marine footprint would be required. The following information and attached documents represents a second attempt to clarify the issues and exhausts the informational sources currently available to NLRC. The information provided has been subdivided into the following sections:

1. Clarification of the context of the FFAW commercial fisheries data.

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2. Resubmission of the compensation strategy document with additional historical information with respect to commercial fisheries and fisheries resources within the project footprint from both an historical and current context
3. Information gathered from DFO Fishery Officers from the Placentia Detachment.
4. Information collected from the DFO CCRI Database.
5. Site-specific fish & fish habitat surveys

FFAW Commercial Fisheries Data

In light of the DFO response received (J. Kelly, September 28, 2007) it would appear that FFAW commercial fisheries information collected from fish harvesters is still being weighted heavily with respect to the marine footprint HADD/species utilization determinations.

The FFAW data was collected with the express purpose of providing a general summary of commercial fishing activities within the whole of Placentia Bay, and in particular, within the context of addressing potential conflicts with respect to the marine traffic lanes that would be utilized by vessels traveling to and from the proposed refinery. The data provided by the FFAW did not address site-specific commercial fisheries prosecuted within the marine footprint of the project.

Some of the commercial fishing areas annotated on the "Fish Harvesting Activity Maps" presented within the EIS documentation indicate that commercial fishing for lobster, blackback, capelin, cod, lumpfish, mackerel, herring, squid, scallop, and urchins occur within the project marine footprint. Inclusion of these species within the project footprint is reflective of the "general" nature of the data collection process and subsequent mapping scale provided, but is not reflective of the site-specific information that NLRC has provided within the marine habitat characterization/compensation strategy documents submitted.

The site-specific commercial fisheries information gathered from local fishers, local DFO fishery officers, and DFO's CCRI database all concur that the only commercial species currently harvested within the project marine footprint is lobster (see below). Prior to the cod fishing moratorium (1992) there was a small-scale cod fishery (2-3 cod trap berths annually) in the vicinity of the marine terminal location. The current cod fishery is prosecuted via deepwater gillnets which are set outside the boundaries of the project marine footprint.

NLRC is cognizant of the fact that the FFAW data provided will be incorporated into DFO's decision-making processes, however we respectfully request that the data be viewed and interpreted with respect to the context in which it was gathered and presented.

Compensation Strategy Resubmission

A revised compensation strategy document (*Newfoundland and Labrador Refinery Project, Southern Head, Placentia Bay, NL, Marine Compensation Strategy, dated Sept 20, 2007*) was submitted to DFO Oceans and Habitat Management Branch on September 25, 2007.

The revised strategy has addressed DFO's comments and suggestions presented at our meeting of 13 Sept 2007 as we understood it. It included additional information with respect to current and historical commercial fisheries and fish resources within the project marine footprint. The information presented was "based upon consultations with local fisherpersons, some of whom have

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fished within the project footprint in excess of forty years". While the entirety of document Section 4.1 Habitat Utilization and Fisheries will not be presented, some pertinent points will be emphasized.

The resubmitted strategy document reiterated the conclusions of the previous strategy submission in that the only commercially prosecuted fishery within the project marine footprint is for lobster and the only other species historically (but not currently) fished within the project marine footprint was cod.

It was also confirmed that the majority of the commercial species indicated as being fished within the project marine footprint by the FFAW maps (blackback, capelin, lumpfish, mackerel, herring, squid, scallop, and urchins) were never (within the last 40+ years) commercially fished within the project marine footprint. Local fishers also supported the conclusions of the submitted Marine Habitat Characterization document with respect to fisheries resources that were present in commercially exploitable abundances (lobster). As the strategy document indicates, exploratory/experimental fisheries have been intermittently attempted within the project marine footprint for scallop, lumpfish, and urchin, but the species abundances were deemed to be to low for commercial exploitation.

DFO Fishery Officer (Placentia Detachment) Interviews

Local DFO fisheries officers whose enforcement area includes the area of the project marine footprint were interviewed via telephone on September 27, 2007. The interviewees included Dave Lambert (5 years at the Placentia detachment) and Max Eddy (20+ years at the Placentia Detachment) and permission was obtained to include their comments within NLRC documents.

Both officers confirmed the conclusions presented within the compensation strategy document with respect to the prosecution of commercial fisheries within the project marine footprint. They both concurred that the only current commercially exploited species is lobster and that from an historical context the only other species commercially fished was cod (prior to the 1992 moratorium). They also confirmed that blackback, capelin, lumpfish, mackerel, herring, squid, scallop, and urchins have never been commercially prosecuted within the project marine footprint.

DFO CCRI Database

Information gathered on October 2, 2007 from the DFO CCRI website with respect to TEK (traditional ecological knowledge pertaining to commercial fisheries and the distribution of fisheries resources) also confirmed the conclusions within the compensation strategy document with respect to the prosecution of commercial fisheries within the project marine footprint. The only commercially exploited species indicated within the project marine footprint was lobster and the exploitation zone for cod was situated in deepwater outside the project marine footprint (See attached shellfish, pelagics, and groundfish CCRI maps). The commercially exploited species indicated in the FFAW maps to occur within the project marine footprint (blackback, capelin, lumpfish, cod, mackerel, herring, squid, scallop, and urchins) were not identified as being either commercially fished or as being present in significant abundances based upon the conclusions of DFO's data collection as presented in the CCRI database.

Site-Specific Fish & Fish Habitat Surveys at Project's Marine footprint

As shown in the *Marine Fish and Fish Habitat Component Study (July 2007)* and the relevant sections of the EIS, NLRC has carried out an extensive site-specific Fish Habitat Quantification surveys based on a stringent protocol developed specifically for the characterization and quantification of marine fish habitat. These surveys (by divers and by Remotely Operated Vehicle)

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provided statistically sound information on habitat and marine organisms in the area that will be affected by the marine terminal and marine intake and outfall.

Conclusion

Based upon the information presented above with respect to the commercial exploitation and potentially exploitable commercial abundances of marine fish and shellfish species documented within the project marine footprint, NLRC puts forward the conclusion that the only commercial fishery currently being prosecuted within the footprint is for lobster. Prior to the cod moratorium (1992) there was a small-scale cod fishery prosecuted within the project marine footprint in the vicinity of the proposed marine terminal. Additional information with respect to historical commercial fisheries and fishery resource abundances within the project marine footprint has been presented within the submitted compensation strategy document.

Based upon the above-summarized site-specific information sources (local fisher interviews, local DFO fishery officer interviews, DFO CCRI Data, and the species abundance information presented within submitted marine habitat characterization/compensation documents) we trust that the FFAW data/maps will be viewed in the appropriate context. While cognizant of the fact that the identification of commercial fisheries and fishery resources is only a component in the eventual HADD determination with respect to the project marine footprint, we feel it is critical that all parties are in agreement on this issue so that the process can move forward based upon the best information available.

We hope this above provides the information you have requested.

Yours Truly,
Newfoundland and Labrador Refining Corporation

Bassem Eid, P.Eng., Ph.D.
Manager, Environmental Assessment
Newfoundland and Labrador Refinery Project

Cc: Tilman Bieger, A/Division manager, DFO
Nick Gillis, Project Manager, SNC-Lavalin
Kjell Rustad, Project Director, NLRC

Attachment

Newfoundland and Labrador Refinery Project
Southern Head, Placentia Bay, NL
Compensation Strategy

Submitted to:

Newfoundland and Labrador Refinery Corporation
87 Water Street
St. John's, NL

Submitted by:

Eugene M. Lee
James H. McCarthy
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133 Crosbie Road
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St. John's, NL
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September 20, 2007

TF6116547

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1.0 INTRODUCTION

The Fisheries Act contains a prohibition (HADD) with respect to the "harmful alteration disruption or destruction "of fish habitat. The Act permits the Minister to issue an Authorization (under Section 35 (2)) which will permit a "HADD" to occur. The issuance of an Authorization is at the discretion of the Minister; however the "rules" for issuing an Authorization are well established.

A HADD Authorization will be issued only in accordance with the Policy for the Management of Fish Habitat. This policy has an objective of achieving a "net gain" in the productive capacity of fish habitat in Canada. The Policy has a Guiding Principle of "No Net Loss", i.e. existing fish habitat will be protected, while unavoidable habitat alterations are to be balanced by development of new habitat.

An Authorization must be issued before any action can be taken to destroy fish habitat; even if an authorization is "in process", such action can result in the laying of charges.

In order to receive an Authorization, the following must occur:

DFO determines that a HADD is likely (this determination acts as a "Trigger" for the Environmental Assessment Act). DFO defines a HADD as "any change in fish habitat that reduces its capacity to support one or more life processes of fish".

The Proponent is required to quantify the habitat which will be affected by their undertaking. This quantification must reflect the productivity of the habitat, and take into account the actual and potential use of the habitat by different fish species and life cycle stages. It must also identify all opportunities to avoid or mitigate potential habitat alteration, damage or disruption.

Once the habitat quantification is accepted by DFO, a HADD determination is made, i.e. a formal statement is made identifying the residual habitat which will be lost following the application of all reasonable mitigation measures. This determination establishes the basis for compensation.

The Proponent develops a Compensation Plan in two stages:

A Compensation Strategy
A Compensation Plan

1.1 Compensation Strategy

The following document outlines a Compensation Strategy with respect to the freshwater and marine environment affected by the proposed development of an oil refinery located at South Head, located at the head of Placentia Bay, NL. The document provides a project description, a summary of the affected habitat, a conceptual description of the options selected to provide replacement habitat, and a proposed monitoring program.

DFO criteria for compensation are based on providing for the replacement of impacted habitat with similar habitat, preferably within the same aquatic system. The preferred compensation

options are as follows:

1 Create habitat or increase the productive capacity of **like-for-like** habitat in same ecological unit;
2 Create habitat or increase the productive capacity of **unlike** habitat in same ecological unit; or
3 Create habitat or increase productive capacity of habitat in a **different** ecological unit

Prior to moving between levels in the hierarchy of compensation options, an attempt **must be** made to complete as much compensation as possible under the higher, more preferred levels. The proponent must provide DFO with an acceptable justification for moving down the hierarchy.

2.0 MARINE

The project will require new marine facilities to be constructed to handle large ocean–going oil tanker and bulk carrier vessel traffic.

2.1 MARINE FACILITIES

The new facilities will consist of the following primary elements (see Figure 2.1 – General Marine Terminal Isometric View):

- Marine Wharf
- Heavy Lift Construction Dock
- Tug Berth – Small Boat Basin
- Bulk Materials – Dry Product Berth (Berth #1)
- Jetty Control Building and Emergency Response Warehouse
- Offshore Berthing Facilities
- Access Trestle
- Jetty 1 (Berth #2 and Berth #3)
- Jetty 2 (Berth #4 and Berth #5)

The facility is located to the west and slightly north of Come By Chance Point in Come By Chance Bay. The location has been selected based on available water depth, shelter from prevailing south west wind and ease of maneuvering to and from the berths. Consultations with the local fishermen have impacted the final location of the Marine Terminal based on efforts by NLRC to minimize interruption to local fishing activities.

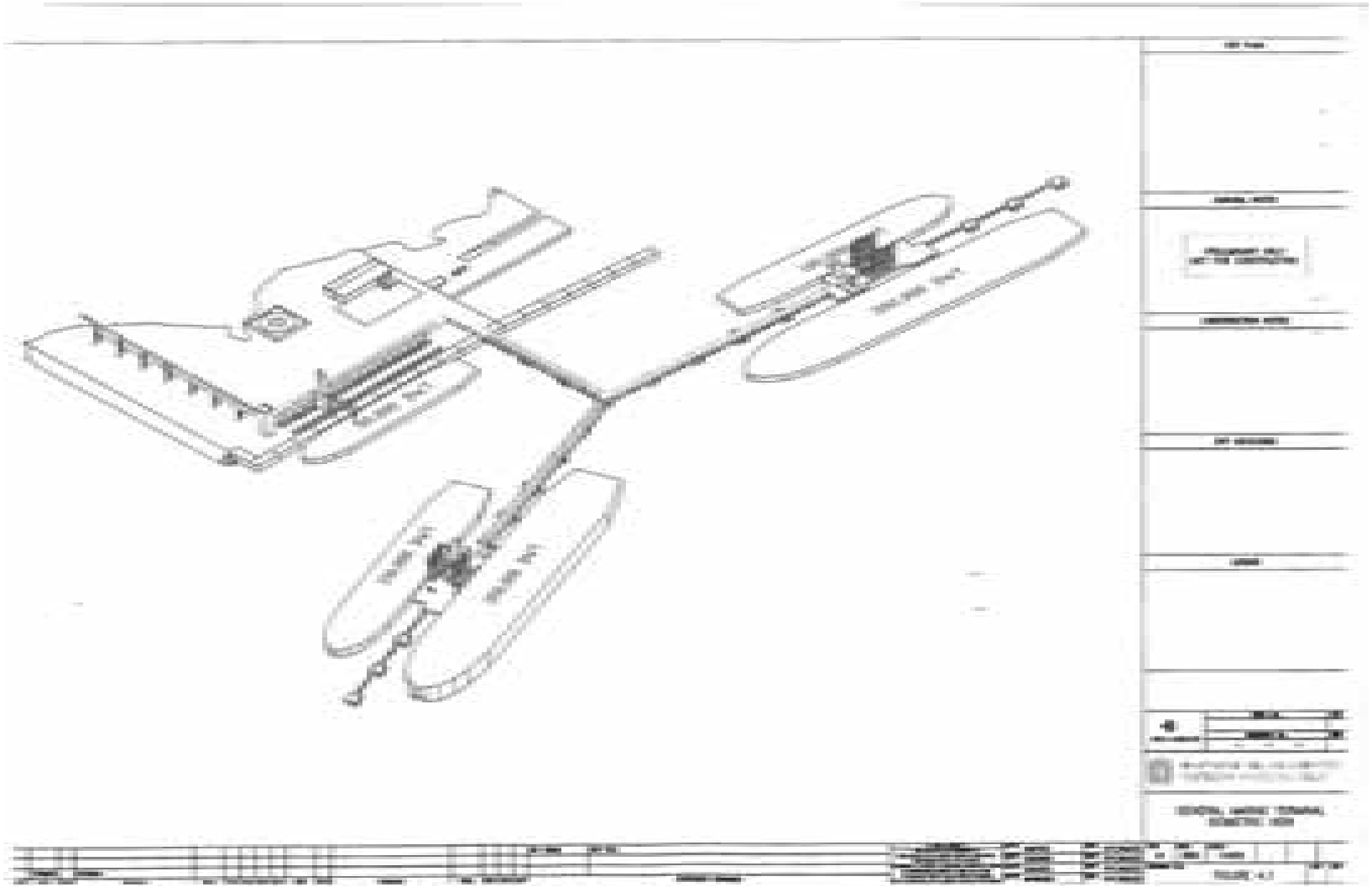

Figure 2.1. General marine terminal isometric view.

The layout and location has been reviewed by the Placentia Bay traffic committee and the Placentia Bay Pilots. Both groups have given favorable comments on the proposed location and layout.

The Marine Wharf facilities comprise all the land–based structures for the marine terminal. These facilities include a tug berth and construction dock, a dry product berth for loading petroleum coke and sulphur products, a small boat basin, central control building and emergency response warehouse. The marine wharf area will be constructed by infilling the existing marine area with rock fill from on–site excavations. The east side will be protected and supported with sheet pile cells or sheet pile bulkhead walls. Armour stone similar to that used in the existing causeway at North Atlantic Refinery will be used as wave protection to the South.

The Heavy Lift Construction Dock will be incorporated into the Tug Berth/Small Boat Basin and will be designed to accept large pre-fabricated modules and construction supplies for the construction phase of the Project. Large deck, low draft barges will be used to transport construction supplies and large construction modules ranging is size from 100 to 5,000 tonnes. Most heavy packages (greater then 100 tonnes) will be transported with roll-on/roll-off barges via multi-wheeled transporters. Heavy packages can be rolled off the side or end of the barge depending on which direction is more advantageous for transport. Smaller packages can be handled by mobile cranes and placed into temporary storage areas on the wharf and from there transported to the main site.

The southern portion of the marine wharf facilities will serve as a dry product berth for the export of sulphur and coke products. This berth will be capable of docking bulk carriers as large as 60,000 DWT and will have a minimum average water depth of 14 m at low normal tide. The berth will service the vessels via a dual stock traveling shiploader with interchangeable telescopic chutes. A closed dual conveyor system and reclaimer will feed the shiploader from the coke and sulphur storage areas. The closed conveyor will eliminate fugitive dust emissions from both products. Handling rates for the dry products will average 2,500 tonnes per hour.

The tug berth is located on the north eastern portion of the marine wharf facilities. The minimum depth at the berth will be 7 m at low normal tide (LNT). Berthing facilities will be provided for tugs sized to handle VLCC size tankers (350,000 DWT) in the sea conditions characteristic of Placentia Bay.

After the construction phase is completed, the area will mainly be used as a tug berth, but will also be used for general docking of barges for unloading of equipment or supplies as needed during operations. The tug berth will also be used during emergency response to launch and dock oil spill response vessels.

The northern portion of the tug berth will serve to dock small sized watercraft (5 m – 15 m length). It will also be equipped with a concrete boat launch ramp for deploying spill response equipment in the event of an emergency. The ramp will also be capable of deploying small rescue craft.

The jetty and offshore berthing portion of the marine terminal is located from 300 m to 400 m from shore and has a total length of approximately 800 m. The facility consists of two (2) offshore Jetties connected to the Marine Wharf area by an Access Trestle.

The access trestle is approximately 100 m long and will form the link between the wharf facilities and the offshore berthing facilities. It will also be used for vehicle access during plant operation to access the jetty loading platforms for operations and maintenance as well as emergency response and firefighting. The access trestle carries the pipe racks for crude and refined products to and from the offshore berths and the refinery tank farm.

2.1.1 Jetty No. 1

Jetty No. 1 will be located in the north eastern corner of the marine facilities area. This jetty will be approximately 400 m long and have two vessel berths. The eastern or seaward berth will be designed to accommodate vessels ranging in size from 20,000 DWT up to 350,000 DWT (VLCC size tankers) will be used as a crude import and product export berth. This berth will have a minimum water depth of 34 m at low normal tide. The western or shore side berth will be designed to accommodate vessels ranging in size from 20,000 DWT up to 105,000 DWT and will primarily be used for the export of petroleum products. This berth will have a minimum water depth of 20 m at low normal tide. Both berths will have sufficient water depth for the largest design vessel when considering fully-loaded draft with wind, wave and tidal conditions at the site.

2.1.2 Jetty No. 2

Jetty No. 2 will be located in the south-eastern corner of the marine facilities. This jetty will be approximately 400 m long and will also have two vessel berths. The eastern or seaward berth will be designed to accommodate vessels ranging in size from 20,000 DWT up to 350,000 DWT (VLCC size tankers) and will be used as both a crude import and product export berth. This berth will have a minimum water depth of 32 m at low normal tide. The western or shore side berth will be designed to accommodate vessels ranging in size from 20,000 DWT up to 150,000 DWT (Suezmax) and will primarily be used for the export of petroleum products but will also be capable of offloading crude from Suezmax size tankers. This berth will have a minimum water depth of 24 m at low normal tide. Both berths will have sufficient water depth for the largest design vessel when considering fully-loaded draft with wind, wave and tidal conditions at the site.

2.1.3 Layout of Jetty

Each marine jetty will include a loading platform incorporating fendering systems, mooring dolphins, and catwalks connecting the mooring and loading platform, a vessel access tower, and other dock structures. Other associated equipment will include the mooring system, cranes, utility and control shack, fire protection systems, spill prevention and containment equipment, and product piping systems.

Large rubber fenders will mounted on the loading platform which forms the fender line, with which the moored ship will be in contact. The fender line is approximately 300 m to 400 m from the shore line. The loading platform is the larger rectangle in the centre of the berth that supports the loading arms, pumps and the utility and control shack. The smaller structures are mooring dolphins, which hold the mooring lines that secure the ship in place at the berth. Ships of various sizes will use the appropriate mooring dolphin to maintain the correct mooring line geometry at the berth.

All structures will be designed to withstand ship berthing loads (the loaded ship bumping the dock and the mooring lines pulling on the dock and mooring dolphins), wave loads, passing

vessel loads and wind loads, all in accordance with recognized national and international standards for the design of marine terminals . The structures will be supported on steel piles or steel jackets complete with a corrosion protection system.

2.1.4 Sea Water Intake

The seawater intake will consist of two (2) 1.2 m diameter high-density polyethylene pipes that will extend from the intake wet well at the shoreline to the seawater collection point approximately 985 m from shore. The pipe will be installed such that it is buried in the inter-tidal zone at the shoreline for protection from erosion and land-fast sea ice. It will be anchored with concrete bocks over the entire exposed length to prevent floating. The depth of the end of the intake will be at 18 m below LNT.

A wedge-wire or V-wire screen (Johnson Screen™) will be used at the end of the intake pipe to reduce the inlet velocity below 0.15 m/s. This reduced inlet velocity protects the surrounding aquatic species and serves to prevent debris from clogging the screen. The screen is also equipped with an air cleaning system in which a periodic blast of compressed air is backwashed through the screen assembly to remove any accumulated debris. The screen material will be selected specifically for the application to prevent corrosion and biofouling.

Water that passes through the intake will enter a wet well at or near the shoreline where the intake pumps will pump it through a pressurized water line to the treatment system.
The peak seawater intake rate is estimated to be 43,320 USgpm (2.73 m^3/s). This is made up of sea water cooling tower makeup and desalination intake (Table 2.4.1).

Table 2.4.1 Sea Water Intake Flow Rates

Seawater Intake	
Sea Water Cooling Tower Makeup	13,300 USgpm (0.84 m^3/s)
Desalination Intake	30,020 USgpm (1.89 m^3/s)

The desalination plant will provide a total of 3,000 USgpm (0.19 m^3/s) fresh water requirements for the refinery.

2.1.5 Effluent Outfall

Wastewater from the refinery that has been treated in the wastewater treatment plant will be discharged through an ocean outfall that will extend to a depth of –18.0 m below LNT. The pipe has a diameter estimated to be 1.2 m and will consist of a solid HDPE pipe to –15.0 m below LNT. After that point, 100 mm diameter diffuser check valves will be installed on the pipe at a spacing of 1000 mm. A total of 100 discharge ports will be required to provide sufficient dispersion of the wastewater in the current conditions at the discharge site.

The pipe will be anchored to the ocean floor using a series of concrete weight blocks. The section of the pipe containing the diffusers will be leveled either using a pad of washed granular material or concrete pedestals depending upon the characteristics of the ocean floor in that area.

The total length of the pipe is estimated to be 405 m. The estimated total wastewater discharge through the outfall during operations is 42,518 USgpm (2.68 m^3/s).

2.2 HABITAT CHARACTERIZATION

On behalf of Newfoundland and Labrador Refinery Corporation, a qualitative and quantitative characterization of the marine habitat was conducted within the footprint of proposed marine facilities associated with the construction and operation of the Newfoundland and Labrador Refinery Project located near Southern Head at the head of Placentia Bay, Newfoundland.

For the purposes of the marine habitat quantification, the project area was divided into four distinct zones (Figure 2.2) including:

- Zone 1 - Marine Terminal/Tug Berth;
- Zone 2 - Marine Jetty;
- Zone 3 - Marine Water Intake; and
- Zone 4 - Marine Outfall.

The marine habitat characterization included substrate distributions, depth profiles, macrofauna and macroflora distributions, and baseline sediment and water chemistry. A complete and detailed habitat characterization based upon *DFO's Interim Marine Habitat Information Requirements* is provided in *AMEC (2007) Newfoundland and Labrador Refinery Project, Southern Head, Placentia Bay, NL, Marine Habitat Characterization*. For the purposes of clarity within the habitat compensation strategy document, habitat information has been summarized in a more general format.

The habitat characteristics of the four zones are summarized in the following sections.

2.2.1 Zone 1 – Marine Terminal/Tug Berth

The marine habitat of Zone-1 Marine Terminal and Tug Berth was representative of a semi-exposed marine ecosystem. Shelter is provided to the west and north via the backshore land mass. The wave exposure fetches are approximately 3 km to the west (eastern shoreline of Come By Chance Harbour), 13 km to the south (Merasheen Islands Archipelago). It should be noted that the Merasheen Island Archipelago, due to its unconsolidated nature provides only partial shelter.

The shoreline consisted of small cobble/gravel beaches with scattered boulder and bedrock margins (50 to 100 m in width) rising to steep rock cliffs in the backshore interspersed with rocky headlands (10 to 40 m in width). Shoreline surveys quantified 5 beaches and 8 headlands within Zone 1.

Generalized substrate distributions within the entire zone consisted of cobble and small boulder (25 to 125 m; mean 70 m) from the shoreline. Following this, the southern portion of Zone 1 (T-1, T-2, T-3, T-4) transitioned into a region of coarse gravels interspersed with occasional bedrock outcrops (15 to 90 m; mean 55 m) followed by a region predominated by sand and fine gravel (75 to 165 m; mean 111 m). The northern section of Zone 1 (T-5, T-6, and T-7) transitioned from the nearshore cobble and small boulder to a region typified by sand and fine gravels (115 to 130 m; mean 115 m).

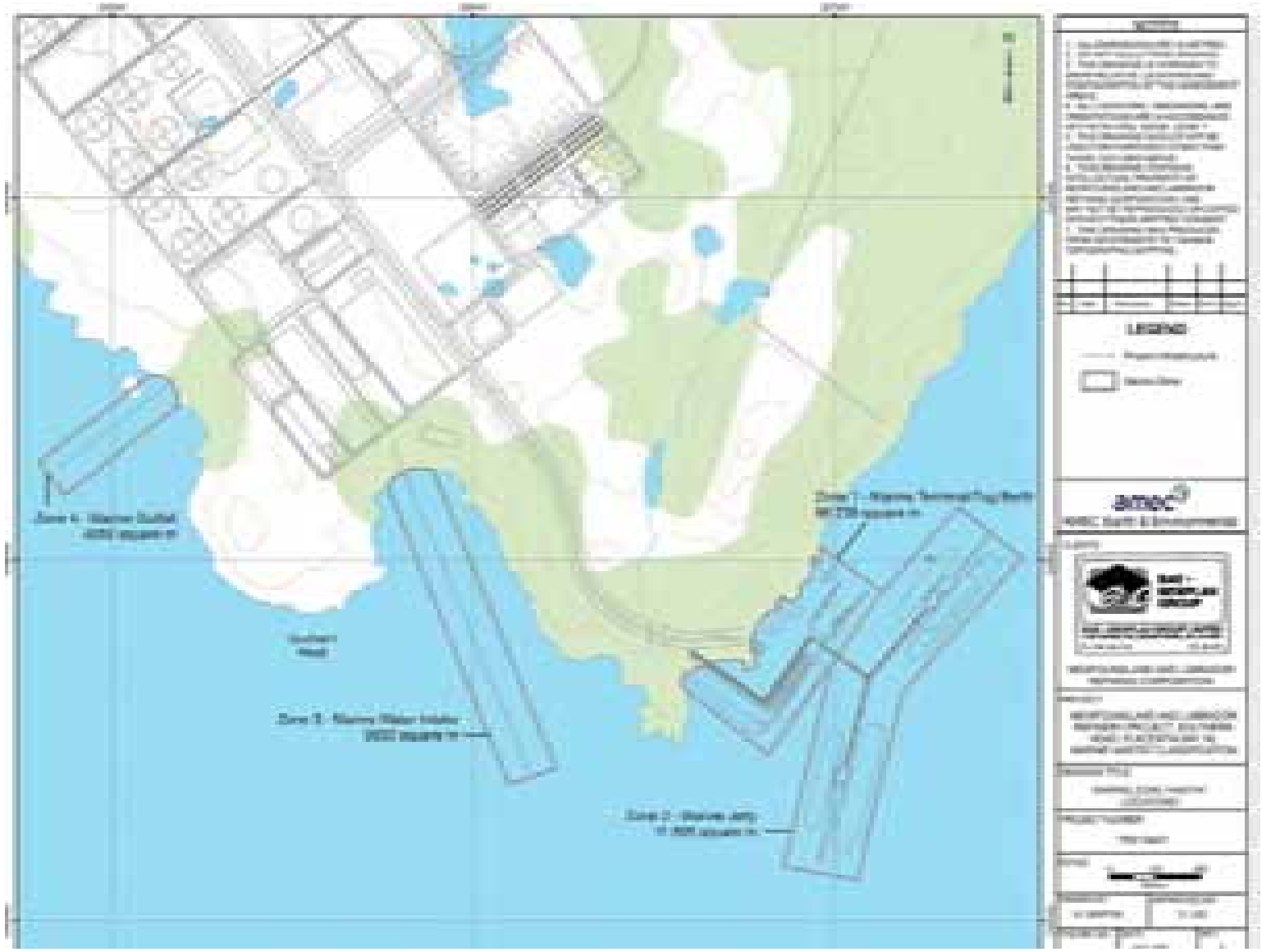

Figure 2.2. Proposed marine terminal footprint.

Sea urchins and starfish in low to moderate numbers were ubiquitous on both hard/coarse and soft/fine substrates from the shoreline to the outer limits of Zone 1. Slightly higher numbers of urchins were associated with sections consisting primarily of large boulder and bedrock. Blue mussels and horse mussels were encountered sporadically on large boulders and bedrock outcrops. Horse mussels were generally encountered in deeper water (10+ m) although blue mussels were also encountered further out on the transect lines on the tops of large boulders. Periwinkles were observed primarily on large substrates within 50 m of the shoreline in water depths < 10 m but were also observed on large shallow substrates at greater distances.

Species encountered more sporadically on large substrates (independent of depth) included frilled anemone in low to high numbers and low numbers of tube worms (1-2 per transect line). Eleven winter flounder observed within Zone 1 were usually associated with gravel and sand substrates. Sand dollars were encountered in moderate to high numbers in association with fine gravel and sand substrates. Deep-sea scallop in abundances ranging from 0-6 individuals per 5 m section and three American plaice were encountered primarily on soft substrates along the furthest reaches of the transect lines (deeper water).

Species encountered infrequently included hermit crab, barnacles (large substrates), sponge, and northern lobster (one individual in a crevice).

Crustose algae was consistently encountered on hard substrates in densities ranging from <25 to 50%. Sour weed was also ubiquitous (< 25 to 75%) on all substrates except fine sand although the highest densities were usually observed on small boulder substrate. Edible kelp (*Alaria sp.*) was commonly observed (<25 to 100%) on large substrates with the highest densities generally associated with the shoreline and intertidal areas. Sea colander was occasionally observed in deeper water at distances greater than 100 m from the shoreline.

Shoreline algal species were dominated by rockweed and knotted wrack interspersed with lesser amounts of green filamentous, black whip weed, sea lettuce, coral weed, red tubed weed, and dulse.

Species observed infrequently included ribbed lace, *Halosaccion sp.*, laver, and ribbon weed.

2.2.2 Zone 2 – Marine Jetty

The marine habitat of Zone 2 Marine Jetty was representative of a semi-exposed, open water, marine ecosystem. Shelter is provided to the west and north via the backshore land mass. The wave exposure fetches are approximately 3 km to the east (eastern shoreline of Come By Chance Harbour), 13 km to the south (Merasheen Islands Archipelago). It should be noted that the Merasheen Island Archipelago, due to its unconsolidated nature provides only partial shelter. Approximately 250 m of the southwestern extent of T-8 is exposed to a 9 km wave fetch to the west (Sound Island).

Substrates were uniform throughout the entire zone consisting primarily of sand with small amounts of gravel and isolated small boulders.

Sea urchins, starfish and deep-sea scallop were consistently encountered in relatively low numbers on sand and gravel substrates throughout the entire transect length. Scallop densities averaged approximately one to three individuals per five meter transect section. Species observed infrequently included American plaice (five individuals), Atlantic cod (three individuals), skate (one individual), frilled anemone, and tube worms.

Crustose algae was encountered sporadically on T-8 and T-10 in association with intermittent cobble and boulder substrate. Sour weed and edible kelp were noted upon isolated hard substrates on the shoreward portion (100 m) of T-10. Storm tossed sour weed, sea colander, kelp (*Laminaria sp.*), and rockweed were noted sporadically throughout the entire section.

2.2.3 Zone 3 – Marine Water Intake

The marine habitat of Zone 3 Marine Water Intake was a combination of both a semi-sheltered (approximately the first 400 m from shore) and semi-exposed (the remaining 560 m) marine ecosystems. Shelter for the first 400 m is provided to the north, west, and east via the shoreline of Hollets Cove. The southern wave exposure fetch is approximately 13 km with partial shelter provided by the Merasheen Islands Archipelago. Shelter for the remaining 560 m is provided to the north via the backshore landmass and to the east via Come By Chance Point. The southern wave exposure fetch is approximately 12 km with partial shelter provided by the Merasheen Islands Archipelago.
The western wave exposure fetch is approximately 8 km to Sound Island.

Substrates from the shoreline to 60 m were predominantly cobble with lesser amounts of sand and gravel with isolated small boulder and bedrock. From 60 m to 470 m substrates were primarily gravel and sand with lesser amounts of cobble and isolated boulder. From 470 m to 960 m substrates were larger, consisting of large bedrock outcrops interspersed with small boulder and gulches dominated by cobble.

Sea urchins and starfish were consistently encountered throughout the entire (960 m) transect length. Horse mussels, blue mussels, and frilled anemone were sporadically encountered on large boulder and bedrock substrates. Species encountered infrequently included hermit crab (one individual), eel pout (two individuals), deep-sea scallop (one individual), and polychaetes (one individual).

Crustose algae was consistently encountered on all hard substrates from 200 m to 960 m. Sour weed was fairly abundant on all substrates from 10 m to 630 m. The predominant shoreline and intertidal species were species were edible kelp, kelp (*Laminaria sp.*), black whip weed, hollow green weed, smooth chord weed, coral weed, green filamentous, red tubed weed, and rockweed. Sea colander were noted to occur from over the outside transect portion from 260 to 910 m. Intermittent species included red fern and banded weed.

2.2.4 Zone 2 – Marine Outfall

The marine habitat of Zone 4 Marine Outfall was representative of a semi-exposed marine ecosystem. Shelter is provided to the north via the backshore land mass and to the west via Southern Head. The southern wave exposure fetch is approximately 13 km with partial shelter provided by the Merasheen Islands Archipelago. The western wave exposure fetch is approximately 6 km to Sound Island.

Substrates from the shoreline to 40 m were predominantly small boulder with lesser amounts of cobble and gravel and isolated small boulder. From 40 m to 200 m substrates were primarily bedrock and large boulder interspersed with cobble and gravel. From 200 to 330 m substrates were dominated by sand and gravels with occasional cobble patches.

Sea urchins and starfish were consistently encountered on all substrates throughout the transect length. Deep-sea scallop were encountered in densities ranging from one to two individuals per five meter transect section. Sand dollars and were encountered on sections of fine substrate. Periwinkles were encountered on large substrate within the shoreline/intertidal zone. Blue and horse mussels, frilled anemone, and barnacles were observed sporadically on large substrates. Species observed infrequently included hermit crab (one individual), winter flounder (two individuals, and skate (two individuals).

Crustose algae was encountered consistently on hard substrates and sour weed on all substrates throughout the transect length. Edible kelp was noted in the shoreline/intertidal area and in a narrow band from 100 to 120 m. Shoreline/intertidal species included rockweed, knotted wrack, coral weed, red fern, sea lettuce, black whip weed, and green filamentous.

2.3 MARINE PROJECT FOOTPRINT

The following marine footprints are an estimate based upon preliminary design and drawings provided by NLRC. Pending final design and on site marine surveys the numbers presented may vary considerably. The current marine footprint estimates are as follows (Figure 2.2):

- Zone 1 – Marine Terminal/Tug Berth = 86,238 m^2
- Zone 2 – Marine Jetty = 11,695 m^2
- Zone 3 – Marine Water Intake = 9,850 m^2
- Zone 4 – Marine Outfall = 5,050 m^2

2.3.1 Habitat Utilization and Fisheries

Based upon survey data and consultations with local fisherpersons, some of whom have fished within the project footprint in excess of forty years, it has been ascertained that lumpfish, capelin, urchins, and scallop are not present in commercial quantities and are not commercially fished within the boundaries of the four zones encompassing the proposed marine facilities.

A lumpfish fishery was attempted for two seasons approximately 10 years ago within the area of the project footprint. Catch rates were low and the commercial prosecution of lumpfish was deemed to be not economically viable. Lumpfish gear has not been set within the project footprint in intervening years and lumpfish were not observed on any of the habitat characterization video transects.

Capelin (a seasonal pelagic species) has occasionally been reported in the vicinity of Zone 3 – Marine Water Intake (Hollets Cove). However, local information indicates that they are not present in significant numbers and do not “spawn/roll” on the coarse beach material (cobble/gravel/bedrock). In addition to this, the complexity of the bedrock outcrops and large boulders that are interspersed throughout Hollets Cove are not conducive to commercial seining. Capelin is not commercially fished within the project footprint. Historical anecdotal information from fisherpersons who lived in the area of the project footprint (prior to resettlement in the late 1960’s) indicates that the small unnamed cove located immediately to the west of Come By Chance Point and to the east of Hollets Cove was known as an area where capelin would “spawn/roll” in intermittent years. However, field surveys revealed a fairly coarse substrate (cobble/gravel) now characterizes this beach and there are no reports of capelin “spawning/rolling” in this area in recent memory.

Urchins were ubiquitous throughout the project footprint, although the densities were low with distributions primarily categorized as “uncommon” (0 to 4 individuals per 5 meter transect section) and “occasional” (5 to 15 individuals per 5 meter transect section). Exploratory dives by commercial harvesters conducted in the past (approximately ten years ago) within the Southern Head area indicated that commercial quantities of urchins were not present. There is currently no commercial harvest of urchins in the general area and field surveys have verified the lack of commercial urchin abundances within the project footprint.

Deep-sea scallop were observed in relatively low numbers (maximum densities of one to three individuals per five meter survey section) primarily in the soft sand and gravel substrates in the vicinity of Zone 2 – Marine Jetty. Deep-sea scallop were observed intermittently at lower densities at various points along transect lines within Zones 1, 3, and 4. Local fisherpersons report that commercial scallop draggers fishing within Placentia Bay have occasionally conducted “exploratory” drags within the vicinity of Zone 2 - Marine Jetty but catch rates were insufficient to warrant a commercial fishing effort.

A seasonal cod gillnetting fishery (with a bycatch of American plaice and Winter flounder) is prosecuted primarily in the deeper waters (20-30 m +) located outside Zone 2 – Marine Jetty and the outer reaches of Zone 3 – Marine Water Intake and Zone 4 – Marine Outfall. Historically (before implementation of the moratorium in 1992) there were two to three cod traps set from the shoreline within and in the vicinity of the project footprint. Winter flounder and American plaice are also fished occasionally for lobster bait via gillnets that are set in deep water outside the project footprint.

Herring and mackerel (seasonal pelagic species) are both fished commercially via fixed and mobile gear at various locations within Placentia Bay. Both species are sold on the commercial market and utilized as shellfish pot bait. Neither species is known to occur in commercial quantities within the project footprint and local fisherpersons were not aware of any significant herring or mackerel fishing within or in the immediate vicinity of the project footprint.

Although lobsters were not observed in significant numbers within Zones 1, 2, 3, or 4 the nearshore areas are known to contain viable lobster habitat. Due to the primarily nocturnal nature of lobster movements it is common for them not to be observed during daylight video surveys. Lobster is the primary commercial fishery currently conducted within the project footprint. This is evidenced by the large numbers of lobster pots observed during the survey period and the long timeline of the traditional lobster fishery in the area. Information from local fisherpersons indicates that lobster catches have declined in recent years and that the decline is most likely attributable to over exploitation of the limited resource.

There are no recreational fishing/harvesting activities known to occur within the project footprint. The annual recreational cod fishery (via handline) occurs primarily in deep water outside the project footprint.

2.3.2 Compensation Habitat Selection

Based upon the results of field surveys, consultations with local fisherpersons, and discussions with DFO Habitat Branch it is suggested that the targeted habitat with respect to both a potential marine HADD determination and habitat compensation issues would be that utilized by the various life stages of lobster (*Homarus americanus*).

Post-larval/juvenile inshore habitat utilized by lobster generally consists of gravel/cobble substrates at depths of 5-10 m, although (1+) juveniles also utilize finer sediments at depths up to 20 m (Palma et al. 1999). Hudon (1987) reported that a variable cobble substrate best protected newly settled and small juveniles (< 100 mm carapace length).

Adult lobster prefer a combination of coarser substrates (large cobble and boulder) and to a much lesser extent, finer substrates that permit burrowing (more typical of offshore populations). Typical adult habitat is further enhanced by the presence of kelp beds and suitable rock crevices. Newfoundland inshore lobster do not exhibit any large-scale migration behaviour. They do exhibit small-scale movements to slightly deeper waters in fall/winter and back to shallower regions in spring/summer, probably in response to storm episodes, increased turbidity and seasonal changes in water temperature (Ennis 1983; 1984). Large juveniles and adult lobster are essentially nocturnal with most feeding and territorial movements occurring at night (Christian 1995).

The inshore fishery in Newfoundland and Labrador is carried out with traps in depths generally less than 15 to 20 m during spring to early summer.

2.3.3 Compensation Habitat Quantification

Lobster habitat quantification was predicated upon the utilization of a variety of substrate types by the various life stages of lobster commonly encountered within the inshore environment. These included cobble, boulder, and coarse gravels based upon the following rational.

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The habitat quantification also considered the preferred lobster prey species identified throughout the survey area. Large juvenile and adult lobsters feed primarily on benthic invertebrates including, crabs, sea urchins, mussels, polychaetes, periwinkles and starfish. The area to be impacted by the refinery marine facilities will also affect habitat for the important prey species which support lobster and thereby the subsequent fishery.

The lobster habitat quantification process was based upon detailed habitat information presented in *AMEC (2007) Newfoundland and Labrador Refinery Project, Southern Head, Placentia Bay, NL, Marine Habitat Characterization*. The quantification was based upon calculating the linear percentages of suitable (cobble/boulder/coarse gravel) and unsuitable (bedrock/sand/fine gravels) lobster habitat within each individual transect (Table 4.3.1). All transects were included within the quantification process except T-13 and T-14 which were

horizontally oriented within Zone 1 – Marine Terminal/Tug Berth. The area represented by T-13 and T-14 was already quantified via the more representative perpendicular transects T1 through to T-7. Transects were then grouped according to the appropriate habitat zone with respect to the project footprint and the individual percentages were combined to provide the percentage of suitable lobster habitat for each individual zone.

Lobster habitat percentages for each individual zone and a habitat compensation estimate are provided in Table 4.3.2.

Table 4.3.1: Lobster habitat quantification for individual transects and habitat zones, Newfoundland and Labrador Refinery Project, South Head, Placentia Bay.

Transect	Zone	Include	Rational	Transect Length (m)	Portions Suitable (m) (Cobble/Boulder/Gravel)	Portions Unsuitable (m) (Bedrock)	Portions Unsuitable (m) (Sand/Fine Gravel)	Total Length Suitable (m)	Total Length Unsuitable (m)	Lobster Habitat (%)
T-1	1	Yes	Adjacent Terminal Infill Footprint	300	0-125 125-180 (50%)	210-300 125-180 (50%)		152.5	147.5	51%
T-2	1	Yes	Within Terminal Infill Footprint	250	0-70 85-155	70-85 155-225	225-250	140	110	56%
T-3	1	Yes	Within Terminal Infill Footprint	200	15-70 80-125	0-15 70-80	125-200	100	100	50%
T-4	1	Yes	Within Terminal Infill Footprint	200	0-25 105-115	25-105	115-200	35	170	18%
T-5	1	Yes	Within Terminal Infill Footprint	170	0-40 (50%) 40-90	0-40 (50%)	90-170	70	100	41%
T-6	1	Yes	Within Terminal Infill Footprint	200	0-85		85-200	85	115	43%
T-7	1	Yes	Adjacent Terminal Infill Footprint	200	0-65 120-145		65-120 145-200	85	115	43%
T-8	2	Yes	Marine Jetty Footprint	700			0-700		700	0%
T-9	2	Yes	Marine Jetty Footprint	700			0-700		700	0%
T-10	2	Yes	Marine Jetty Footprint	200			0-200		200	0%
T-11	3	Yes	Marine Intake Footprint	950	0-60		60-170 170-960	60	890	6%
T-12	4	Yes	Marine Outfall Footprint	330	0-40	40-200	200-330	40	290	12%
T-13	1	No	Covered by Perpendicular Transects I	585	NA	NA	NA	NA	NA	NA
T-14	1	No	Covered by Perpendicular Transects	NA	NA	NA	NA	NA	NA	NA

Table 4.3.2: Lobster habitat percentages and habitat compensation estimates, Newfoundland and Labrador Refinery Project, South Head, Placentia Bay.

Zone	Lobster Habitat (%)	Estimated Footprint (m^2)	Compensation Estimate (m^2)
1 – Marine Terminal/Tug Berth	43%	86,238	37,082
2 – Marine Jetty	0%	11,695	0
3 – Marine Water Intake	6%	9,850	591
4 – Marine Outfall	12%	5,050	606
		TOTAL	**38,729**

Suitable lobster habitat percentages were estimated to be 43% for Zone 1 – Marine Terminal/Tug Berth, 0% for Zone 2 – Marine Jetty, 6% for Zone 3 – Marine Water Intake, and 12% for Zone 4 – Marine Outfall (Table 4.3.2). Based upon the estimated footprints provided by Newfoundland and Labrador Refining Corporation the resulting potential lobster habitat compensation estimates are 36,670 m^2 for Zone 1 – Marine Terminal/Tug Berth, 0 m^2 for Zone 2 – Marine Jetty, 591 m^2 for Zone 3 – Marine Water Intake, and 606 m^2 for Zone 4 – Marine Outfall (Table 4.3.2). This results in an overall compensation estimate of 38,729 m^2 or 193 habitat units (200 m^2).

2.4 PROPOSED MARINE COMPENSATION STRATEGY

Based upon these guiding principals it is anticipated that placement of rock fill/armor stone associated with construction of the marine terminal and tug berth, marine jetty, marine water intake, and marine water outfall will provide the required compensatory lobster habitat. This will increase the habitat complexity of the general area and provide material of a diameter ranging from 0.3 m (rock fill) to 1.0 m (armor stone) that will be utilized by the various life stages of lobster.

This will constitute the application of Option 1, the creation of like-for-like habitat within the same ecological unit. The actual volume and extent of rock fill/armour stone placement will be based upon the final construction engineering specifications to be provided by North Atlantic Refining Corporation. The rock fill/armour stone to be utilized for construction purposes will be clean, non-acid generating granite of appropriate size preferably obtained from the nearby construction site.

The final determination of habitat created will be determined in consultation with DFO Habitat Branch and will be predicated upon the volume of rock fill/armor stone placed within a depth profile of greater than two meters.

If it is determined that placement of rock fill/armor stone will be insufficient in achieving the amount of habitat compensation required, Newfoundland and Labrador Refining Corporation is prepared to enter into discussions with DFO to assess the applicability and effectiveness of alternative methods to be employed within the same ecological unit. These would include, but not necessarily be limited to the creation of artificial reef habitat or the augmentation of habitat in relation to other species such as deep-sea scallop by increasing habitat complexity via the strategic deposition of scallop shells.

The increase in complexity provided via the placement of rock fill/armour stone will also be beneficial to other flora and fauna known to utilize the marine habitat within the project footprint. This would include species which have the potential for commercial prosecution such as lumpfish, sea urchin, and whelk. Other species which will benefit from the increase in habitat complexity include blue mussels, horse mussels, starfish, anemones, barnacles, rock crabs, and tube worms.

Marine fauna will also benefit from the increase in habitat complexity provided by the mixture of substrates (0.3 m to 1.0 m) in that new attachment sites will become available. Survey transect data revealed that the distribution of the various fauna within the project footprint was closely linked to the availability of larger substrates (coarse gravels, cobble, boulder, and bedrock). The placement of the rock fill/armour stone should substantially increase the distributions and biomass of marine fauna which will in turn increase the habitat complexity and shelter available to numerous invertebrate and fish species.

All compensation activities and concepts will be performed in consultation and cooperation with DFO Habitat Branch and adjacent stakeholders.

2.5 PROPOSED MONITORING STRATEGY

If required by DFO Habitat Branch, a monitoring program will be employed to monitor the structural stability and habitat utilization of newly created lobster habitat.

The monitoring program would consist of but not necessarily be limited to the following:

- Video and photographic surveys
- Visual inspections (monitoring any structural changes)
- A record of flora and fauna related succession with respect to utilization of the new habitat
- A record of lobster utilization of the new habitat.

In addition to the scientific/quantifiable monitoring initiatives it is also anticipated that local lobster fishers will be involved in the monitoring process. This will involve the collection of quantifiable replicate fishing data with respect to lobster populations both within and outside of the newly created lobster habitat.

Monitoring performance criteria will consist of three components which include:

1. verification of the structural stability of the created lobster habitat;
2. verification of the utilization and succession of flora and fauna associated with the created lobster habitat; and
3. verification of the utilization of the created habitat by the various life stages of lobster.

3.0 FRESHWATER

The major onshore components of the Project will include a refinery processing facility, storage tanks and pipelines, sulphur and coke storage/export facilities, utilities, infrastructure, support systems as well as water treatment facilities. Details of these facilities are provided in the Project Registration document (NLRC 2006).

As stated in DFO guidance documents, the proponent should initiate the development of a Compensation Strategy by outlining one or more possible opportunities. Each compensation opportunity should be realistically assessed in terms of its position in the Hierarchy of Preferred Options, feasibility, value toward achieving No Net Loss, economic viability and public acceptability. More than one of the options from the Hierarchy of Preferred Options may be used in compensating for the loss of freshwater fish habitat.

3.1 EXISTING ENVIRONMENT

The following section provides a summary of the existing environment in the Southern Head area. Extensive surveys of the Project area were conducted during the period 2006/7 as part of the baseline characterization. These surveys included sampling for fish species presence/abundance, habitat mapping, hydrological data collection, water and sediment quality surveys.

The targeted habitat with respect to a freshwater HADD determination was conducted using the *Standard Methods Guide for the Classification/Quantification of Lacustrine Habitat in Newfoundland and Labrador* (Bradbury *et al*. 2001) and the *Classification and Quantification of Fish Habitat in Rivers of Newfoundland and Labrador* (McCarthy *et al*. 2007). A summary of the baseline characterization is provided below to provide an overview of the existing aquatic environment within the proposed Project area and footprint. Readers are referred to the individual baseline and component studies for further details.

3.1.1 Species Present

Fish species recorded during Southern Head studies in the proposed Project Area include brook trout (*Salvelinus fontinalis*), Atlantic salmon (*Salmo salar*) and American eel (*Anguilla rostrata*). Several DFO documents summarize the general biology of each species for use in habitat quantification (see Bradbury *et al*. 1999 and Grant and Lee 2004).

3.1.2 Drainage Basins In and Near The Project Footprint

There are a total of five drainage basins within the Southern Head area with all five being directly within or near the footprint of the proposed refinery (Figure 3.1). Provided below is a general description of the existing environment within each of the potential basins within the Project footprint. It should be noted that all other streams and ponds within the project footprint not identified below are not considered fish habitat as they did not contain fish or were small overland flooded flows with no suitable habitat.

Holletts Brook (Tributary T1)

Holletts Brook (T1) and its tributary stream, T1-1 are located on the southwest side of Southern Head. It is a small drainage area directly within the footprint of the proposed refinery which flows south and drains into Holletts Cove, Placentia Bay.

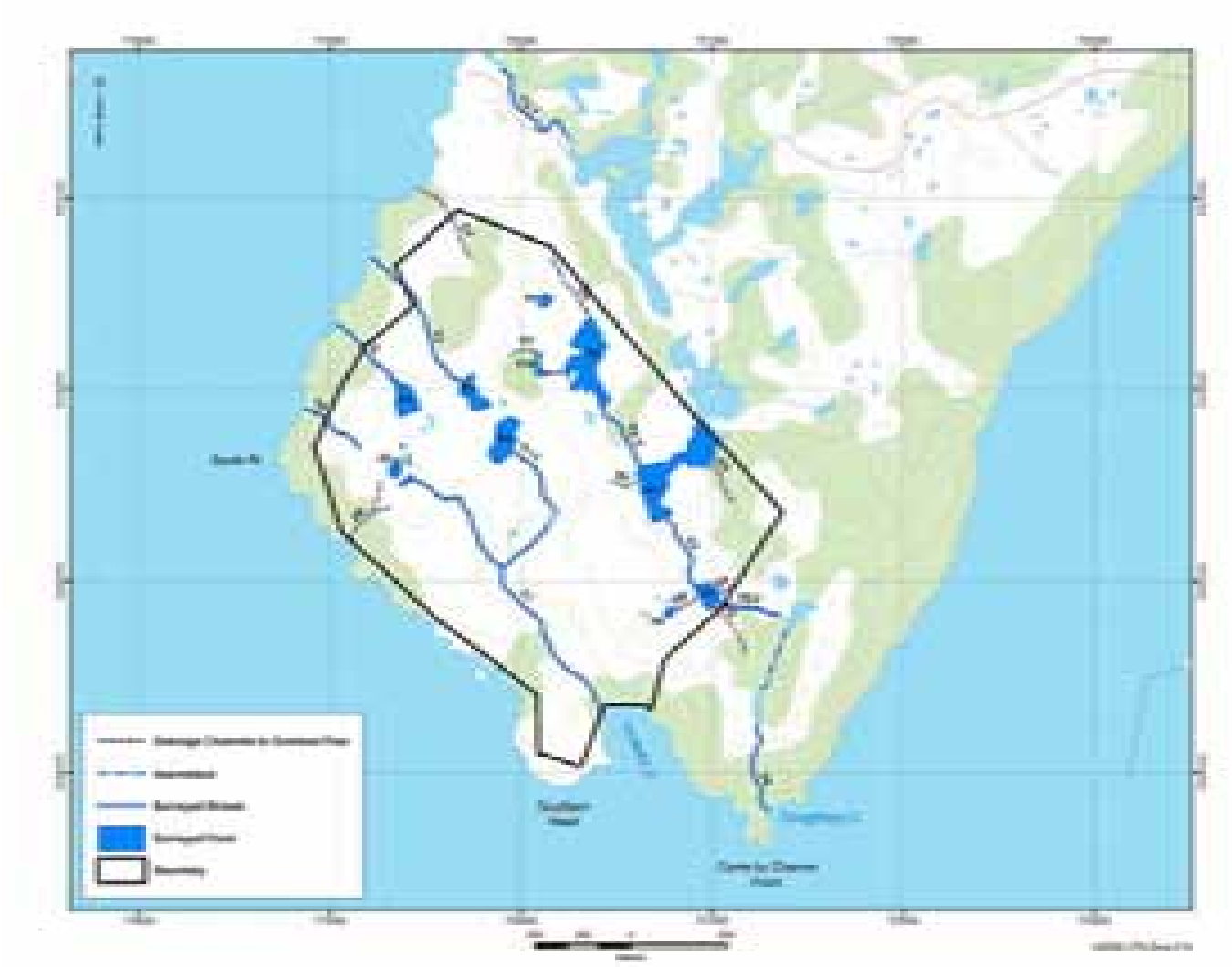

Figure 3.1. Ponds and streams within the general Project Area.

It extends approximately 2km inland from its outflow at the southern tip of Southern Head and drains approximately 1.5km^2 (40% of the Project footprint area). Sample streams T1 and T1-1, when combined, measure a total of 2,412m in length (all within the project footprint).

Holletts Brook, and its small tributary, flows primarily through sections of open bog and grassy overland flood flows. Both streams have riparian vegetation consisting of predominantly gramminoids with some conifers. The substrate composition of stream T1 is mostly bedrock and gravel. The substrate composition of tributary T1-1 was predominantly detritus and rubble. Both follow the surficial contours of the bog and for the most part have gradients of less than 10%.

The habitat within Holletts Brook was classified as 3.83 units of Steady, 12.78 units of Riffle, 4.04 units of Run, 0.61 units of Rapid and 0.67 units of Pool. The small tributary was classified as containing 0.84 units of Riffle and 0.20 units of Steady. The remainder consisted of flow over grass (i.e. overland flow) that would be dry during low flow periods and hence is not considered fish habitat.

Both brook trout and American eel were captured in Holletts Brook during electrofishing surveys.

Watson's Brook (T2, T2-1 and T2-2)

Sample streams T2, T2-1 and T2-2 are part of the Watson's Brook drainage basin. The drainage area within the footprint is small (1.24km^2) which drains the northeastern portion of the footprint (Figure 3.1). The area within the footprint comprises 4.2% of the Watson's Brook drainage basin (total drainage of 29.86km^2). All reaches within the project footprint flow through sections of bog with shoreline vegetation consisting mostly of gramminoids and conifers. Substrate throughout is predominantly rubble and boulder.

T2 itself drains from a small bog pond (Pond P7) on the eastern edge of the footprint to a larger pond (Pond P1) on the northern edge. It has a total length of 409m (all within the project footprint), has an average gradient of less than 2.5% and contains a considerable quantity of overland flow. The habitat within T2 was classified as 0.72 units of Riffle, 0.70 units of Run and 1.52 units of Pool. There were also 1.29 units of flow over grass.

Tributary T2-1 originates outside the eastern edge of the project footprint. It is a small tributary that empties into the eastern side of Pond P7. The stream itself measures approximately 343m in length and only the first 37 m of the stream falls within the Project footprint, however, any alteration to the first 37 m of this stream will more than likely result in fish being unable to access the remainder of the stream. For instance, the headwater ponds feeding this stream drain through the upland bog for a distance before the stream begins to take shape; as such fish are considered not to have access to the stream from headwater ponds and therefore must gain access from below. The shoreline vegetation is made up entirely of gramminoids and conifers. The stream for the most part was well defined and, with the exception of reach 4, had an average gradient of less than 5%. The habitat within the entire tributary was classified as 1.21 units of Riffle and 0.56 units of Cascade and 0.29 units of flow over grass (overland).

Stream T2-2 drains a pond toward the northern edge of the footprint (Pond P8) into Pond P1. It has a total length of 363m (all within the project footprint) and has a gentle gradient (less than 1%). The habitat was classified as 1.61 units of Riffle and 1.39 units of Pool.Brook trout,

Atlantic salmon and Threespine stickleback are all known to occur within the Watson Brook watershed.

3.2 POTENTIAL HABITAT LOSSES

The total habitat equivalent units of affected habitat that will be considered with respect to potential habitat compensation are under review by DFO however, the final units required as a result of HADD determination does not preclude the generation of a compensation strategy for these losses. Freshwater habitat losses and compensation are primarily related to the loss of stream and pond habitat within the footprint of the refinery. All other interactions with the freshwater environment relate to culvert and bridge installations. These will be permitted and adhere to DFO's Newfoundland and Labrador Operational Statements and all permit requirements.

3.3 PROPOSED COMPENSATION STRATEGY

It is anticipated that several habitat rehabilitation activities will be conducted that will achieve a no net loss of productive aquatic habitat. In keeping with DFO's hierarchy, the most preferred options outlined below are those that would occur within the same habitat type (i.e. pond for pond and stream for stream) and the same ecological unit (i.e. Watson's Brook).

Contact and communication has been ongoing with a locally forming Placentia Bay river stewardship group. While they have not formally organized, local interest is high with coordination being provided through the Salmonid Association of Eastern Newfoundland (SAEN). Similar to past work conducted in the Placentia/Argentia area, this group will be a valuable source of information, contact and public participation for any habitat improvement and rehabilitation works.

3.3.1 Lacustrine Habitat

In recent conversations with DFO the importance of headwater ponds within riverine systems, as well as for the value of fish and fish habitat within the ponds themselves has been discussed and is acknowledged. While the ponds in the area are small and shallow, it has been shown above that several of them may be affected by the Project.

While the ponds within the footprint are very shallow (less than 1m), fish were recorded in several of them and hence the strategy is to create equivalent pond-type habitat near the Project footprint. Several options have been identified in preliminary discussions with project engineers which would provide compensatory pond habitat. The preliminary options include:

- Creation of shallow (1-2m deep) ponds near the Project site that would be interconnected with Watson's Brook;
- Excavation of existing shallow ponds to achiever a greater depth and hence higher utilization; and/or
- Control of flows from existing ponds to increase depth and hence higher utilization.

The options above are presented in order of most likely to least likely, however all options at this time are being considered. The final location and configuration will need to be assessed in terms of their constructability (eg. access, logistics and damage to existing habitat), cost and potential for meeting the compensation requirements.

Feasibility

During construction, numerous pieces of equipment would be on-site and could be made available to assist in the creation/excavation of compensation ponds and any required substrate placement. In addition, many construction hands would also be available to limit machinery to those tasks where they would be absolutely required.

It would be anticipated that much of the heavy excavation would be conducted during the winter months when heavy machinery could access the proposed locations with as little subsequent damage as possible. Ponds would most likely be created/excavated in isolation from the existing Watson's Brook and later connected to the system by removal of a plug/dam when all construction is completed. Reclamation and revegetation of access points and shorelines upon completion will also be anticipated.

Preliminary discussions with Project engineers have outlined numerous locations where this option could be implemented within Watson's Brook and near the Project site. This option has therefore been considered feasible.

Value toward No Net Loss

While Watson's Brook contains many small, shallow ponds throughout the peninsula, this option meets DFO's highest compensation option criteria (**like for like**) and would compensate directly for the habitat type (pond) that is being affected. As such, the strategic addition/enhancement of compensation ponds would maintain the production capacity of the Watson's Brook system.

Economic Viability

Although Watson's Brook is isolated to some degree, it is used by local anglers. Maintenance of the recreational angling opportunities as a result of the proposed compensation pond creation/excavation could be seen as a local, long-term economic benefit. In addition, on-site equipment during construction will also make this option economically viable to NLRC.

Public Acceptance

While public consultations will be conducted to present the local communities with the potential compensation options, it is felt at this time that any compensation of local habitat within Watson's Brook will meet with public acceptance.

3.3.2 Watson's Brook Main Stem

Stream habitat potentially affected by the Project is relatively small in nature with many intermittent sections interspersed. While the habitat is narrow and shallow, fish were recorded utilizing the habitat and hence will require compensation. As discussed with DFO, sections of Watson's Brook were surveyed in order to get an understanding of the system and what may be some of the biological limiting factors that could be improved so that an increase in productive capacity could be achieved within this habitat type. While much of the potentially affected habitat within the Project footprint contains limited spawning habitat and would be considered primarily juvenile rearing habitat, a preliminary investigation into the surficial geology of the southern Head peninsula was conducted to determine whether the lack of smaller, rounded substrate was a result of excess flows or availability. It was concluded that glacial action has stripped the Southern Head peninsula down to the bedrock surface in most areas including the

area around Watson's Brook. Based on air photo interpretation, field mapping by AMEC staff and confirmed by the published Surficial Geology maps, the area around Watson's Pond from Winging Point southeast to the project footprint consists of 75% exposed bedrock, 15% bog cover and 10% till veneer. No surficial geological features were identified that would indicate the presence of a source of rounded or sub-round, washed gravel-sized aggregate along the banks of Watson's Brook. While hydrologic information is being produced, it is clear that gravels are limited in the Watson's Brook drainage basin and hence spawning habitat may be limiting overall production.

Increased Habitat Capacity and Utilization

Stream surveys and electrofishing results from the main stem of Watson's Brook indicate that the area has low utilization by all species (Atlantic salmon, brook trout and stickleback) and that no young-of-year Atlantic salmon were captured (i.e. eight and seventeen juveniles in stations one and two respectively). While habitat improvements focus on spawning, additions of smaller substrates currently limited in Watson's Brook has the potential to increase the overall capacity of the system. Preliminary investigations were limited to the main stem at this time as this area would receive the full benefit of flows from the entire 28.63km^2 drainage basin. However, improvements within the upper reaches of the system can also be considered as direct compensation for the loss of other small streams within the system (*see* Section 3.3).

The majority of the main stem consists of bedrock/boulder dominated substrate. Reach 4 has considerable cobble and gravels (75%) however the remainder is limited in terms of smaller substrates suitable for spawning and juveniles. Photos 4.1 – 4.6 present each reach. As shown, each reach consists of gentle slope and many pockets and backwaters where smaller placed material would stabilize and accumulate.

Additional assessment would be required to ensure that placed gravels would not affect velocities such that they would become less suitable and to determine the volume of gravels required. In addition, the hydrology of the main stem would need to be assessed to ensure that any placed substrates would remain stable and not be removed due to spring high water levels.

Feasibility

During construction, numerous pieces of equipment would be on-site and could be made available to assist in the placement of smaller substrates. In addition, many construction hands would also be available to limit machinery to those tasks where they would be absolutely required. This option is considered feasible.

Value toward No Net Loss

Watson's Brook appears to be limited in terms of suitable smaller-sized substrates suitable for spawning and juveniles and as such, the strategic addition of this material would increase the production capacity of the habitat. This option also meets DFO's highest compensation option criteria (**like for like**) and would compensate directly for the habitat type (stream) that is being affected. The relative increase in production would need to be monitored.

Photo 4.1 Reach 1 T2-3, Southern Head, 2007

Photo 4.2. Reach 2 T2-3, Southern Head, 2007

Photo 4.3 Reach 3 T2-3, Southern Head, 2007

Photo 4.4. Reach 4 T2-3, Southern Head, 2007

Photo 4.5. Reach 5 T2-3, Southern Head, 2007

Photo 4.6. Reach 6 T2-3, Southern Head, 2007.

Economic Viability

Although Watson's Brook is isolated to some degree, it is used by local anglers. Improvements to the recreational angling opportunities as a result of increased production due to increased utilization and survival of young-of-year and juvenile life cycle stages could be seen as a local, long-term economic benefit. In addition, on-site equipment during construction will also make this option economically viable to NLRC.

Public Acceptance

While public consultations will be conducted to present the local communities with the potential compensation options, it is felt at this time that any local improvement to Watson's Brook will meet with public acceptance.

3.3.3 Watson's Brook Tributaries

As stated above, further compensation options may exist within Watson's Brook tributaries. Surveys will be conducted to determine whether areas of habitat degradation have occurred and whether it would be feasible to enhance these areas. It is reasonable to assume that the limited small substrate quantities recorded in the main stem and tributaries within the Project area would extend to other tributaries on the peninsula. Options would be based on the type of enhancement required however potential options could include:

- Substrate augmentation and stabilization;
- Habitat improvements (increased habitat variability and suitability);
- Bank substrate stabilization; and
- Riparian vegetation stabilization.

Feasibility

All potential options listed above have proven techniques associated with them and can be implemented using onsite equipment and personnel. If a location is identified, it will be assessed in terms of what habitat improvement would be required and how it would be competed (access, logistics cost). The Project has proposed access roads and hence many of the smaller headwater systems may be relatively accessible without excess disturbance of terrain. Therefore habitat improvements within smaller headwater streams is most likely feasible however access compared to the main stem of the brook will most likely be more difficult.

Value toward No Net Loss

Habitat rehabilitation within Watson's Brook tributaries throughout the peninsula would meet DFO's highest compensation option criteria (**like for like**) and would compensate directly for the habitat type (stream) that is being affected. As such, the strategic rehabilitation of streams within the Watson's Brook system will be considered.

Economic Viability

Although Watson's Brook is isolated to some degree, it is used by local anglers. Maintenance of the recreational angling opportunities as a result of the proposed stream rehabilitation could

be seen as a local, long-term economic benefit. In addition, on-site equipment during construction will also make this option economically viable to NLRC.

Public Acceptance

While public consultations will be conducted to present the local communities with the potential compensation options, it is felt at this time that any compensation of local habitat within Watson's Brook will meet with public acceptance.

3.4 PROPOSED MONITORING STRATEGY

The final Compensation Plan will include details regarding any compliance monitoring. The following is a draft outline of those monitoring parameters most likely required.

Each area of compensatory habitat will be monitored to ensure that the physical attributes of the habitat are being maintained (eg. substrate placement, habitat stability) as well as the anticipated net production increases.

Increased Habitat Utilization

Areas with habitat improvements (including compensation ponds) will be monitored for the presence and persistence of Atlantic salmon (and brook trout). Typical sampling would include redd surveys and species presence/abundance.

Reach Rehabilitation

Each reach where habitat structures are added or modified will be surveyed for habitat stability. Each reach will be physically surveyed to ensure that placed substrates are being maintained and that factors such as unanticipated ice or high flow conditions do not render the habitat unsuitable.

3.5 PUBLIC CONSULTATIONS

NLRC will implement a public consultation program with respect to the Fish Habitat Compensation Plan and will include the following:

- Contact with outfitters and others whose operations utilize the local freshwater resources;
- Contact with sport fishing and environmental organizations in the local area;
- Inclusion of descriptive material about the habitat compensation strategy into public briefing materials; and
- An offer to nearby communities to attend consultation meetings on the proposed compensation plan.

Documentation and reporting on comments received with respect to the Plan and descriptions of the measures proposed/taken to address suggestions and concerns will also be completed.

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