Improving Resources to Assess Climate Change Coastal Vulnerability: A Pre-Assessment Criteria of the Socio-Economic Values of Working Waterfront Infrastructures in Nova Scotia

By

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Table of Contents

List of Tables

List of Figures

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Abstract

The scientific community has stated that coastal zones will be among the zones that would suffer major negative consequences in terms of climate change effects. Nova Scotia, as a coastal province, is not absolved of such predictions. Working waterfront facilities are infrastructures that are always exposed to the inclement weather events, such as hurricanes, and would be threatened by future coastal hazards, such as sea level rise. Although full and detailed vulnerability and risk assessments are evaluations that could contribute to determine the level of risk a facility is exposed to, pre-assessment have been seen as useful tool to broadly estimate potential loss in terms of values. One such pre assessment tool is the Nova Scotia Coastal Infrastructure Assessment Tool (CIAT) used to determine economic vulnerability of working waterfronts. This graduate project seeks to complement the CIAT by incorporating an additional criteria in which the societal and non-fishery based economic values of working waterfront facilities are assessed together with the financial and economic fishery based values. The method used to build the Socio-economic Pre-Assessment Criteria (SEPAC) was the inventory of other uses and activities at working waterfronts, which consisted of literature online searches, site visits, and expert consultation. The SEPAC was also tested by two Nova Scotia Department of Fishery and Aquaculture (NS-DFA) staff. A focus group comprising of representatives from the NS-DFA and the Federal Small Craft's Harbour (Division of Department of Fisheries and Oceans) was also conducted to obtain feedback on the SEPAC and the practical implications for decision-making. Overall, the SEPAC appears to be a pre-assessment component that (i) represents socio-economic values that working waterfront offers to local citizen and visitors, (ii) is practical and easy to assess, and (iii) is a potential assessment component that could guide future assessments and decision-making in terms of prioritising infrastructures in regards of their values.

Keywords: working waterfront, socio-economic, pre-assessment, climate change, Nova Scotia, management.

List of Abbreviations and Symbols Used

ACASA	Atlantic Climate Adaptation Solutions Association
CAI	Critical Asset Identification
CIAT	Coastal Infrastructure Assessment Tool
CNN	Coastal Community Network
CS	Coastal Strategy
CPA	Canada Port Authority
DFO	Federal Department of Fisheries and Aquaculture
HA	Harbour Authorities
HRM	Halifax Regional Municipality
IPCC	Intergovernmental Panel on Climate Change
NS-DFA	Nova Scotia Department of Fisheries and Aquaculture
SCH	Small Craft Harbour
SEPAC	Socio-Economic Pre-Assessment Criteria
SIA	Social Impact Assessments

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CHAPTER 1: INTRODUCTION

1.1 Background to the Management Problem

The Intergovernmental Panel on Climate Change (IPCC) states that climate variability is/will continue to affect both terrestrial and marine systems (Adger et al., 2007), which in turn could impact the socio-economic sectors in coastal zones (Nicholls et al., 2007). For example, variations observed within marine systems include: changes in global temperatures, salinity, ocean circulation, water masses, and sea level (Intergovernmental Panel on Climate Change - IPCC, 2007a). Specifically focusing on sea level, a projected increase could potentially be within a range of 38 cm to 60 cm in 2100 (IPCC, 2007b). As such, sea level rise presents itself as a key factor which could contribute to making coastal areas and infrastructure vulnerable to climate change effects. For example, Nicholls and Cazenave (2010) suggest that permanent inundation of coastal areas could be one of many serious impacts influenced by sea level rise. This type of statement is not a new issue for the scientific community. Over the last twenty years, coastal zones have been considered to be one of the most vulnerable areas to climate change impacts (IPCC, 1996). For example, studies have indicated that an increase in coastal erosion could be a major impact from accelerated sea level rise (Church et al., 2008). Other impacts include an increment in the frequency and intensity of hurricanes (Meehl et al., 2007). In addition to physical impacts, climate change can also impact coastal zones from a socio-economic perspective (Sarwar & Khan, 2007; Kont, Jaagus & Aunap, 2003). For example, estimations made for Estonia noted that serious property loss, infrastructure damage and flooding of important areas could have negative impacts on both the economy and well-being of coastal towns (e.g. sea level rise) (Kont et al., 2003).

The literature states that coastal zones in Nova Scotia will experience certain impacts due to such climate variability (Vasseur & Catto, 2008). For example temperature change in the future is projected to induce warmer springs (+0.4 °C) and autumns, (+0.1 °C), and cooler winters (-0.1 °C); whist in some areas of the province, precipitation could increase up to 81.3 (mm) mean rainfall in 2080. As well, an acceleration of coastal erosion could be triggered due to several factor such as decrease in the duration and extension of sea ice in shorelines, and extended exposure of the coastlines to wind and wave actions (Vasseur & Catto, 2008). Intense short-period rainfall, winter cyclonic and tropical storm

ranges, as well as, an increase of storm surges are among other major climate change impacts that coastal areas will face in the forthcoming years[1] (Vasseur & Catto, 2008). Also, as for the 2012 predictions, the Canadian Hurricane Centre has estimated that it is probable that hurricane season could start earlier than the regular season (The Canadian Press, 2012). Although an average number of storms are expected for this year, the intensity of some of them could be considerable: "They are predicting between 9 and 15 named storms this year, with one to three expected to become major hurricanes with sustained winds of 178 kilometres per hour" (The Canadian Press, 2012, para.7).

In accordance with the federal initiative to reduce potential future climate change impacts (Government of Canada, 2003), the Province of Nova Scotia has been developing its own plan. This plan includes a wide variety of strategies such as (i) policy instruments that will help to expand the understanding of climate change effects in the province (e.g. Nova Scotia's Climate Change Action Plan), (ii) development of initiatives to set up different type of baselines that will help to estimate future coastal scenario for Nova scotia[2], and (iii) the creation of mechanisms to mitigate[3] and/or suggest measures to adapt to such changes. Although mechanisms to mitigate climate change effects are important, their development may not totally impede the impacts of the climate change in coastal zones. As such, adaptation measures are mechanisms that address directly imminent climate change effects in the coast. However, in order to select the most adequate measure(s), it is necessary to understand the level of vulnerability to which coastal community and infrastructure are exposed. Vulnerability evaluations[4] are tools that could help provide vital information on which to assess the level of impact that people, environment, and infrastructure could be exposed to and/or their ability to cope with such events (Tompkins et al., 2005 as cited in Levina & Tirpak, 2006).

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[1] See website: http://climatechange.gov.ns.ca/adaptation/48#table

[2] See websites: www.atlanticadaptation.ca/ns_projects;
http://climatechange.gov.ns.ca/adaptation/48#table

[3] See website: www.climatechange.gov.ns.ca

[4] The term "evaluation" is used synonymously with the term "assessment" through this document

1.2 The Management Problem

"A working waterfront consists of sites or facilities that provide physical access to the sea for ocean dependent-uses and business, as well as all related infrastructure and services, which may or may not occur at the water's edge, e.g. processing plants, and lighthouse etc." (Nova Scotia Fisheries, n.d., as cited in CBCL Limited, 2009a, p.116). Working waterfront infrastructures can encompass, for example, harbours, wharves, breakwaters, marine navigational aids, fish plants, fish farms, roads/causeways/access routes to the infrastructure, and so on (CBCL Limited, 2009a). However, for this project, working waterfront infrastructure will refer only to small-craft harbours, wharves, and/or breakwaters designed in such a way that people and boats can access and berth, respectively. In Nova Scotia, working waterfronts play an important role for both the local work force (e.g. fishing and recreational industry), and the community and people. As such coastal infrastructures offer a wide range of benefits (e.g. non-economic and economic) for people and businesses. Consequently managerial decisions regarding these infrastructures must consider an integrated perspective that ensures both the economic and non-economic values of the working waterfront infrastructures are equally assessed

For Nova Scotia, working waterfronts represent a vital economic value for the fishery and aquaculture industry. It is well-known that coastal fishing communities depend on these structures to support their livelihoods (Gardner, Fraser, Milloy & Frost, 2005). Although the fishery industry has been declining over time, coastal rural community work force still rely on such industry, either by working for the fishery/aquaculture industry, or other business that uses the working waterfront (CBCL Limited, 2009a). However, working waterfronts also provide other benefits that are not necessarily related to fishery purposes. For the society, in general, working waterfront infrastructures represent a very important socio-economic asset. Working waterfronts symbolize the "highway" between the land and the ocean, because such type of waterfront allows local citizens and visitors to utilize the harbour facilities for a wide variety of recreational activities (Praxis Research & Consulting Inc., 2004). A working waterfront provides access to the ocean either directly such as a place for the public to fish or indirectly such as providing the ability to see the ocean. In Nova Scotia "public coastal access refers to people's ability to view, reach and move along the shoreline of both the mainland and nearby islands" (CBCL Limited, 2009b, p.139). Given the importance of working waterfront infrastructures, it is imperative to determine their

vulnerability to imminent coastal climate change effects. Vulnerability assessments are key evaluations that will help to obtain relevant information about the status of working waterfront infrastructure.

As a maritime province, Nova Scotia is an active member of the Atlantic Climate Adaptation Solutions Association[5] (ACASA) (Atlantic Climate Adaptation Solutions Association (ACASA), n.d.a). The province, under the direction of the Nova Scotia Department of Fisheries and Aquaculture (NS-DFA), is in charge of one of the ACASA projects, referred to as "An Assessment of Coastal Infrastructure Relevancy" (ACASA, n.d.b). One of the many ACASA projects, the NS-DFA developed an Coastal Infrastructure Assessment Tool (CIAT), with the purpose to assess the vulnerability of working waterfront infrastructures related to the fishery and aquaculture industry to future climate change impacts (CBCL Limited, 2012) (Appendix A). The main purpose of the CIAT is to rapidly assess which working waterfront infrastructure are relatively more vulnerable, so that further detailed analysis can be focused on priority infrastructure (potentially using more sophisticated technology) (CBCL Limited, 2012). Information collected using this tool could also help or guide federal/provincial government agencies to make decisions on (i) determining harbour funding allocations, and/or (ii) the distribution of resources to maintain such working waterfront infrastructures.

CIAT has two main evaluation sections (CBCL Limited, 2012). The first section is the "vulnerability assessment and outlines a set of seven Boolean questions (yes/no responses) to assess the natural coastal hazards (e.g. wave action, wind, ice, river flood, and erosion) that an infrastructure is exposed to. Characteristics of the infrastructure such as area above water level, and dependency of other infrastructure for accessing the infrastructure are also evaluated. In order to proceed to the next second section, at least one of the seven questions requires a positive response. The second section is the "value assessment" component that refers specifically to the fishery and/or aquaculture industry. This section includes the financial, economic, and utility information relating to the working waterfront infrastructu-

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[5] ACASA aims to "create resources and processes that will facilitate routine consideration of the adaptation measures that will guide land use and protect valuable infrastructure now and in the future" (Atlantic Climate Adaptation Solutions Association, n.d.c, para. 2)

res that is being evaluated based on a three tiered system (categorical system) (Appendix A). The result of the CIAT is based in the sum of the financial, economic, and utility scores; then, considering that the working waterfront infrastructure which has higher scores are more vulnerable to coastal hazards.

The CIAT focuses specifically on economic values directly related to the fisheries and aquaculture industry (CBCL Limited, 2012). The author of this project considers that based on this rational, the CIAT only reflects one single use, therefore, potentially misevaluates other values that working waterfronts provide. Small working waterfront facilities in Nova Scotia provide economic benefits from a fishing context; however they also provide social and cultural benefits (Praxis Research & Consulting Inc., 2004). This paper highlights the need for the CIAT to encompass both the values of the small working waterfront facilities (economic and non-economic) and the role that these infrastructures play for local communities, and the general public. Therefore, the author strongly believes that the CIAT could produce a more realistic assessment of the vulnerability of a. working waterfront infrastructure if the evaluation considers the multiple uses of the infrastructure rather than focusing on a single use. By focusing on a single use and not multiple use leads to a potential management problem where certain user's interests or values are ignored in the pre-assessment of vulnerability. Considering such potential management problem, the author proposes that in order to assess the vulnerability of small harbour facilities to future climate change effects in a multi-uses approach, a preliminary assessment of socio-economic values of working waterfront facilities would contribute to assess the other waterfront facility's values; therefore, avoiding a potential management problem in terms of decision-making of such infrastructures.

1.3 Research Questions, Objective, and Scope

Based on the final report for the CIAT (CBCL Limited, 2012), thirty-one fishing-related coastal infrastructures have already been assessed through pilot trials (Appendix B). However, no assessments have yet been conducted by the NS-DFA because the department is still working through the multiphase process of the assigned ACASA project. Given the potential advantage of this tool in its ability to conduct rapid assessments of vulnerable coastal areas, the NS-DFA has indicated a high degree of interest and willingness to test this

tool as a means to both support coastal communities and provide essential data for more informed decision making (David Mitchell, personal communication, May 7, 2012). Within this context the research questions for this project are as follows:

1 Since the CIAT currently only assesses working waterfront from a purely fishing industry perspective, is it feasible to incorporate a socio-economic approach into the CIAT?
2 How practical is to gather information for the SEPAC?
3 How would multiple-uses criteria in the CIAT benefit practical actions and/or decision making to manage working waterfront infrastructures?

To address these three research questions, the project proposes the following objective:

- **Objective**

To expand the CIAT by developing an additional criteria in which information related to other type of uses (socio-economic) relevant to the working waterfront infrastructure and surrounding areas is included.

This paper is divided into six chapters. Chapter one corresponds to the Introduction. This Chapter includes the background of the problem, the management of the problem (motivation of the study), the research questions, objective and scope of the project. Chapter two, Literature Review, explores key concepts that helped to build the knowledge about the current situation of working waterfront facilities in terms of management, programs, socio and economic values, and pre-assessments for underpinning vulnerability assessments. This information was fundamental to analyze the results, and to structure the discussion. The methodology employed to meet both the objective and the research questions is discussed in detailed in Chapter three. Chapter four presents the results obtained from the different phases of the project. Then, Chapter five includes the evaluation of the Socio-Economic Pre-Assessment Criteria (SEPAC), and the results obtained through the application of the SEPAC in order to respond the research questions. In addition, this Chapter shows some of the limitations experienced during the execution of the project. Finally, Chapter six encompasses the conclusion, which consists in an overall reflection of the whole graduate project.

CHAPTER 2: LITERATURE REVIEW

2.1 Working Waterfront

2.1.1 Definition

As stated previously, the definition used in this research project for a working waterfront refers to "sites or facilities that provide physical access to the sea for ocean dependent-uses and business, as well as all related infrastructure and services, which may or may not occur at the water's edge, e.g. processing plants, and lighthouse etc." (CBCL Limited, 2009a, p.116). Working waterfronts can include huge harbour facilities (e.g. Halifax Port) to small harbours (e.g. Fishermen's wharf in Lunenburg). Harbour facilities are classified into three categories: Canada Port Authority (CPA) ports[6] (Figure 1a), local and regional ports[6] (Figure 1b), and small-craft harbours.

Figure 1a. Port of Halifax (CPA port)
Source:
http://www.atlanticgateway.gc.ca/strategy/chapter6.html

Figure 1b. Little Harbour, Halifax County (small craft harbour)
Source: http://www.dfo-mpo.gc.ca/sch-ppb/photo-eng.asp?c=1155&p=ns&r=h

[6] CPA, regional and local ports are not part of the scope of this project; however, an explanation of its meaning is provided in this footnote (CBCL Limited, 2009a). CPA ports correspond to ports that are considered "vital to trade and are financially self-sufficient" (p. 117) (e.g. the Port of Halifax). Regional and local ports are ports that "serve a mixture of marine shipping and primary fishery users…larger waterfront operations" (p.117), communities are less dependent on waterfront activities.

As noted earlier, the focus of this project is on small harbour facilities. Small-craft harbours, although small in size and economic revenue if compared with CPA ports, are fundamental for the province of Nova Scotia because they are a vital asset for several communities as they depend upon them for their livelihood (CBCL Limited, 2009a). The status of a working waterfront is measured in accordance to the relationship between the working waterfront and the community well-being (CBCL Limited, 2009a). This tight relationship is reflected in the type of working waterfront community. Four types of working waterfront communities were identified in 1991, corresponding to: "healthy" communities, "transitional" communities, "declining "communities, and "statistical outlier". However, the last evaluation about the state of working waterfront community identified that in 2003, community types reduced from four to three (healthy, declining, statistical outlier), being the "transitional" working waterfront community the ones that transfer to the "declining" community type (CBCL Limited, 2009a).

2.1.2 Working Waterfront Infrastructures: Programs, Management, and Initiatives

- Department of Fisheries and Oceans Canada Branch: Small Craft Harbour Division

Since 1972, the Small Craft Harbour (SCH), a division of the Federal Department of Fisheries and Aquaculture (DFO) has been in charge of the management of harbours facilities[7] in Canada (House of the Commons Canada, 2009). The SCH vision focuses on having "essential, affordable, national network of safe and accessible harbours, in good working condition, that meets the principal and evolving needs of commercial fishing industry, while supporting the broader interests of coastal communities and Canada's national interests" (Fisheries and Oceans Canada, 2009).

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[7] For SCH, harbour facilities include breakwaters, wharves, launching ramps, lighting, water services, and sometimes other type of service such as net storage place (Fisheries and Oceans Canada, 2012). Working waterfronts comprise harbour facilities. For this project, likewise the term "working waterfront facilities", the term "harbour facility" will only include wharves, small harbours, and breakwater designed to fishes and visitors. These two terms are used synonymously throughout this assignment.

Supported by the Fishing and Recreational Act[8], the SCH has three main roles: the maintenance of core harbours[9], the promotion and formation of Harbour Authorities (HA), including the transferring of non-core[9] and recreational[9] harbours to local communities, and reducing the number of abandon or low-activity fishing harbours" (Fisheries and Oceans Canada, 2012a).

As part of their responsibilities for harbour facilities the SCH has several programs to help concentrate federal resources on core harbours. In 1987, the SCH started a program called the "Harbour Authority" in response to both managerial and financial limitations from the SCH division (Fisheries and Oceans Canada, 2011). This program allows the transfer harbour managerial responsibilities to a local level (e.g. provincial, municipal, community). Diverted harbour facilities include low-activity fishing harbours, recreational harbours, and derelict harbours, as they are more linked to provincial, municipal, and community interest in terms of economic development (Fisheries and Oceans Canada, 2011).

Another key mechanism is the "Small-Craft Harbour Divesture Grants" program (Fisheries and Oceans Canada, 2006). This objectives of this program, which was implemented in 2001, are to off-load the harbour facility maintenance workload by transferring the title of the harbour facilities to other federal departments, provincial or municipal government, local-no-profit organizations, or First Nation communities[10] (Fisheries and Oceans Canada, 2011). Based on these one-time grants, the eligible recipients

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[8] Fisheries and Recreational Harbours Act, R.S.C., 1985, c. F-24

[9]According to the Small Craft Harbour (Fisheries and Oceans Canada, 2010):
Core Harbours: correspond to harbours that are critical to the fishing and aquaculture industries and that are managed by Harbour Authorities,
Non-Core Fishing Harbours: are harbours that support the fishing and aquaculture industries but are not managed by Harbour Authorities, and
Recreational Harbours: correspond to harbours that support the recreational community

[10] The socio-economic and cultural benefits working waterfront facilities provide to First Nations communities are not part of the scope of this project

and general public, and agree to keep the facility in good working conditions and safe for public access for a minimum of five years (Fisheries and Oceans Canada, 2006). Given their local knowledge of appropriate services for the community, municipalities have shown a huge interest in taking on the managerial responsibilities of harbour facilities (House of the Commons Canada, 2009).

Collectively, the "Harbour Authority" program and the "Small-Craft Harbour Divesture Grants" program are "expected to increase the efficiency of property management for all levels of government and to facilitate the devolution of federal responsibilities to local governments" (Fisheries and Oceans Canada, 2006, section 3.1, para. 3). Considering that harbour facilities: (a) represent a significant asset for fishing communities, local citizens, and the public in general, and (b) will experience future climate change effects, it is necessary to include mechanisms for evaluations that could provide an integrated approach analysis of the state and/or vulnerability of the diverted and potentially diverted harbour facilities; evaluations that could complement and make more sound decisions.

- The Government of Canada response to the SCH Program Evaluation related to Harbour Facilities Uses and Climate Change effects.

A report from the House of Commons Standing Committee on Fisheries and Oceans (House of the Commons Canada, 2009) relevant to the SCH program highlights the "need of emerging sectors". The report states that wharves are used not only for the fishing industry, but also for multiple uses (e.g. recreational and sport fishing uses), thus, recommending the following:

That Fisheries and Oceans Canada reviews the mandate of the Small Craft Harbours Program to acknowledge that, while it primarily provides harbours that are open, safe and in good repair for the commercial fishing industry, harbours are used and managed for other purposes, including those of recreational and Aboriginal fisheries, commercial sport fishing,… (Recommendation 18) (House of the Commons Canada, 2009, p.31).

Furthermore the section relating to the "protection from storm", identifies a general concern about the increase of storm, wind, wave, and flooding to the harbour facilities; therefore, putting at risk the safety of all users and vessels. As such, the Standing Committee

recommends that “Fisheries and Oceans Canada assist Harbour Authorities to recognize and respond to the local effects of climate change” (Recommendation 7) (House of the Commons Canada, 2009, p.9).

The Government of Canada partially supports recommendation 18, arguing that the first priority of a harbour is to accommodate and provide services for commercial fisheries activities and secondly for other users “if possible” (Parliament of Canada, n.d). However, the Government also recognizes that there are other users besides fisheries such as recreational boaters, recreational anglers, tourism, and other commercial users. Although harbour facility services are not officially extended to non-commercial fishing users, the author of this project highlights that the Government of Canada is aware of the other users in the harbour facility.

In contrast to the recommendation 18, the Government of Canada fully supports the recommendation 7 (Parliament of Canada, n.d). The Government agrees that local climate change effects are an issue that the SCH must take into consideration. The Government also recognizes that among the coastal hazards are: sea level rise, reduced formation of shore-fast ice, extreme weather events such as storm and tidal surges, hurricanes, and ice impacts. The Government of Canada states that SCH has already incorporated a study to improve the understanding of climate change impacts in order to identified specific risks and vulnerabilities. “This study is the primary phase of Small Craft Harbours plan to adapt proactively to climate change impacts and incorporate climate change considerations into the management of its infrastructure” (Parliament of Canada, n.d., recommendation 7, para. 3).

- Province of Nova Scotia

Nationally, non-core harbours have been and/or are being divested to provincial, municipal, and no-governmental organizations. Currently, all recreational harbours in the province of Nova Scotia has been divested (Fisheries and Oceans Canada, 2008c, as cited in CBCL Limited, 2009a) and since, April 2012, at least 164 of the 184 fishing harbours are under the management of Harbour Authorities (Fisheries and Oceans Canada, 2012b). When the divesture grant program started, the major concern for the Federal Government was the budget needed to cover such grants; today, every public infrastructure organization

in Canada has funding issues (personal communication, June 12, 2012, Paul MacDonald). Similar to the Federal Government, Harbour Authority were, and still are, concerned about the budget received to cover the maintenance of harbour facilities as funding is limited to expenses related to vessel docking and fish landings, but not for other additional upgrades (CBCL Limited, 2009a).

Besides those economic limitations, since the last decades, another threat has become evident. Climate change effects (e.g. stronger and more frequent storm and storm surges) have been impacting coastal zones in Nova Scotia. For instance, in 2003, hurricane Juan caused significant damage of waterfront infrastructures in Halifax, and surrounding areas (Natural Resource Canada, 2007). Other parts of Nova Scotia have also experienced extreme storms and flooding events impacting working waterfronts. For example, in 1976, in South-western Nova Scotia, the historical Groundhog storm caused mayor damages such as the complete destruction of several harbour facilities and working waterfronts along the coast in the Yarmouth area of Nova Scotia (Fundy Group Publications, n.d). These negative climate change impacts (or threats) will have a biggest impact in working waterfront infrastructures and if the infrastructure is impacted then so are the livelihoods dependent of them.

The Coastal Community Network (CCN) was a community network comprised of over 240 organizations both governmental and non-governmental organizations and private industry which was disbanded. The CCN emphasised that the maintenance of waterfront infrastructures should not be limited to just maintaining the infrastructure in good conditions, but also to accommodate changes in the event of future climate change impacts (Coastal Community network, 2004, as cited in CBCL Limited, 2009a). This project supports such viewpoint and as such, encourages provincial, municipal, and/or local organizations in charge of working waterfront facilities to include, as part of the maintenance operations, vulnerability assessments in which the status of coastal facilities can be assessed in a more integrated-based approach. The Government of Nova Scotia supports vulnerability assessments; reflected in, the Nova Scotia's Climate Change Action Plan (Nova Scotia Department of Environment, 2009) as follows:

> *Action 58*
>
> "Begin work on a provincial vulnerability assessment and progress report on adaptation to climate change in Nova Scotia. This report, which will be updated

biannually, will provide updates on the latest climate research, review critical information gaps, and provide policy direction for the province" (p. 31).

Action 61

"Ensure that design standards and plans for new provincial construction, and for the renewal of existing provincial infrastructure, reflect projected climate trends…" (p. 32).

Another initiative from the Government of Nova Scotia is the development of the Coastal Strategy (CS), which contains a section committed to the improvement of working waterfront (Government of Nova Scotia, 2011). Within this section, the CS highlights the importance of working waterfront as a vital support for some of the most important business in Nova Scotia (e.g. fishing, aquaculture, oil and gas, shipping and tourism). Such an understanding is well known among NS government agencies, stakeholders, and communities. This understanding is also reflected within provincial, consulting companies and stakeholder reports. Nonetheless, the author of this report would like to stress that the CS recognizes that working waterfront have other uses beyond the fishing-related activities underlying in the CS that "waterfronts also serve as social gathering places and give many Nova Scotia communities their distinctive look and feel" (Government of Nova Scotia, 2011, p.10). Thus, having as ultimate goal to achieve more efficient and save working waterfront in order to sustain the different coastal dependant industries and community uses (Government of Nova Scotia, 2011).

Two other sections with a connection to working waterfront issues are "Public Coastal Access" and "Sea level rise" (Government of Nova Scotia, 2011). For example, within the CS, it states that public coastal access is a critical issue in the province, especially for coastal tourism, and visitors eager for coastal enlightenment and adventures. As an objective is to increase the number of coastal public access points, as well as the quality and diversity of such access points, the CS proposes to create an inventory of the existing coastal access points. The section relating to "sea level rise" urges that there is a need for taking into consideration the coastal hazards and future threats within provincial decision-making process. Taking these approaches helps to reduce damage from coastal hazards and/or prevent them from happening thus, protecting provincial/local economies and livelihoods. (Government of Nova Scotia, 2011). If working waterfront infrastructures are considered as public coastal access points, a coastal hazards analysis should be conducted for such

facilities, that includes both the fishing-related activities, but also community and visitors use of such facilities. The CS does not explicitly refer to this as being a gap that needs to be assessed. In that sense, a vulnerability assessment will be more comprehensive in its approach if it incorporates both the extent coastal hazards can affect working waterfronts infrastructures and the different users as a whole.

2.1.3 Relationship among Working Waterfront, Fishing Community, Local Residents, and Visitors

Initially, harbours and wharves were used for supporting fishing-related activities; however, to date, such facilities are also being seen and utilized in a different way (Government of Nova Scotia, n.d.). Historically, working waterfronts have served as major assets to support ocean-related industries. For example, in Australia, the Port Adelaide waterfront, which dates back to the 1800s, is both a major shipping and boat building port, but also provides an identity for the community in terms of place, experience, familiarity, continuity, and tradition (Oakley, 2005). For small-scale fishing communities that economically depend on these working waterfronts, taking on the role for "maintaining the built environment and associated infrastructure that enables working waterfront uses, such as wharves, breakwaters, lighthouses, and other port and harbour facilities, is an especially daunting task for those small coastal communities that are economically dependent on their harbours" (CBCL Limited, 2009a, p.118).

Working waterfronts are beneficial for other users. Economic benefits provided by a working waterfront facility are not only circumscribed to the fishing industry but for-profit businesses such as ocean-related tourist recreation (e.g. fishing tours) as well. Besides economic profits, working waterfront facilities also provides non-economic benefits. Access to the sea, for example, could be considered as a not-for-profit benefit to the working waterfront community, local residents, and visitors. In that sense, it can be stated that working waterfront provides (i) infrastructure for a variety of active and passive recreational activities (see section 2.2.4 of this Chapter for more detailed information about active and passive recreation), (ii) a centre for conducting community recreational activities, and (iii) an environment which support social and recreational activity that favor the personal health of both residents and visitors (CBCL Limited, 2009a).

2.1.4 Nova Scotia Working Waterfronts: Socio and Economic Benefits to Local Citizens and Visitors

Working waterfronts provide to the communities and visitors a wide range of benefits both social and economic. For instance, a study on the non-economic positive impacts generated by Nova Scotia harbour facilities noted three major non-economic, socio-cultural benefits: boating and recreational activities, harbour front development projects, and harbour festivals (Praxis Research & Consulting Inc., 2004). During the summer season, both local citizens and visitors amuse themselves from activities such as boating, scuba diving, swimming, water-skiing, kayaking, canoeing, sailing, cruising, sport fishing, and whale and bird watching (Praxis Research & Consulting Inc., 2004; Toews, 2005; Government of Nova Scotia, 2010). For example, in Big Bras d'Or (Praxis Research & Consulting Inc., 2004), school and community groups have picnics in their boats; while in other areas (e.g. Herring Cove, Englishtown), people fish from harbour facilities, thus attracting more people to the infrastructure (personal observation, May 27, 2012; Praxis Research & Consulting Inc., 2004). Other working waterfront facilities are also seen as popular meeting points for the community (e.g. Digby neck) (Praxis Research & Consulting Inc., 2004).

In addition to ocean-related activities, working waterfronts are also important for the shore-based businesses that depend on the presence of the working waterfront facility. For example, a study determined that in Harbourville, retails seafood outlets, art gallery, restaurants, and bed and breakfast are among the businesses which rely upon the existence of the wharf (Praxis Research & Consulting Inc., 2004). Similar to Harbourville, Eastern Passage encompasses several businesses near the working waterfront facility such as retails seafood outlets, restaurants, bed and breakfast, and handicraft stores (personal observation, May 26, 2012). As working waterfront infrastructures play a vital role for conducting socio and cultural activities in Nova Scotia, such infrastructures must been assessed considering such activities. After all, it is the local people and visitors who benefit the most in terms of "health and physic activities, exposure to nature, and expanded awareness of ecological issues" (Praxis Research & Consulting Inc., 2004, p.18).

In coastal fishing communities, festivals occur mainly during the summer season, and most major festivities are either near working waterfront infrastructures, or within the

facility's boundary (MacInnes, De Soussa, & Munro, 2006; Praxis Research & Consulting Inc., 2004; Toews, 2005). These harbour festivals, that can run for several days, include a variety of activities where people from different age groups can enjoy as such as music concerts, craft fairs, boat tours, dory races, and picnics (Praxis Research & Consulting Inc., 2004; MacInnes et al., 2006). For example, in Big Bras d'Or, the Annual Big Wave Festival (Praxis Research & Consulting Inc., 2004) and Bras d'Or Yacht Club's Regatta Week (Bras d'Or Yatch Club, 2011) are events that attract summer residents and visitors, but also allow local citizens to introduce/interact with each other in the community. Similar to festivals, some fundraising events make use of working waterfront facilities. In Herring Cove, for example, the "Polar Bear Dip" is an event that has been fundraising for the charitable organization "Feed Nova Scotia" since the last eighteen years (Polar bear dip, 2011). Also, the "Mackerel Fishing Tournament", is the biggest community's fundraising event in Pugwash town (Pugwash Village., n.d.).

Working waterfronts also provide opportunities to develop projects along he harbour front. The working waterfront environment and facilities makes it attractive for business initiatives (e.g. restaurants, fish markets) and non-profit projects (e.g. boardwalk, picnic areas). "Wharves have become integral components of these developments and provide opportunities for passers-by to observe fishermen at work and to interact with them on an informal basis" (Praxis Research & Consulting Inc., 2004, p.18). For example, the Town of Digby working waterfront includes a large wharf, marina, and parking space near the facility, which provides local citizens and visitors the opportunity to buy fresh fish directly from the fishers, or to observe fishing-related activities from businesses nearby, or from the boardwalk (personal observation, Jun 10, 2012).

2.2 Societal value

2.2.1 Definition

Societal values correspond to "factors of importance to society and human life…" (Noble, 2005, p.121). Societal values include, for example, human health and safety, demand for public resources, demand for infrastructure and services, and recreational value. In a Social Impact Assessments (SIA), the societal value components are an essential part of the analysis. Indeed, the identification of potential societal values and the degree of impact to such societal values is a systematic task within SIA and very similar to environmental impact assessment (EIA). The identification/evaluation of social impacts provides a better understanding of the social and cultural consequences which cause people to experience and modify the way they live, work, play, relate to others and identify themselves as members of a society (Barrow, 1997). Based on the scope of this project, the "Societal Value" section will only focus on recreational values as societal value.

2.2.2 Recreational Value

To explain the concept of "recreational value", the definitions of value and recreation will firstly be defined. Values, in contrast to cost, have non-monetary expenses associated. For example, "the willingness to pay represents the importance or value a person assigns to outdoor recreation", such as the amount of time that people set aside to go for a walk in the woods (Plummer, 2009, p.143). On the other hand, the significance of recreation is also evolving with society. Currently, recreation is neither consider only as a period of restful activity, or as a free time after work or during vacation (Torkildsen, 2005; McLean & Hurd, 2012). On the contrary, people are fully involved physically and mentally in recreational activities, as well as, recreational activities are seen for all leisure times. As noted by McLean and Hurd (2012), recreation definition can include the following elements:

- A wide range of activities that involve mental, physical, social, and emotional activities.
- Activities that may consist of "sports, games, crafts, performing arts, music…travel, hobbies, social activities. These activities may be engaged in by individuals or by

groups and may involve single or episodic participation or sustained and frequent involvement one's lifetime" (p.25).

- Activities that look for attaining intellectual, physical, and/or social needs.

For the purpose of this project, the concept of "recreational value" is defined as the willingness of people to spend their time conducting a wide range of recreational activities and the infrastructure that support those activities regardless of the non-economic or economic costs associated with such endeavours.

2.2.3 Recreation: Benefits and Classification

Within a community and people participation context, recreation offers several societal benefits (McLean & Hurd, 2012). For instance, some of the general benefits provided by recreation include: (i) improving the quality of life, (ii) contributing to personal development, (iii) making the community a more attractive place to life and visit, (iv) providing positive opportunities for youth development, (v) improve intergroup and intergenerational relations, (vi) strengthening neighbour and community ties, (vii) sustaining economic health and community stability, and (viii) enriching community cultural life.

Recreational activities can be conducted either indoors or outdoors. As this project focuses on working waterfront facilities, and these infrastructures are located in open spaces next to the ocean, the analysis of recreational activities focuses on the outdoor recreation component. Plummer (2009) defines "outdoor recreation as the voluntary participation in a free-time activity that occurs in the outdoors, and embraces the interaction of people with the natural environment" (p.18). Outdoor recreation is highly linked to the natural environment and has served to promote awareness, education, and knowledge in themes related to ecological processes and interactions (Plummer, 2009). Figure 2 shows the wide range of activities that consider outdoor recreation. Besides the natural surroundings, outdoor recreation can also be undertaken in human built environments. Thus, a full range of recreational resource ranges from "biophysical resources - natural environments" to "human-constructed resources-built environments" (Kreutzwiser, 1989, as cited in Plummer, 2009). Another classification proposes that

outdoor recreation can be classified as terrestrial recreational resources, and aquatic recreational resources. Within the aquatic classification, ocean - coastal environments support a series of activities such as sailing, fishing, kayaking, and diving (Plummer, 2009). For the purpose of this project "working waterfronts are included as part of the human constructed outdoor environments because harbour facilities (i) require humans to build the infrastructure, (ii) serve to connect people with the environment, and (iii) provide an access to the ocean for conducting different water-related recreational activities.

In addition to outdoor and indoor categories of recreational activities, outdoor recreation can be further classified. For instance, Plummer (2009) classifies outdoor recreation based on "nature-based tourism", in which he suggests six groups: adventure, ecotourism, 3S (sunbathing, sailing, swimming), captive, extractive, and health (Figure 2). Although not all outdoor recreation activities are exclusively performed during the tourism season or connected to working waterfront facilities or water-based activities, Plummer (2009) perspectives have contributed to this project by providing alternative approaches to classifying some of these activities.

Given the nature of this project, the classification for outdoor recreation activities is based on whether the activity is passive or active. This classification process is explained in the next section.

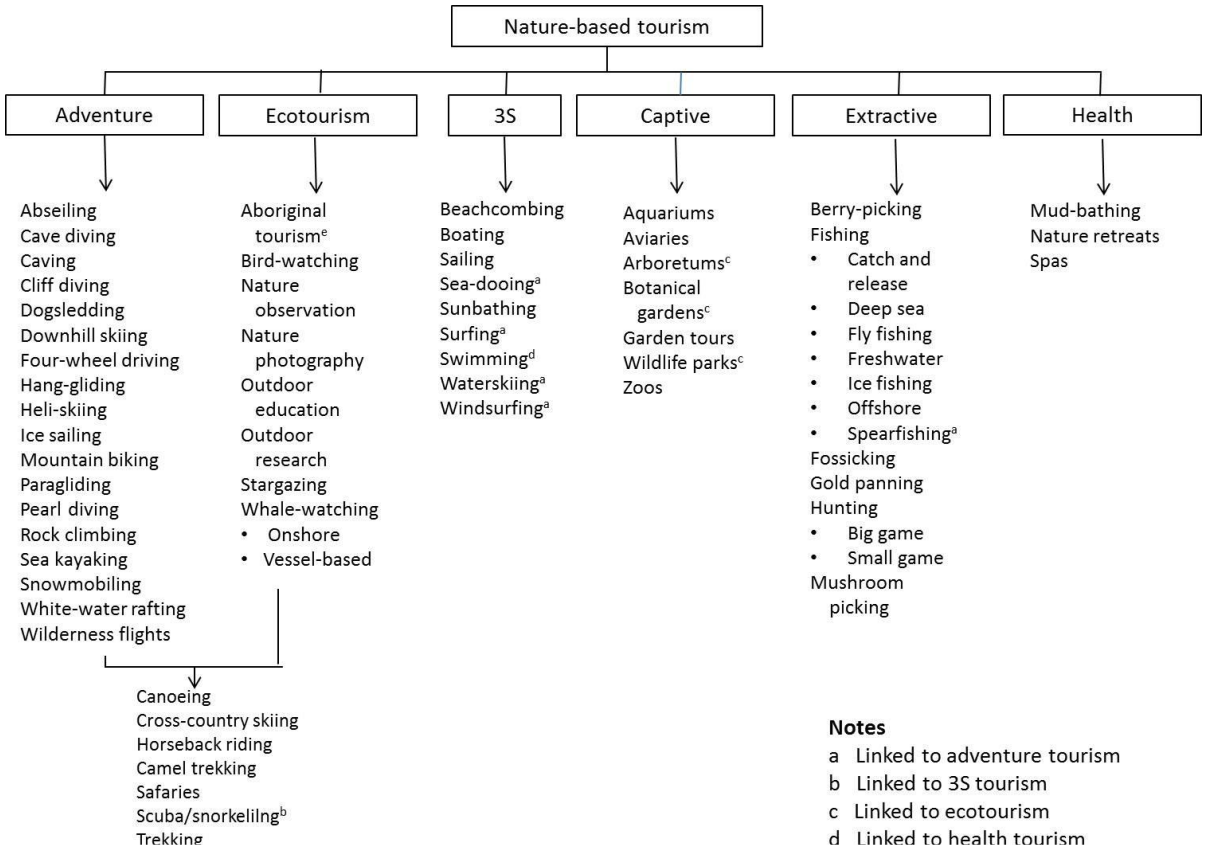

Figure 2. Dichotomy of nature-based tourism by Plummer (Plummer, 2009, p.335)

2.2.4 Passive and Active Recreation

Based on the literature passive recreation can be explained in different ways. For instance, passive recreation can be considered as activities where individuals "receive or consume entertainment through the actions of other people and their activities" (Roberts, 2001, p.2). As another perspective is that passive recreation is "any recreation that does not involve the use of vehicles (including bicycles) and motorized equipment and excludes any organized sport" (Rotorua District Council, 2004). Activities such as watching (wilderness, other people), reading, meeting with friends, taking photographs are also considered as passive recreation (Woolley, 2003). Jensen and Guthrie (2006), define passive recreation as being dependent on the context that is being described). For example, it can be considered as any recreation that does not depend of physical activity (e.g. birding, sightseeing,

picnicking), whereas in the context of park planning, "passive recreation refers to non-consumptive recreation in natural setting…e.g. bird watching, hiking, canoeing, but does not include hunting" (Jensen & Guthrie, 2006, p.349). Active recreation, instead, requires physical and active endeavour from the people who execute them, as in the case of marine sports (e.g. fishing, diving, sailing) (Walsh, 1995). Sports, for example, can be considered as part of active recreation because it involves physical effort, either within or without a competition (Roberts, 2001). Based on these definitions for the purpose of this project, outdoor passive and active recreation will be defined as follows:

- Passive Recreation corresponds to any non-extracting activity that does not require intense physical effort or rules; and may include training, and/or equipment. These activities can be conducted independently or in company with more people. Thus, for this project, recreational activities can include whale and bird watching (onshore, vessel-based), seascape observation (onshore, vessel-based), watching (wilderness, other people), taking photos, reading, walking on the facility, walking their pets, sun bathing.

- Active Recreation corresponds to any activity that requires physical effort; and may include training, rules, equipment, and for its meant for extractive/consuming purposes. These activities can be conducted independently or in company with more people. For this project, active recreation can include sea kayaking, scuba, snorkelling, swimming, boating, sailing, sea-skiing, sport fishing (from the facility, vessel-based).

2.3 Pre- Assessments and Vulnerability Assessments

The section describes some of the pre-assessment and vulnerability assessment approaches that are relevant to establishing a pre-assessment. There was little to no information on pre-assessment and vulnerability assessments for harbour facilities. However, given the nature of the infrastructures, there is potential to adapt some of these approaches in the context of working waterfront infrastructures.

2.3.1 Pre-Assessment for Vulnerability Assessment

For the purpose of this paper, pre-assessment not only aims to both assist with distinguishing which working waterfronts are relatively more vulnerable to hazards, but also to distinguish which facilities are critical. The author proposes that by combining the fishery perspective-based pre-assessment (CIAT) with the socio-economic perspective-based pre-assessment (SEPAC), it will allow for a more integrated understanding of which working waterfront infrastructures are more vulnerable and critical.

Belluck and colleagues (2007) summarize several definitions related to "Critical infrastrucure[11]". Although critical infrastructure can be described as a complex societal system, they can also be defined as an infrastructure in itself. In terms of working waterfront facilities, the most relevant definition which expresses the concept of critical infrastructure is the one proposed by the Queensland Government: "Critical infrastructure is defined as infrastructure which, if destroyed, degraded or rendered unavailable for an extended period, will significantly impact on social or economic well-being…" (Queensland Government, n.d., as cited in Belluck, et al., 2007, p.6). Adapting this definition, the author proposes the following definition: Critical working waterfront infrastructures refer to all working waterfront facilities that if destroyed, degraded, damaged, and/or rendered will cause major negative impacts due to the large amount of users that depend of such infrastructure. This "critical working waterfront infrastructure" concept is key to understand what a pre-assessment aims for.

Pre-assessments are assessments that seek underpinning vulnerability assessments and, *are-a-posterior*, to the risk management process as a whole. Based on the literature reviewed, there does not appear to be a standard definition, methodology or guideline for what constitutes a pre-assessment. However, there are some similarities across the many approaches (United States Department of Energy, 2002a, United States Department of Energy, 2002b). For instance, pre-assessments may contain the following phases:

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[11] The term "critical infrastructure" is used synonymously with the term "critical asset" throughout this project.

(i) asset identification and (ii) identification of criticality/consequences of loss; or it can also include (iii) identification and characterization of threats, and (iv) identification and analysis of vulnerabilities if the pre-assessment is to determine the risk level (Figure 3) (United States Department of Energy, 2002b).

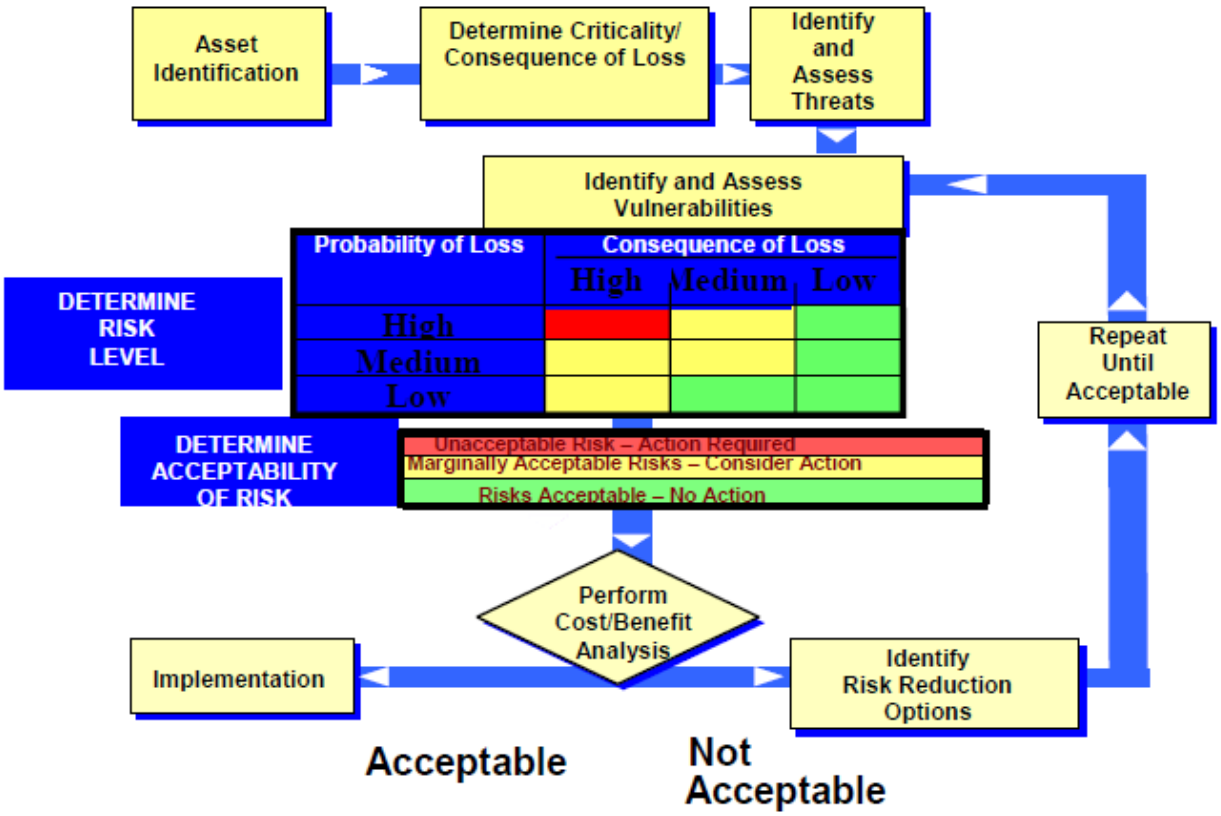

Figure 3. Risk management process adapted from U.S. Federal Aviation Agency (United States Department of Energy, 2002b, p.11)

Each of the pre-assessment phases as shown in Figure 3 is vital to the other because of its dependency factor. However, pre-assessment concepts are mainly focused on "identification of criticality/consequences of loss" phase. It is that phase which is linked to the scope of this project; thus, the following paragraphs will focus in such phase.

"Identification of criticality/consequences of loss" phase also known as "Critical Assets Identification and Impact of their Losses" (CAI)[12] aims for identifying which infrastructure is/are the most critical, in terms of no-monetary/monetary values loss, that a working waterfront facility could experience due to a natural/human-provoked event.. The outcomes obtained from the CAI phase are expressed as either a "Consequence level" or "Criticality" level, which refers to the denomination of low, medium, or high loss from a no-monetary/monetary value perspective. CAI covers two tasks: to identify and to rank critical assets; consequently, helping future assessment to focus their analysis, and supporting the risk management process. Then, CAI results allow for:

- a better understanding of factors that affect risks, threats, vulnerabilities, consequences of loss/damage of the asset
- a more focused contemplation of risk mitigation options
- people that manage critical facilities to develop sound methods for dealing with the consequences of loss/damage of the asset
- an increase awareness among the facility users an opportunity to identify and/or put into place policies and procedures to mitigate the consequences of loss/damage of the asset

According to the United States Department of Energy, CAI results are highly correlated to risk characterization because while CAI outlines and prioritizes critical assets, risk characterization uses CAI outcomes to focus investments and implementation priorities (United States Department of Energy, 2002b). Hence, "assets with low criticality (e.g. whose disruption would result in low consequences) would not merit substantial investment in protection" (United States Department of Energy, 2002b, p.11). The author agrees with the United States Department of Energy in which by applying a common set of criteria (e.g. multi-criteria assessment for all working waterfront infrastructures that are part of a waterfront community) will allow a uniform analysis, and comparable results.

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[12] "Identification of criticality/consequences of loss" will be called "Critical Assets Identification and Impact of their Losses" (CAI) in this paper

- Review of the "Critical Assets Identification" Phase (CAI) Methodology

The methodology presented in this section is based on the framework proposed by the U.S. Department of Energy (United States Department of Energy, 2002a, U.S. Department of Energy, 2002b). According to such framework, the CAI phase requires to follow some questions/requisites. These questions are categorized in three segments: questions that assess functions and assets, questions that assess impact of loss, and questions that assess asset value (Table 1) (United States Department of Energy, 2002a). These questions/requirements respond to critical infrastructure assessments in general. For these questions/requisites to work at the level of working waterfront infrastructure they would need to be adapted.

Criticality Criteria (Functions and Assets)	
☐	What critical mission activities take place at the energy facility or its remote sites?
☐	What critical or valuable equipment is present at the facility or its remote sites?
☐	Where are the critical assets located?
☐	Have people, installations, and operations been considered when assessing assets?
☐	Have cyber networks and system architectures (e.g., SCADA systems, business e-mail, and e-commerce) been documented fully?
Criticality Criteria (Impacts of Loss)	
☐	What would the energy facility lose if an adversary obtained control of a specific asset?
☐	What affects would be expected if a specific asset were compromised?
☐	Is the asset still valuable to the energy facility once an adversary has it?
☐	What is the potential for immediate and significant local impacts due to the loss of the asset?
☐	What is the potential for loss of energy supply to civilian areas?
☐	What facility personnel, tenants, customers, and visitors could be affected by the loss of the asset?
☐	What would be the impact on people's lives and on national or local security due to the loss of the asset?
☐	What would be the financial impacts to the energy facility and the local community?
Criticality Criteria (Asset Value)	
☐	Is there little or no redundant capacity or capability to mitigate the loss of the asset?
☐	What is the potential for cascading effects (e.g., to other interdependent infrastructures or industries) due to the loss of the asset?
☐	Do any special situations need to be considered regarding the loss of the asset, such as the status of hospitals, life support systems, or emergency services that depend on the energy infrastructure supported by the asset?
☐	What is the potential for catastrophic effects (weapons of mass destruction levels impact)?
☐	What did it cost to develop the asset?
☐	Would the energy facility need an extended period to make repairs to the asset?
☐	How does the need for protecting the asset compare with other assets also considered critical?

Table 1. Questions needed to assess the "Criticality Asset Identification" phase (United States Department of Energy, 2002a, p.10, p.11)

Besides the questions and/or requirements required for assessing this phase, CAI methodology includes five stages and these are: critical asset identification, consequence basis for critical asset identification, critical asset list, special focus areas, and information to assist in determining critical asset and components (United States Department of Energy, 2002b). In the first stage, a workshop (participants may include organization representative, stakeholders, users) is recommended to define and achieve consensus about criticality, and also list the potential critical assets.

In the second stage, the consequences of the loss of these assets are given a level of criticality. For example, for some infrastructure, financial loss is categorized as high or low if it reaches amounts greater than $1 billion or less than $ 50 000, respectively (e.g. in the CIAT, the highest financial loss in terms of the replacement value of working waterfront infrastructures is estimated to be "greater than 5 million $"). The consequence level is expressed in three levels: high, medium, and low; and it could be analysed in terms of legal liability; environmental, safety and health; financial; and operations (see United States Department of Energy, 2002b for specific details). Some losses are hard to appraise since they do not have an easy-to-estimate monetary cost, such as the loss of a brand name, or the loss of access to certain infrastructure (e.g. loss of public access to working waterfront infrastructures).

The third stage consists of listing all the evaluated critical assets, based on the consequence of loss level, and is then classified according to their criticality (e.g. the CIAT final report shows the 31 working waterfront infrastructures which were listed a-posteriori assessed by using the CIAT [CBCL Limited, 2012]). The fourth stage is the identification of additional assets that are essential for the operations of the infrastructure, but the information to assess their criticality may not be available. The fifth and final stage is to identify the top critical infrastructures that will need to be repaired/replaced/updated/analyses in detailed, which will then provide results for the coming assessments (e.g. vulnerability, risk)

2.3.2 Vulnerability and Risk Assessments and its relation with the CIAT

Vulnerability and risk assessment will be briefly discussed in this section since the CIAT aims to be part of the methodology to determine a climate adaptation approach: Apply of the CIAT, establish life-time of working waterfront infrastructures, assess risks, identify adaptation options (protect, accommodate, retreat), make a decision, monitor (see CBCL Limited, 2012 for more details).

- Vulnerability Assessment and the CIAT

Vulnerability assessment can be interpreted either as part of a risk management process, or as an independent assessment; nonetheless, its outcomes are fundamental to identified threats and its potential mitigation measures. Vulnerability assessment is defined, then, as the evaluation of the weaknesses of an asset[13] to possible threats in order to determine the total risk to the asset (United States Department of Energy, 2002a). Both, vulnerability and risk assessments depend of other assessments, i.e., vulnerability assessments depend of pre-assessments, as risk assessments depend of vulnerability assessments (see Figure 4 in the following section "Risk Assessment and the CIAT").

There is not a stated methodology for vulnerability assessments because the assessment depends on the resource to be analyzed. For instance, airport vulnerability assessment (e.g. effectiveness of security system assessment) adopted by the Science Application International Corporation (Veatch, James, May, Wood & Kruse, 1999) was developed from an adaptation of vulnerability assessment to other facilities. In such particular case, the vulnerability assessment project plan addressed several topics (e.g. site-specific scope of the assessment, site-specific scenarios threat, and project plan), and the assessment methodology included the analysis of adversary threat, target attractiveness, malevolent acts, and consequences of adversary success.

With some similarities, Baker (2005) suggests a vulnerability assessment methodology for critical infrastructures. As such a "common" methodology appears to be a real fact since many infrastructures have similar "support systems" (Baker, 2005). Working waterfront facilities are a lot less complex critical infrastructures compared to, for example, airport security system infrastructure. As such, there is perhaps no need to consider all the steps of the vulnerability assessment methodology as proposed by Baker, (2005) and described in Table 2 (left column). Baker further notes that a vulnerability assessment should incorporate a matrix in which "easy-target" support systems (e.g. electric power and

[13] Asset is defined as "any person, equipment, material, information, installation, or activity that has a positive value to an organization or facility" (United States Department of Energy, 2002a, p.25)

water systems) and/or critical assets are integrated with identified threat for a straightforward assessment. From the perspective of this paper, the phases, which have been adapted by the author of this project, are indicated by a check mark in Table 2 (right column).

Vulnerability Assessment Methodology for Critical Infrastructures

	Critical Infrastructures in general	Working Waterfront Infrastructures	
Threat/hazard Identification	Potential threats/hazards could affect the facility. They could be natural disasters, physical attacks, or normal accidents in a regular basis.	✓	Potential threats/hazards would be coastal climate change effects such as intense storms, storm surges, sea level rise, wave and wind action, etc.
Mission Identification	Identification of the system mission/operation, and the functions required to complete the mission.	✓	Purposes of having/keeping working waterfront infrastructures
Supporting System Identification	Mission system and/or operation system runs due to support systems (e.g. electric power, water supplies, etc..).	✓	Support systems and/or operation systems: Roads, electric power systems, snow removal service, cool room storage facilities, etc.
Critical System Element Interconnections and Interdependencies	Understanding and tracing system interdependency. It will allow identify potential cascade effects.		
System Reconstruction	Evaluates the time factor in repairing/replacing the critical facility. Also evaluates repair sequencing, number and location of maintenance personnel.	✓	Time needed to repair/replace a working waterfront facility that has been disrupted due to a coastal climate change effect
Determining Vulnerabilities	Determination of which operation systems will be affected by which threat. Strengths of exposed systems. Use of matrix to figure out the correlation of potential vulnerable systems vs. threats.	✓	Potential vulnerable systems vs. coastal climate change effects matrix. Strengths of exposed systems
System Interdependency	Organizations and/or other infrastructures could depend of the systems/facility under threat. Consider the effects of disruption of both downstream and upstream organizations/infrastructures.		
Personnel and Responsibility	Determine which mission and personnel are necessary for regular operations, as well as staff responsibilities, and skills to response in a emergency situation.	✓	Small craft harbour managerial skills/responsibilities to response in a emergency situation (e.g. storm surge, storms, damaged harbour facilities). Skills of user(s) to back-up their operations/uses which depend of the presence of the working waterfront facility.
Endurability	It depends of the procedure, equipment, and skills of users/managers to diminish the effects of the natural/man-provoked incidents	✓	Protocols, equipment, users ability to reduce the negative effects occasioned by coastal climate change threats
Planned System Changes	Take into considerations planned facilities upgrades and changes		

Table 2. Vulnerability Assessment Methodology for Critical Infrastructures.
Left column shows the methodology proposed by Baker (2005). Right column shows

Although the CIAT is not a vulnerability assessment in itself, one of its sections aims to briefly determine the vulnerability of the working waterfront infrastructure in terms of coastal hazard exposure (Appendix A). Thus, coastal hazards such as sea level rise, storm surges, coastal erosion, high winds from the increased intensity of the storms are taken into consideration in the "Vulnerability Assessment" section of the CIAT (CBCL Limited, 2012). The CIAT defines a working waterfront infrastructure as being vulnerable "if the community is sensitive to the loss or impairment of the infrastructure, and if the infrastructure is exposed to wave attack, wind damage, sea ice damage, located on erodable surfaces, and located in an area susceptible to river flooding" (CBCL Limited, 2012, p.4). The likelihood of the coastal hazards is not evaluated in the CIAT, but a general identification of themselves, in such, the "vulnerability assessment" section of the CIAT only provides a rapid evaluation of what would be a working waterfront infrastructure located in a coastal zone greatly exposed to coastal hazards.

- Risk Assessment and the CIAT

Even though the CIAT is not a risk assessment, but a pre-assessment tool, the author believes that its outcomes are essential for the risk assessment process. By identifying the most critical working waterfront facilities during the pre-assessment phase by using the CIAT, risk assessment approach (risk assessments aim for determining priorities for asset protection and identifying mitigation options) will help focus on selected working waterfront facilities, therefore, allowing for cost effective risk assessments. Likewise the CIAT, SEPAC will help to build-in the risk assessment process, either by complementing the fishery-oriented CIAT or by analyzing the working waterfront from a socio-economic perspective. Also, by including SEPAC in the risk assessment process of working waterfront facilities, it would help to identify mitigation/adaptation options that fit both the fishery and socio-economic interests.

As it was mentioned above, risk assessments depend of other assessments. The determination of risk starts with the results of the vulnerability assessment, as well as the involvement of information related to the likelihood, magnitude, probability of a threat/event (Horlick-Jones et al, 1995 and Taylor, 1993, as cited in Barrow, 1997). Risk assessments can provide information that allows for the comparison and prioritization of

specific risks (Suter, 1993, as cited in Barrow, 1997), and adds consideration of the likelihood of threats coupled with the economic, political and social consequences of the system failure" (Baker, 2005, p.3).

The risk management process comprises six phases. Figure 4 describes the risk management process and provides some prompting questions/requirements to help guide the process. Each risk management phase is crucial for achieving cost-effective risk mitigation measures and making informed risk management decisions. For that reason, this paper urges government/local agencies to include both CIAT and SEPAC as part of the risk management process of working waterfront infrastructures to coastal climate change effects.

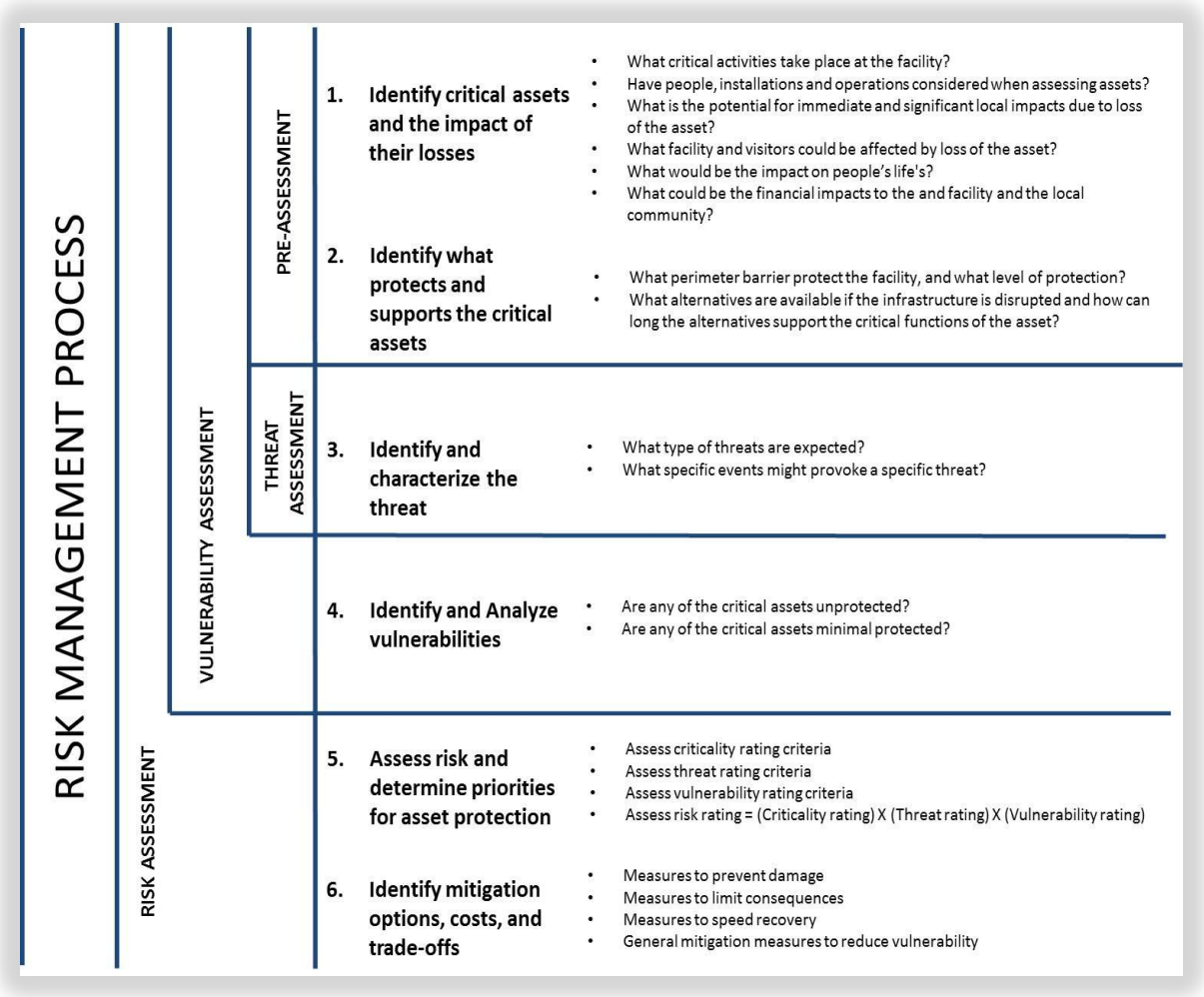

Figure 4. Risk Management Process. Based on the energy infrastructure risk management of the United States Department of Energy (2002a)

Vulnerability and risk assessments have been conducting, firstly, for environmental security purposes. For example, some of the analysis has been tailored to proactively develop risk management plans against environmental alteration due to potential chemical releases into the environment. However, for the scope of this project, the threats or hazards are focused on climate change effects (e.g. intense storms and surges, wave action), rather than man-made triggered. Hazards classification includes natural, quasi-natural, and man-made hazards (Barrow, 1997). Thus, when the threat is natural, hazards assessment deals with flood, storms, tornado, tsunami, etc.

Finally, in general, independently of the assessment type (e.g. pre-assessment, threat, impact, vulnerability, risk), these evaluations offer several benefits. For example, building awareness, as well baselines in which future assessment could be compared, feedback on best assessment practices. Characterization of key critical infrastructures and identification of vulnerabilities to develop responses are also among the benefits provided by the assessments mentioned above (United States Department of Energy, 2002b). Also, by knowing the vulnerabilities either for previous assessments or incidents offer key information to built-in new pre-assessments, vulnerability and risk assessments, real consequences, and potential cascade effects expected for identified threats (Baker, 2005).

CHAPTER 3: METHODOLOGY

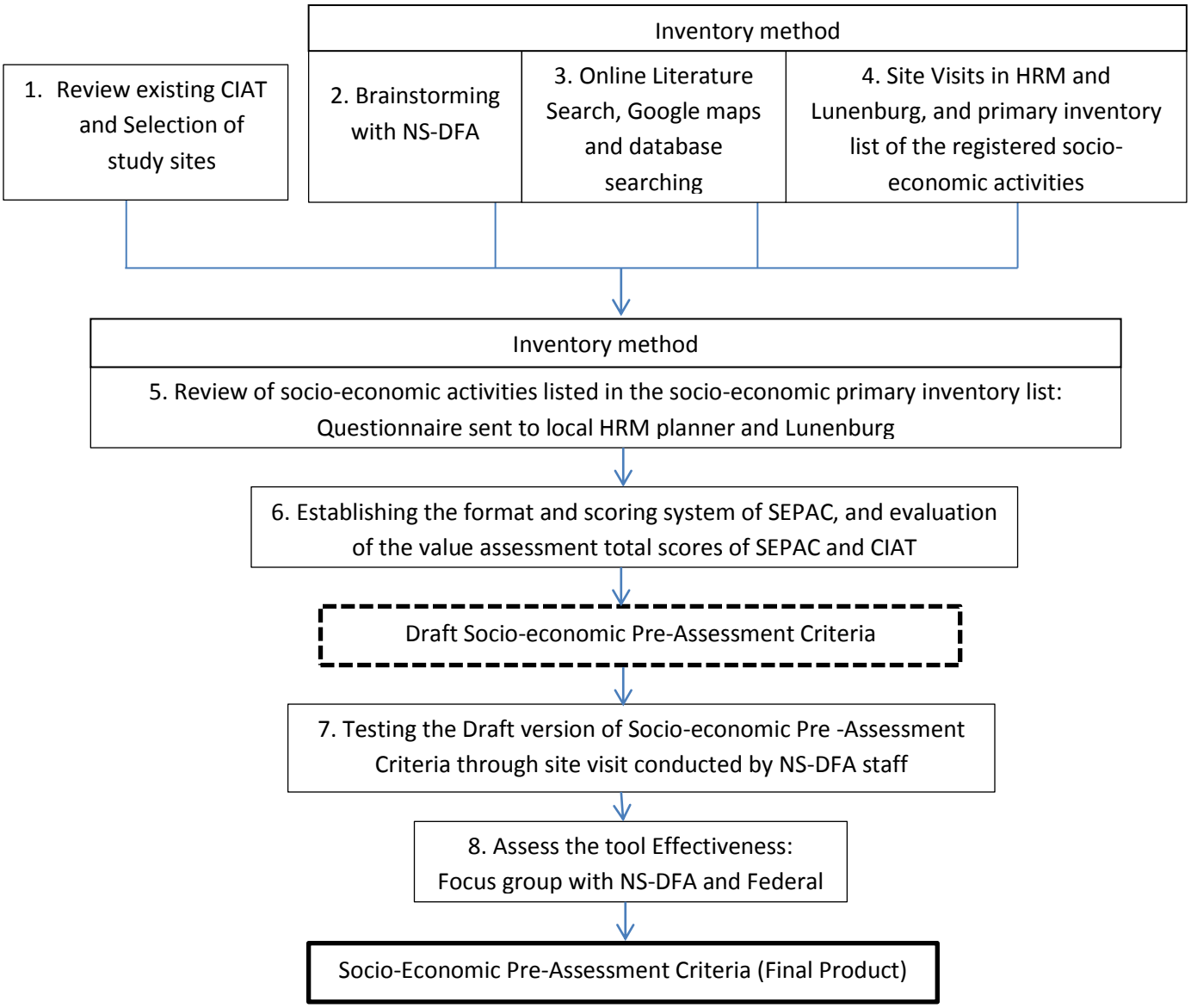

Figure 5. Methodology to Develop the Socio-Economic Pre-Assessment Criteria

The methodology used to develop the SEPAC included eight phases (Figure 5). Phase one consisted of reviewing the CIAT to select the sites of studies and to get a better understanding of the CIAT in order to help in the development of the SEPAC. Phase two

served to brainstorm and to choose the method utilized to develop the SEPAC. Similar to phase one, phase three consisted of a desktop analysis, which helped to identify some of the socio-economic activities being conducted at and within Nova Scotian working waterfronts. Phase four encompassed site visits to the working waterfront selected in phase one; and this phase helped to identify/confirm socio-economic activities occurring in/around working waterfronts. In phase five, expert consultation was undertaken. A questionnaire was sent to local HRM planner and Lunenburg NGO in order to confirm/add information about the socio-economic activities that occur in and nearby the selected working waterfront facilities. Phase 6 involved the combination of information collected during phases 1-5, which then guided the structure of the scoring system for the SEPAC. During phase seven, NS-DFA representatives tested the SEPAC. Finally, in phase eight, the effectiveness of the tool in terms of practical actions and/or decision-making processes was assessed through a focus group comprising of selected Government personnel. A detailed explanation of each phase is presented in the following sections.

3.1 Selection of Study Sites

As noted in Chapter 1, the pilot vulnerability assessments for 31 fishing-related coastal infrastructures was previously conducted by CBCL Ltd. using the CIAT (CBCL Limited, 2012). Coastal infrastructures that were assessed include breakwaters, fish plants, oil storage facilities, ship repair buildings, harbours, and wharves. Geographical locations where the CIAT was applied included five Nova Scotia coastal towns: Halifax Regional Municipality (HRM), Oxford Port-Howe, Minas Basin, Yarmouth, and Lunenburg. (CBCL Limited, 2012) (For detailed information about specific places within the six towns see Appendix B). For the scope of this project, the focus is specifically on working waterfront infrastructures such as wharves, small-craft harbours, and breakwaters.

Due to logistical constraints including time, location accessibility and budget, the criteria used to select the final study locations for this project are as follows:

- The place that has the wharf/small-craft harbour/breakwater must be located less than 200 kilometres from Halifax
- The wharf/ small craft harbour/breakwater must not be located in an isolated[14] area
- The wharf/ small craft harbour/breakwater must be part of a working waterfront community

Based on these criteria, at least three working waterfront infrastructures were selected at each of the two main locations (HRM and the Town of Lunenburg). Within the HRM location, Herring Cove and Eastern Passage were the selected areas (Figure 6a). For the Town of Lunenburg, the Lunenburg Harbour was the selected working waterfront area (Figure 6b). Figure 7 shows the working waterfront facilities that were assessed in each area.

Figure 6a. HRM selected sites: Eastern Passage and Herring Cove
(Source: https://maps.google.ca)

[14] For this project, the term "isolated" refers to an area that it is not part of or close of a community.

Figure 6b. Town of Lunenburg selected site: Lunenburg Harbour (Source: https://maps.google.ca)

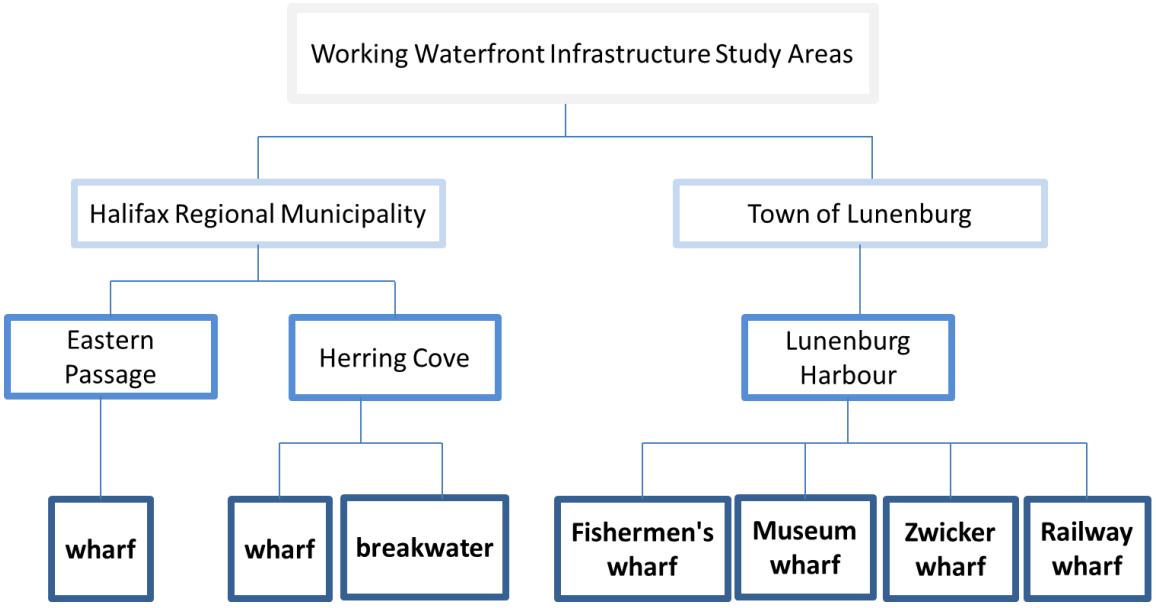

Figure 7. Working waterfront infrastructure areas of study

- **Site boundaries**

A key consideration prior to developing the SEPAC is to delimitate the boundary of the working waterfront area of study. Sairinen and Kumpulainen (2006), in their study about urban waterfront regeneration[15], delimited their area of study by including only buildings and areas that were either on the water, or visually linked to the area. For the purpose of this project, the study of area for each working waterfront facility (includes the facility and its area of influence) was delimited based on (i) the description of a "working waterfront" (Nova Scotia Fisheries, n.d., as cited in CBCL Limited, 2009a), and (ii) the land and/or buildings adjacent to the sea on both sides of the facility or main road to the facility within the 200 metres (m). This boundary was re-confirmed when the site visits were conducted.

3.2 Inventory Method

- Brainstorming

Brainstorming is a general facilitation technique that serves to generate several ideas in a short period time. Brainstorming can be used to start a discussion of business, systems, applications, and other requirements; to collect important points from several discussions; and "to generate ideas around functions or features desired in a new tool, application, product, or service" (Means & Adams, 2005, p.202). For this project, brainstorming sessions were conducted to identify the most practical method to develop the SEPAC (considering the time limit of the project). Following an extensive discussion by the author with Dr. Rapaport (Dalhousie University and member of the Canadian Institute of Planners), NS-DFA staff members and host supervisors David Mitchell[16] (Coastal Strategist),

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[15] "Waterfront regeneration" has been described as the process in which abandoned waterfront industrial areas, and/or seafront in general are renovated to "offer a new quality development of the whole city in a proactive and creative manner (Morena, 2012, p.81)

[16] During the development of this project, Mr. David Mitchell was working closely with the author of the assignment. However, at the last phase, he was not able to participate due to he changed work.

Justin Huston (Coastal Zone Coordinator) and Sean Weseloh McKeane (Coastal Zone Coordinator) the approach recommended to develop the SEPAC was the inventory method. The inventory method included three phases: literature search, site visits, expert consultation.

- Online Literature search

The literature search was done by reviewing online non-commercial published information focusing on other uses/activities (besides fisheries) happening on wharves, small craft harbours and/or breakwaters. Online information sources included Google maps, land use plans, gray literature (e.g. provincial technical reports, consulting companies' reports, and working papers), governmental websites (federal, provincial, and municipal)l, community websites, commercial websites (recreational and tourism), local non-governmental organization websites, and newspaper websites.

Google maps were used to find information regarding socio-economic activities in/nearby working waterfront infrastructures. The maps helped to spatially identify the activities and business occurring mostly in the surroundings of the facility. Some of the economic businesses running nearby the facility are tagged in Google maps; however, that information only served to form a general conceptualization about what could have been expected to see during the site visits. Gray literature, in particular, contributed to bring together the other pieces of information related to non-fishing activities happening in/nearby the working waterfront facilities, whist websites (e.g. community, business, and newspaper websites) helped to obtain information on typical yearly and current recreational activities and tourism services.

- Site Visits

Shelby and Harris (1985) stated that site visit provides a more comprehensive representation of all site characteristics. In such, site visits contributed to build the whole picture about everything related to working waterfront facilities and adjacent areas. Two site visits were conducted in May. The site visits took place over a weekend (during the first site visit the day was cloudy, whereas for the second site visit it was a sunny day). Each site visit was conducted between the hours of 10.00 and 18.00. The first site-visits were to Eastern Passage and Herring Cove working waterfront areas. The second site visits, were to Herring Cove and Lunenburg harbour working waterfront areas. In contrast with Eastern

Passage and Lunenburg Harbour, Herring Cove is neither a Heritage place nor an obvious tourist location. For that reason, site visits in Herring Cove were conducted during both cloudy and sunny days to assess if there were any difference in the types of activities taking place at this location. Although local citizens and visitors were eager to share their viewpoint on the uses that working waterfront facilities provide for them, only the *in-situ* observations and photographs taken by the author were used to assess each of the working waterfront areas.

The assessment time per working waterfront facility and nearby area was approximately one hour. Inventorying of the socio-economic activities took approximately half an hour per working waterfront facility, with an additional 30 minutes to assess other socio-economic activities happening within a 200 m radius (as indicated in the "Site Boundaries" section). During the site visits, it was decided that: (i) for a better understanding of the socio-economic activities happening in the working waterfront infrastructures, and (ii) for a more effective analysis of the information collected through the inventory method, the data collected were organized in four categories: passive recreational activities, active recreational activities, economic activities that directly use of the facility, and economic activities that do not directly use the facility. Site visits helped to confirm and/or add information to that already obtained from the online literature search; a socio-economic primary inventory list was developed as a result of the site visit phase

- Expert Consultation

Expert discussion was facilitated using the questionnaire and through informal email exchange. The socio-economic primary inventory list was used to develop a two-page open-ended questionnaire. The objective of the questionnaire was to help support and expand upon the information collected during the literature review, and site visits (Appendix C). Based on the questionnaire, the experts were asked to answer six questions regarding different types of recreational activities (passive or active) they had observed at the working waterfront and nearby areas. The questionnaire also sought comments on festivals happening in and/or nearby the facility, ocean-related business using the facility, and businesses that could depend of the facility. The experts were also asked to provide feedback on relevant socio-economic activities that may have been missed in the study.

In order to proceed with the expert consultation, the author contacted government or non-government personnel who had considerable experience in issues relating to working waterfronts, and/or had information regarding other uses and activities happening in and nearby the selected working waterfront facilities. For expert discussion[17], it was planned to contact HRM and Lunenburg municipal planners because of their direct experience with wharves, small harbours, and/or breakwater within their jurisdiction. Unfortunately, for the Town of Lunenburg (at least at the time this project was in process), there was not a municipal planner assigned for this location (personal communication, David Mitchell, June 4, 2012). Nonetheless, it was recommended to contact a representative of the NGO Bluenose Atlantic Coastal Action Foundation (see www.coastalaction.org). Table 3 provides the information for those that took part in this process.

Expert Information	Halifax Regional Municipality	Town of Lunenburg
Name of expert	John Charles	Brooke Nodding
Institution and/or organization	Planning and Infrastructure	Bluenose Atlantic Coastal Action Foundation
Position / Role	Planner	Executive Director

Table 3. Professionals consulted for the expert consultation phase

[17] The terms "expert consultation" and "expert discussion" is used synonymously through the project

3.3 Establishing the Format and Scoring System of SEPAC, and Evaluation of the Value Assessment Total Scores of SEPAC and CIAT

- Format of the SEPAC

In general, for the design of the SEPAC, the format followed the similar structure of the current CIAT form (Figure 8) with the following amendments/additions:

(i) The value considerations were organized in sections by type of scoring.

(ii) Since the CIAT is meant to conduct rapid assessments, the response options for the SEPAC did not have to include fine-detailed information

(iii) The numerical-based scale system was structured by a categorical classification (ordinal variables type) which included only 1, 2, 3 score responses, where 3 represented the higher score, while 1 the lower score. The author of the project decided only to include the number 1, 2, and 3 as categorical numbers to keep the same numerical based system of the CIAT in order to be able to compare and combine the outcomes of the CIAT with/without the SEPAC.

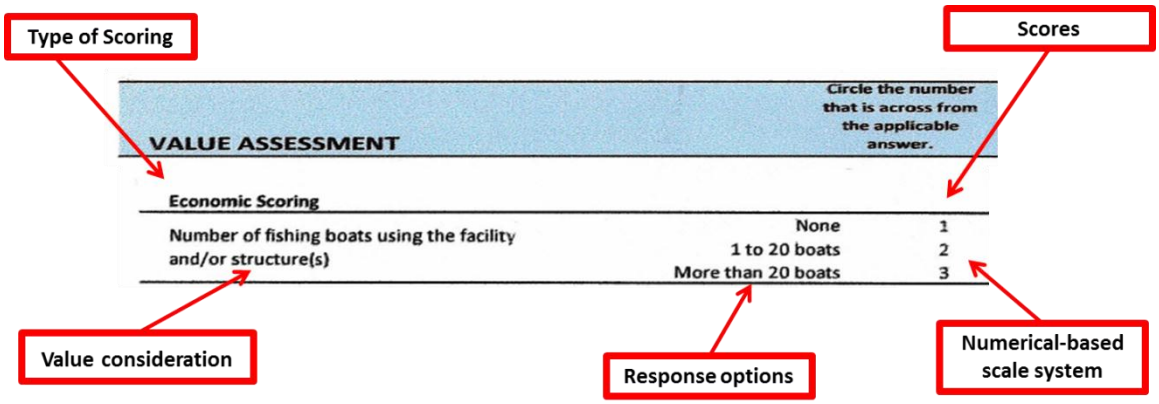

Figure 8. Scheme of value assessment taken from the CIAT (CBCL Limited, 2012)

Having already established the SEPAC format, it was developed by firstly integrating the findings gathered during the inventory phase. A list was then created to compile all the activities (e.g. people walking in the facility, boat tours, festivals, business nearby the facility) registered and observed during the online literature search and site visits, and further confirmed during the expert consultation phase. These socio-economic activities were grouped according to their category (passive recreational activities, active recreational activities, economic activities that directly use of the facility, and economic activities that do not directly use the facility). Later, the socio-economic activities were organized according to their type of value (societal value, economic value, and other type of value).

As in the "Value Assessment" section of the CIAT, where the fishing-related economic values are grouped into three type of scoring (financial scoring, economic scoring, and utility scoring) (Appendix A), the socio-economic values for the SEPAC were grouped as follows: Societal Scoring, Economic Scoring, and Other Scoring. The development of the value considerations for each type of scoring for the SEPAC included the socio-economic activities registered/identified from the inventory. Value considerations for the Societal Scoring included non-economic recreational activities (passive and active), whereas value considerations for the Economic Scoring included economic activities that depend on and/or use the working waterfront infrastructures. The value considerations for the Other Scoring category comprised of activities that could not fit in any of the previous types of scoring (supporting and complementary structures, as well as, festivals/events For clarification on the types of information being collected using the SEPAC, examples of socio-economic activities were also provided in the value consideration section (see Chapter Results, section 4.2).

Since the SEPAC is intended to be part of a rapid assessment (CIAT), it was not necessary to include questions that demand fine-detailed response options. Also, there is not a database that has financial information related to other coastal recreational activities besides cruise ships and marine recreational fishery (Gardner et al., 2005). The response options for each value consideration were formulated according the information found in the online literature search and during site visits. For instance, some working waterfront facilities host only one festival/event per year, while in other facilities there are several events and festivals for the same period of time. Thus, suggesting that response options

should consider not include very wide ranks. Nonetheless, such rational was not applied in all the value considerations. This exception corresponded to the value consideration that assessed affluence of people visiting the facility (some harbours are more busy than others), thus, suggesting considering wider response options.

Finally, for the numerical-based scale system the author used the qualitative ordinal variable type of the categorical classification. This numerical-based scale system only includes the scale from 1 to 3 (1, 2, 3), thus allowing for a meaningful ordering where 3 was the higher score, and 1 the lowest. As noted previously, the author also decided to keep the same 1, 2, 3 numerical-based scale system of the CIAT in order to compare/combine the results of the CIAT with/without the SEPAC.

- Evaluation of the Value Assessment Total Scores

After testing the SEPAC, the values value assessment total scores of the tested working waterfront facilities, together with the value assessment total scores of the same facilities assessed by CBCL assessors, were evaluated in order to identify the most vulnerable working waterfront facilities (criticality). This evaluation was done by employing two different approaches: Categorical Rating, and Ranking.

For the Categorical Rating approach, the identification of the most vulnerable working waterfront infrastructures was done by assigning a categorical rating number to the value assessment total scores of the assessed facilities. Similar to the numerical-based scale system in the CIAT, the categorical rating only included three-scale system: 1, 2, 3 (Table 4). Each categorical rating was then correlated to a consequence level or criticality[18], where the categorical rating 1 represented “Low Consequence Level”, the categorical rating 2 represented “Medium Consequence Level”, and the categorical rating 3 represented “High

[18] As mentioned before, the results obtained from the "Critical Assets Identification and Impact of their Losses” (CAI) phase are expressed in “Consequence level” or “Criticality”, which refers to the denomination of low, medium, or high, in term of loss of no-monetary/monetary values, a working waterfront facility could experience due to a natural/men-provoked event.

Consequence Level" (Table 4). This categorical rating approach was applied to the value assessment total scores obtained from both the CIAT and the SEPAC.

	Value assessment score range	Categorical Rating	Consequence Level or Criticality
Based on the CIAT value assessment total scores*	0 -7 8 - 14 15 - 21	1 2 3	Low Medium High
Based on the SEPAC value assessment total scores	0 -7 8 - 14 15 - 21	1 2 3	Low Medium High
Based on combination of the categorical rating of CIAT plus categorical rating of SEPAC		2	**Very Low**
		3	**Low**
		4	**Medium**
		5	**High**
		6	**Very High**

* See report "Assessment of coastal infrastructures relevant to the fishing and aquaculture industres (CBCL Limited, 2012)

Table 4. Correlation among Value Assessment Total Score/ Categorical rating/ Consequence Level[19]

[19] To determine the value assessment score range of each categorical rating for the CIAT, the author summed the same score type (1 or 2 or 3) per each value consideration (Appendix E). The total sum per each score type was the maximum value per score range. For example, the sum of all the score type 1 (CIAT has seven value considerations) has a total of 7. Thus, the categorical rating 1 encompassed value assessment total scores from a minimum of 1 to a maximum of 7. For the next value assessment score range, the maximum was established by summing all the score type 2 (∑=14), while the minimum is the value score 8 (next value score from the value score maximum of categorical rating 1) (See Appendix E for the other value assessment score ranges and categorical rating assignation). Since the SEPAC has the same format of the CIAT, the same procedure was done to determine the value assessment score range of each of its categorical rating.

To assess the consequence level or criticality of the working waterfront facilities from a multi-uses perspective, a combination of both the CIAT categorical rating, and the SEPAC categorical rating was done (∑ CIAT categorical rating + SEPAC categorical rating). The combination of the two minimum categorical rating (∑ CIAT categorical rating 1 + SEPAC categorical rating 1) established the minimum categorical rating (2) for this combination, whilst maximum categorical rating (6) was calculated by the sum of the maximum categorical rating of CIAT and SEPAC (∑ CIAT categorical rating 3 + SEPAC categorical rating 3).

The categorical rating approach served to compare the consequence level or criticality of the working waterfront facilities from both a purely fishery perspective and a purely socio-economic perspective. However, in order to assess the criticality of the working waterfront facilities from a multi-uses perspective (that is to say including the fishery and socio-economic viewpoint together), a combination of the categorical rating of both the CIAT and the SEPAC was put in place (Table 4). Finally, each categorical rating combination was assigned to a consequence level or criticality, where 2 represented "Very Low Consequence Level", and 6 represented "Very High Consequence Level" (see Table 4 for the others consequence level assignation).

The second approach, Ranking, basically consisted of assigning an ordinal number to each value assessment total score. For ranking purposes, ranking number 1 was considered as the most important critical facility in terms of loss of values (e.g. financial, economic, societal, etc.), whereas lower numbers were descending in importance. The correlation between ranking numbers (1, 2, 3, 4, etc.) and value assessment total score was the following: higher value assessment total scores/lower ranking numbers. This ranking approach was applied to the scores obtained from the CIAT, SEPAC, and the sum of both total scores (CIAT plus SEPAC).

3.4 Testing the Draft Version of the Socio-Economic Pre-Assessment Criteria and Assessing its Effectiveness

After the draft version of the SEPAC was developed, two NS-DFA Coastal Zone Coordinators were requested to test it. Justin Huston and Sean Weseloh McKeane volunteered to test the SEPAC. The author asked to the NS-DFA staff to test the same working waterfront facilities assessed during the site visits, thus, allowing a comparison of the results obtained from the NS-DFA staff with the information compiled during the site visits by the author (Appendix D shows the working waterfront facility test areas). The testing process was done during the weekend of July 7th and 8th. Similarly to the site visit phase, the testing evaluations coincided with cloudy and sunny days. The testing evaluation time per each wharf was approximately one hour and was conducted between the hours of 10.00 and 16.00.

Also, in order to address the research questions, a group discussion (focus group) approach was conducted to obtain feedback about the SEPAC, value assessment total score results, and the potential way to evaluate the results. Focus groups "are carefully planned group meeting designed to collect perceptions and information of a defined area of interest" (Chalofsky, 1999, p.1), thus allowing for interaction and discussion among the members of the focus group (Chalofsky, 1999). The snowball approach was used to identify and select the government personnel for the focus group. This approach, employed for finding research subjects, has been used "to provide a researcher with an expanding set of potential contacts (Thomson, 1997, as cited in Miller & Brewer, 2003, p.275).

The focus group was conducted concurrently via phone and face-to-face discussion that lasted about an hour. With prior approval from the participants, the discussion was digitally recorded. The focus group was composed of 5 people: 2 representative of NS-DFA, one representative of Small Craft Harbour - DFO Division, Dr. Eric Rapaport (Dalhousie University), and the author of this project (facilitator during the group discussion).

Prior to the group discussion, an info sheet containing the open-ending questions, draft version of the SEPAC, value assessment total score results of CIAT and SEPAC, and the analysis of the results were sent to the participants. The four open-ending questions that were addressed in the focus group are the following:

1. What it is your opinion about the SEPAC?
2. The CIAT assesses the vulnerability of working waterfront infrastructures to climate change effects from a pure fishery perspective; do you think the SEPAC could make the CIAT to be a more complete rapid assessment tool? And if so, are there any limitations to the SEPAC in making the rapid assessment?
3. Do you think the SEPAC could benefit practical actions related to working waterfront infrastructure management (specifically decisions in terms of which working waterfront infrastructure urges for a detailed analysis, fund allocation, repairing and maintenance, and/or structure of protection?
4. How do you think this could/is going to impact decision making?

CHAPTER 4: RESULTS

4.1 Inventory Method

In this section the main findings obtained from the inventory method (literature search and site visits) are presented. The inventory approach helped to identify the most relevant and representative socio-economic activities that depend upon and/or use working waterfront infrastructures.

- Online Literature Search

The online literature search contributed to identifying and developing the selection of the four categories (passive and active recreation, economic and non-economic activities) used in this research. Based on the literature, specific socio-economic activities were noted (Table 5). For example, among the passive recreational activities are people: gathering at the facility, having picnics on their boats, and walking within and along the facility. Active recreational activities include people fishing, swimming, canoeing, kayaking, and boating from the facility. Economic activities that use the facilities were mostly tours (e.g. sport fishing, cruising, whale and bird watching). Whereas economic activities that do not use the facility but depend on its presence are, for example, fish retail markets, restaurants, and bed and breakfast establishments. Festivals and public events are also among the top activities happening within or in close proximity to the facilities (e.g. Herring Cove Polar Dipe, Pugwash Mackerel Fishing Tournament). Those public activities were not initially included in any of the four categories but are assigned in a separate category named "Other activities". However, based on feedback from the group discussion (see Chapter 5 for further details) this categorization changed. The category "Other activities" also includes structures such as side floating docks, seating areas next to the working waterfront facilities.

Table 5. Socio-Economic Activities Identified during the Online Literature Search

		CATEGORIES				
TYPE OF SOURCE	SOURCE	Passive SOURCE Activities	Active Recreational Activites	Economic Activities that directly use and depend of the facility	Economic Activities that not use but depend of the facility	Others
Written literature: Government reports, Consulting company reports, NGOs' reports	Praxis Research & Consulting Inc., 2004	People walking in the facility People gathering	People fishing from the harbour Boating Scuba diving Canoeing	Crusing Spor fishing Whale and bird watching Kayack tours Boat tours	Seafood retail outlet Art gallery Restaurants Bed and breakfast	Habour frestivals Fishing parties Harbour Tournaments Cultural activities Concerts dances Lobsters dinners Fishing derbies
	CBCL Limited, 2009a	working waterfronts are the centre of community recreational activities working waterfronts support a wide range of recreational activities	working waterfronts are the centre of community recreational activities Swimming working waterfronts support a wide range of recreational activities			
	Toews, 2005		Tourism industry Sailing Swimming Recreational vessels canoeing kayaking Sport fishing	Tourism industry Berthing kayaking Sport fishing Whale watching	Tourism industry	Festivals
	MacInnes, De Soussa, & Munro, 2006	Picnics Community gathering	Sailing Swimng Canoeing kayaking Fishing			Cultural events
	Government of Nova Scotia, 2010		Recreational fishing Pleasure boating kayaking			
Websites: Community, Business	Pugwash Village., n.d					Mackerel Fishing Tournamnet
	Polar bear dip, 2011 (CBC news)					Herring Cove Polar Bear Swim
	Bras d'Or Yatch Club, 2011					Bras d'Or Yacht Club's Regatta Week
	see http://www.novascotiawhalewatching.com			Whale watching tours		
	see http://www.lunenburgoceanadventures.com			Recreational deep sea fishing Dive chapters Shark fishing shark cage diving		
	see http://www.pleasantpaddling.com/			kayack rentals kayack tours		
	see http://www.novascotiasailing.com/			Sailing tours Harbour boat tours		
	see http://my-waterfront.ca/development/zwicker-wharf-2					Seating areas Wooden walkway Additional floating docks
	Google maps (Eastern Passage/Herring Cove)			McNab's Island ferry	Wharf Wrap restaurant Old Dory Lobster restaurant Sal's Bed and Breakfast	

- Site Visits

Different types of activities were documented during the site visits. Most activities came under the recreational activities type both passive and active; while others were economic activities dependent upon the presence of the facility. For example, some of the passive recreational activities were people: enjoying the seascape, walking along the facility, walking their dogs and/or taking photos, and even reading in the facility (Figure 9a, 9b, 9c).

Figure 9a. Passive Recreation: people walking their pets – Railway wharf (© Cisneros, 2012)

Figure 9b. Passive Recreation: people walking and sitting in the facility– Museum wharf (© Cisneros, 2012)

Figure 9c. Passive Recreation: people sunbathing and reading in the facility– Zwicker wharf (© Cisneros, 2012)

Several active recreational activities were observed during the site visits. These included people fishing and using their kayaks from the facility (Figure 10a). Also, private motor and sailboats, as well as many dinghies and small boats were seen either attached to fishing boats or to the harbour facilities (Figure 10b). It was noticed that by paying a berthing fee, it is possible for private boats to park at the working waterfront facilities at any time. At other facilities small boats and dinghies were given prioritization.

Figure 10a. Active Recreation: people fishing from the facility– Herring Cove Breakwater (© Cisneros, 2012)

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Figure 10b. Active Recreation: people sailing from the facility– Zwicker wharf
(© Cisneros, 2012)

As noted earlier, economic activities were distinguished based on whether (a) they were directly dependent upon and/or utilized the working waterfront facility, or (b) did not directly use the facility, but depended upon its presence. For instance, activities that directly use the facility included sport-fishing tours, sight-sitting tours, ferries, whale and bird watching tours, sea kayak tours, and people buying seafood from the fishers (Figure 11a). Whereas activities that did not directly depend upon the facility included restaurants, bed and breakfast establishments, fish retailed markets, handcraft stores, hardware, and shipbuilding stores (Figure 11b).

Figure 11a. Economic Activities that use the facility: sea kayaking tours – Railway wharf
(© Cisneros, 2012)

Figure 11b. Economic Activities that do not use the facility but depend of its presence: Seafood retail stores, handicraft and souvenir stores – Eastern Passage wharf (© Cisneros, 2012)

There were also other activities and complementary facility infrastructures that did not easily fit with any of the four categories. However, based on evidence from the literature and observations, it is the opinion of the author that these activities and complementary facility infrastructure are essential to the working waterfront community's identity. Furthermore the accessibility and attractiveness of these facilities and events help to enhance the health of the local fishing community, visitors and the general public. Some of these activities include festivals and fundraising programs (Figure 12a); whilst among the complementary facility infrastructures are lighting, benches, visitor information tables, museums, and parking space (Figure 12b).

Figure 12a. Public festivals and events: Polar Bear Swim – Herring Cove wharf (source: http://laytonreidblog.com/?p=16214)

Figure 12b. Complementary structures: benches in front of working waterfront – Zwicker wharf (© Cisneros, 2012)

- Expert Consultation

Only one expert, the NGO representative, had first-hand knowledge of socio-economic activities being under taken at the working waterfront infrastructures besides fisheries related ones. As the two-page questionnaire asked respondents to answer the questions to the best of their understanding, the second expert, a municipal planner, declined because he did not feel he had enough knowledge[20]. Nonetheless, this was not a limitation, as information already collected during the site visits reflects the socio-economic activities happening at these harbour facilities, at least during the summer season. The Table 6 shows the socio-economic activities found through the expert consultation.

[20] If there is an association affiliated with the working harbour facility, he/she might be an appropriate person to contact to help in reviewing the criteria for such as an assessment tool.

Socio-Economic Recreational Activities	
Passive Recreational Activities	People walking in the facility
	People taking pictures
	People walking their pets
	Sitting
Active Recreational Activities	People fishing from the facility
Economic Activities that directly use and depend of the facility	Bird and whale watching tours
	Sailing tours
	Harbour tours
Economic Activities do not use but depend of the facility	Restaurants
	Fish markets
Other Activities and/or Complementary Infrastructures	Events and festivals

Table 6. Socio-economic activities identified through expert consultation

The outcomes obtained from the integration of the information gathered from the inventory method are presented in Table 7. Activities and complementary facility infrastructure that did not fit within any of the four categories were assigned to a separate category “other activities/complementary infrastructure”.

Passive Recreational Activities	Active Recreational Activities
• People enjoying the seascape from the facility • People walking in the facility • People walking their pets in the facility • People taking pictures from/in the facility • People reading in the facility • People using the facility as a meeting point • Watching (nature, other people)	• People fishing in the facility • People swimming from the facility • People kayaking from the facility • People parking their motor boats, sailboats, dinghies, jet ski in the facility • People launching their motor boats, sailboats, dinghies, jet ski from the facility

Economic Activities that directly use and depend of the facility	Economic Activities that do not use but depend of the facility
• Sport-fishing tours, Harbour tours • Ferry • Whale and bird watching tours • Businesses using the facility as storage place • Business using the facility as departure points • People buying seafood from the facility • Diving business using the facility as a staging and testing area	• Restaurants • Bed and breakfast • Retail outlet fish markets • Handy craft stores • Hardware stores • Shipping building stores • Supermarkets

Other Activities/complementary structures		
• Festivals • Fundraising events	• Side floating docks • Parking space • Lighting • Electrical power systems	• Museums • Visitor information tables and signals • Benches

Table 7. Socio-economic activities being conducted within/from/around Nova Scotia working waterfront facilities

4.2 Draft version of the Socio-Economic Pre-Assessment Criteria

The results obtained from the inventory method served to develop and set the SEPAC (Figure 13). The SEPAC is composed of the following parts: Societal Scoring, Economic Scoring, and Other Scoring. The value considerations for the first type of scoring include the number of people conducting both passive and active recreational activities; along with the non-for–profit value that working waterfront infrastructures provide to people that use the harbour infrastructures to facilitate their water-related activities. The

second type of scoring assesses the economic values represented by the presence of businesses; either depended upon and utilize working waterfront facilities or depend upon but not utilize the facility. The last type of scoring, addresses value consideration including public festivals/events happening within/nearby the facility, in addition to the value of any complementary structure that makes working waterfront infrastructures more attractive to local citizens and visitors. The SEPAC is the main product of this paper. This socio-economic pre-assessment was tested by NS-DFA staff members, and was the main point of discussion during the focus group.

Date: Assesor:		
SOCIO-ECONOMIC PRE-ASSESSMENT CRITERIA	**circle the number that is across from the applicable answer**	
Societal Scoring		
Number of people using the facility to conduct social activities (e.g. visitng of facility, dog walking, taking pictures, scenic&sighseeing, swimming,kayaking, fishing from the facility)	1-5 people per hour 6-10 people per hour Greater than 10 people per hour	1 2 3
How many people of non-commercial water-related means of transportation do you see using the facility? (e.g. private boats, jet ski, dinghies, private sea kayak, canoe, ect.)?	1-2 3-4 Greater than 4	1 2 3
Economic Scoring		
How many types of commercial recreational activities are provided in and/or use the facility (e.g. types of recreational use;ferry,jet ski, birds&whale watching tours, cruising, recreational fishing, diving tour, scenic & waterfront tours, etc.)?	1-2 3-4 Greater than 4	1 2 3
Number of recreational companies that use the facility as a departure/parking/storage point, or have in the facility a structure that serve as publicity/purchase point	1-2 3-4 Greater than 4	1 2 3
Number of commercial business within 200 metres from the facility (e.g. restaurants, handicraft stores, fish markets, bed and breakfast, etc.)	1-2 3-4 Greater than 4	1 2 3
Other Scoring		
Is there any festival or social event that happens in the facility or within 200 metres from the facility?	1-2 events and/or festival per year 3-4 events and/or festival per year Greater than 4 events and/or festival per year	1 2 3
Are there other structure/infrastructure nearby the facility that makes it more attractive for visitors (e.g. parking space, side floating dock, lighting, benches, visitor information center/tables, cultural centre)?	1-2 complementary infrastructures 3-4 complementary infrastructures Greater than 4 complementary infrastructures	1 2 3
Value Assessment Total	**(total of the circle answers)**	

Figure 13. Draft version of the Socio-Economic Pre-Assessment Criteria

4.3 Testing the Draft version of the SEPAC and assessment of its effectiveness

Based on the feedback from the NS-DFA staff and the focus group discussion three main points were identified. Firstly, some improvements to the SEPAC were suggested. For example, information that needed to be added/re-arrange in order to make the SEPAC more practical and clear. Considering the feedback obtained from the Government staff, Figure 14 shows the final version of the SEPAC. Secondly, the value assessment total scores of each of the seven working waterfront facilities where the SEPAC were applied are presented in Table 8. Finally, the correlations between the value assessment total scores and their meaning in terms of criticality by using the Categorical rating and Ranking approach are shows in Table 9. The analyses of the three points, as well as the practical implications of the SEPAC are discussed in more detail in Chapter 6.

Site location:_____

Date:_____ Time:_____Weather:_____

Assessor:_____

Coastal infrastructure type:_____

SOCIO-ECONOMIC PRE-ASSESSMENT CRITERIA	Circle the number that is across from the applicable answer	
Societal scoring		
Number of people using the facility to conduct social activities*: Underline the activities observed: visiting of facility, dog walking, taking of pictures, scenic & sightseeing, swimming, kayaking, fishing from the facility Others:_____ Note:	1 – 5 people per hour 6 – 10 people per hour Greater than 10 people per hour	1 2 3
How many types of non-commercial water-related means of transportation do you see using the facility? Underline the ones observed: private boats, jet ski, dinghies, private sea kayak, canoe Others:_____	1 -2 3 -4 Greater than 4	1 2 3
Is there any festival or social event that happens in the facility or within 200 metres from the facility?	1 - 2 events and/or festivals per year 3 - 4 events and/or festivals per year Greater than 4 events and/or festivals per year	1 2 3
Economic scoring		
How many types of commercial recreational activities are provided in and/or use the facility? Underline the ones observed: ferry, jet ski, birds & whale watching tours, cruising, recreational fishing, diving tours, scenic & waterfront tours. Others:_____	1 -2 3 - 4 Greater than 4	1 2 3
Number of recreational companies that use the facility as (underline the ones observed) departure/parking/storage point, or have in the facility a structures that serve as publicity/purchase points Others:_____	1 -2 3 -4 Greater than 4	1 2 3
Number of commercial businesses within 200 metres from the facility Underline the ones observed: restaurants, handicraft stores, fish markets, bed and breakfast Others:_____	1 -2 3 -4 Greater than 4	1 2 3
Other scoring		
Are there other structures/infrastructures within 200 metres from the facility that make it more attractive for visitors? Underline the ones observed: parking space, side floating dock, lighting, benches, visitor information center/tables, cultural centre. Others:_____	1 - 2 complementary infrastructures 3 - 4 complementary infrastructures Greater than 4 complementary infrastructures	1 2 3
Value Assessment Total	(Sum of all the circled responses)	

Figure 14. Final version of the Socio-Economic Pre-Assessment Criteria

				Halifax Regional Municipality			Town of Lunenburg			
site location				Eastern Passage	Herring Cove	Herring Cove	Lunenburg Harbour	Lunenburg Harbour	Lunenburg Harbour	Lunenburg Harbour
date				18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12
assesor				VL	VL	VL	BH	BH	BH	BH
name of structure				**SCH**	**Breakwater**	**Wharf**	**Museum**	**Zwicker**	**Railway**	**Fishermen's wharf**
current use				wharves fish plants	wave protection for inner harbour	wharf for fish landing	wharf	wharf	wharf	wharf
VULNERABILITY ASSESSMENT	**circle the applicable answer**									
Is the structure you are reviewing:										
less than 2.0 metres above high tide (I.e. exposed to storm surge damage and sea leel rise?	Yes	No		Y	Y	Y	N	Y	Y	Y
exposed to wave damage?	Yes	No		Y	Y	Y	N	N	N	N
exposed to wind damage?	Yes	No		N	N	N	N	N	N	N
exposed to sea ice damage?	Yes	No		N	N	N	N	N	N	N
exposed to river flood damage?	Yes	No		N	N	N	N	N	N	N
located along an eroding shoreline or on unstable soil?	Yes	No		N	N	N	N	N	N	N
Does the structure depend on other vulnerable infrastructure for assess (e.g. low-lying access road or causeway) or for safe operation (e.g. harbour entrance breakwater)?	Yes	No		N	N	N	N	N	N	N
If your answer yes to any of the questions above, please proceed to Section 2. If you answered not to all the questions above, this facility does not need to be assessed										
VALUE ASSESSMENT	**circle the number that is across from the applicable answer**									
Financial Scoring										
Approximate replacement value of the facility and/or structure (s)	Less than a 1 million $ 1 to 5 million $ Greater than 5 million $	1 2 3		3	2	2		2	2	2
Remaining life of the facility and/or structure(s)	Less than 5 years 5 to 20 years Greater than 20 years	1 2 3		3	3	2		3	2	3
Economic Scoring										
Number of fishing boats using the facility and/or structure(s)	None 1 to 20 boats More than 20 boats	1 2 3		3	2	2		1	2	2
Annual seafood value produced, landed, or processed at the facility or at facilities serviced by the structure	0 to $500,000 $5000,000 to 1 million $ Greater than 1 million $	1 2 3		3	1	1		1	3	3
Number of jobs provided by the facility	None 1 to 20 jobs Greater than 20 jobs	1 2 3		3	2	2		2	2	3
Utility Scoring										
Is there a facility nearby that is able to offer the same service?	Yes Yes, but not inmediately No	1 2 3		3	3	3		1	1	1
Does the nearby facility have additional capacity available?	Yes, inmediately available Yes,if significant additional investment is made No	1 2 3		2	2	2		2	2	2
Value Assessment Total	**(total of the circle answers)**			20	15	14		12	14	16
Date:				07-Jul-12	07-Jul-12	07-Jul-12	07-Jul-12	07-Jul-12	07-Jul-12	07-Jul-12
Assesor:				SWM	JH	SWM	SMW	JH	JH	SMW
SOCIO-ECONOMIC PRE-ASSESSMENT CRITERIA	**circle the number that is across from the applicable answer**									
Societal Scoring										
Number of people using the facility to conduct social activities (e.g. visitng of facility, dog walking, taking pictures, scenic&sighseeing, swimming,kayaking, fishing from the facility)	1-5 people per hour 6-10 people per hour Greater than 10 people per hour	1 2 3		3	1	1	3	2	1	2
How many people of non-commercial water-related means of transportation do you see using the facility? (e.g. private boats, jet ski, dinghies, private sea kayak, canoe, ect.)?	1-2 3-4 Greater than 4	1 2 3		2	2	1	3	3	3	1
Economic Scoring										
How many types of commercial recreational activities are provided in and/or use the facility (e.g. types of recreational use;ferry,jet ski, birds&whale watching tours, cruising, recreational fishing, diving tour, scenic & waterfront tours, etc.)?	1-2 3-4 Greater than 4	1 2 3		2	3	1	2	1	2	
Number of recreational companies that use the facility as a departure/parking/storage point, or have in the facility a structure that serve as publicity/purchase point	1-2 3-4 Greater than 4	1 2 3		1	1	1	3	1	1	1
Number of commercial business within 200 metres from the facility (e.g. restaurants, handicraft stores, fish markets, bed and breakfast, etc.)	1-2 3-4 Greater than 4	1 2 3		3		1	3	3	2	2
Other Scoring										
Is there any festival or social event that happens in the facility or within 200 metres from the facility?	1-2 events and/or festival per year 3-4 events and/or festival per year Greater than 4 events and/or festival per year	1 2 3		3		1	2	3	1	1
Are there other structure/infrastructure nearby the facility that makes it more attractive for visitors (e.g. parking space, side floating dock, lighting, benches, visitor information center/tables, cultural centre)?	1-2 complementary infrastructures 3-4 complementary infrastructures Greater than 4 complementary infrastructures	1 2 3		3	1		3	3	1	2
Value Assessment Total	**(total of the circle answers)**			17	8	6	19	16	11	9
VALUE ASSESSMENT TOTAL (CBCL results + SEPAC results)				**37**	**23**	**20**	**19**	**28**	**25**	**25**

Coastal Infrastrucutre Assessment Tool (CIAT) designed and assessed by CBCL Ltd.

SEPAC designed by the author of the project and tested by NS-DFA staff

Table 8. Results of the application of the SEPAC and the CIAT (see CBCL Limited, 2012 for the CIAT final report)

a)

Value Assessment Score Range, Categorical Rating, and Consequence Level

	Value assessment score range	Categorical Rating	Consequence Level or Criticality
Based on the CIAT value assessment total scores*	0 -7 8 - 14 15 - 21	1 2 3	Low Medium High
Based on the SEPAC value assessment total scores	0 -7 8 - 14 15 - 21	1 2 3	Low Medium High
Based on combination of the categorical rating of CIAT plus categorical rating of SEPAC		2	Very Low
		3	Low
		4	Medium
		5	High
		6	Very High

			CIAT			SEPAC			CIAT plus SEPAC	
			Score	Categorical Rating	Consequence Level	Score	Categorical Rating	Consequence Level	Σ Categorical Rating	Consequence Level
Halifax Regional Municipality	Eastern Passage	SCH	20	3	High	17	3	High	6	Very High
	Herring Cove	Breakwater	15	3	High	8	2	Medium	5	High
	Herring Cove	Wharf	14	2	Medium	6	1	Low	3	Low
Town of Lunenburg	Lunenburg Harbour	Museum	0	1	Low	19	3	High	4	Medium
	Lunenburg Harbour	Zwicker	12	2	Medium	16	3	High	5	High
	Lunenburg Harbour	Railway	14	2	Medium	11	2	Medium	4	Medium
	Lunenburg Harbour	Fishermen's wharf	16	3	High	9	2	Medium	5	High

b)

			CIAT		SEPAC		CIAT plus SEPAC	
			Score	Ranking	Score	Ranking	Score	Ranking
Halifax Regional Municipality	Eastern Passage	SCH	20	1	17	2	37	1
	Herring Cove	Breakwater	15	3	8	6	23	4
	Herring Cove	Wharf	14	4	6	7	20	5
Town of Lunenburg	Lunenburg Harbour	Museum	0	6	19	1	19	6
	Lunenburg Harbour	Zwicker	12	5	16	3	28	2
	Lunenburg Harbour	Railway	14	4	11	4	25	3
	Lunenburg Harbour	Fishermen's wharf	16	2	9	5	25	3

Table 9. Identification of critical working waterfront infrastructure (criticality) (a) value assessment scores (CIAT, SEPAC, CIAT plus SEPAC) evaluated by using the Categorical Rating approach. (b) value assessment scores (CIAT, SEPAC, CIAT plus SEPAC) evaluated by using the Raking approach.

CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

The focus of this paper was to complement the "Coastal Infrastructure Assessment Tool" (CIAT) by incorporating an additional criterion in which the societal and non-fishery based economic values of working waterfront facilities are also included with the financial and economic fishery based values. Specifically the research questions were:

1. How practical is this tool for conducting rapid vulnerability assessments of working waterfront infrastructures?
2. As this tool currently only assesses working waterfront in terms of fishing-related users, how could this tool provide a more integrated assessment?
3. How could the findings of this vulnerability assessment tool better inform practical actions and/or policy implications to manage future impacts from climate change?

This Chapter will address the project research questions by firstly discussing two perspectives concerning the SEPAC: (i) the practicability of the SEPAC, and (ii) the potential practical application and/or decision making opportunities that these improvements could provide towards the management of working waterfront infrastructures. The first section of this Chapter will focus on the feedback from the NS-DFA assessors who tested the SEPAC, as well as the author's observations attained during the site visits. The second section of this Chapter, will discuss which of the two approaches (categorical rating or the ranking method) was the most practical way to evaluate the value assessment total scores. Professional feedback from representatives of the: Small Craft Harbour Division (DFO), and NS-DFA Nova Scotia Department of Fisheries and Aquaculture have contributed to a better understanding of the implications of this SEPAC to help with decision-making related to the management of coastal climate change effects.

5.1 Evaluation of the Practicality of the Socio-Economic Pre-Assessment Criteria

The CIAT is a tool meant to assess the vulnerability of working waterfront facilities to coastal climate change effects. The tool was designed for the NS-DFA considering in its design the fact that non-technical people are able to apply it (CBCL Limited, 2012). Similar to the objectives of the CIAT, the author considers pre-assessments should seek for a practical application of itself. In such, the practicality of SEPAC depends on how feasible it is to use by NS-DFA staff. As such, the SEPAC was tested by two representative of the NS-DFA, and produced some interesting results. Based on the test results, overall the SEPAC was positively received. In addition, the practicality of the SEPAC was further discussed during the focus group. Some of the feedback received included:

"The SEPAC certainly works well as an additional piece if we were doing a rapid vulnerability assessment; it did not take long to work through the questions" (personal communication, June 10, 2012, Sean Weseloh Mckeane).

"I think the SEPAC reflects the socio-economic information needed for a rapid assessment. Visitors and local people tend to gravitate to the harbours to be close to the ocean. Considering this fact, I think the SEPAC reflexes the socio-economics of working waterfront infrastructures" (personal communication, June 12, 2012, Paul MacDonald).

As noted in Chapter three, the SEPAC outline was developed using published Government reports and gray literature. Although the literature was useful for getting a general sense of the scope and material, there were some limitations. For example, information about the socio and economic aspects that are not related to the fishery industry was produced mostly between 2004 and 2005 (Gardner et al., 2005; Praxis Research & Consulting Inc., 2004), with a few more reports released in later years under the direction of the Provincial Government (CBCL Limited, 2009a). In Nova Scotia, most of the studies relating to working waterfront facilities, local citizens, and people were addressed by the Coastal Community Network. Unfortunately, with the closure of this civil society based organization, the result has been a great decrease in the production of essential forms of non-commercial published material. This situation in turn has contributed towards the creation of a gap in information that documents changes and trends in economic and non-economic benefits of working waterfront facilities. Site visits provided an updated

perspective on what is happening at these working waterfronts; however it is not possible to state new trends or benefits because of the perceived limitations of these visits (e.g. number of visits and potential seasonal variations). For example, the Province of Nova Scotia has a higher affluence of people (local, residents, and visitors) during summer season, as such it can be inferred that the value assessment total scores of the SEPAC would be higher if working waterfront infrastructures are assessed during the summer season rather than during the winter season. Unfortunately, the time period of this graduate project do not allow for testing the SEPAC during the other seasons (winter, autumn, spring), therefore, it is not being able to determine with certainty if the seasonal factor is a limiting influence in the application of SEPAC.

The further analysis and suggestions to improve the SEPAC came from on-going feedback from NS-DFA staff members (prior the trial, during the trial, after the trial). One of the standpoints relates to the weather factor. It is probably safe to say that sunny days will motivate more people to conduct outdoor recreational activities within or nearby the facility, if compare to a rainy day. For example this aspect was noticed during the site visits to Herring Cove breakwater where there were two people for an approximately one hour period on a rainy day, but nine people on another day when it was sunny. This potential bias was again raised during the group discussion by NS-DFA representatives, in which it was also recommendable that the application of the SEPAC be used only in comparable weather situations (e.g. only sunny days). One of the experts also noted that, weather/date/time information should be included as it would provide a better sense of context and lead to a more sound analysis, provide the chance to analyze the value assessment total scores within a better context (personal communication, June 10, 2012, Sean Weseloh Mckeane).

An identified representation of what was observed, rather than just annotate a relative number of people visiting the facility was other of the observations. For instance, the first value consideration (Societal Scoring) asks for the number of people visiting the facility in a one-hour period (Figure 14). By considering only such information, it only represents a volume of people. But, by including the type of activities conducted by those people, then, it could allow for an extrapolation of information as guidance for future detailed assessments (personal communication, June 10, 2012, Sean Weseloh Mckeane). A potential limitation is related to the type of activity people are undertaking at the facility.

For example, if a person is walking on the pier, it is difficult to determine whether that person is just walking along the waterfront facility or, heading to undertake a specific activity such as renting a canoe. In that case, probably the only way to clarify this observation and save time on the assessment would be by asking the person what they are doing at the pier.

As the SEPAC is meant to be a rapid socio-economic pre-assessment, the evaluation time is a critical factor that needed to be considered. For instance, one of the value considerations that were seen as another potential limitation refers to the time spent for assessing public events and festivals. In some working waterfronts, festivals are well-advertised events, while others are more locally publicized. However, as this information can be attained by employing media sources such as the Internet or by asking key stakeholders, who can then provide impartial responses to the SEPAC, this potential limitation can be addressed. For instance, besides the information obtained from the online search or site visits (e.g. Lunenburg Folk Harbour Festival) (see http://www.folkharbour.com; personal observation, May 19, 2012), the same result was also acquired through the expert consultation process. By asking the Executive Director of the Bluenose Atlantic Canada Association, it was noted that the expert clearly has a good understanding of public festivals and events happening in his area (i.e. Lunenburg Harbour). However, the information obtained from the expert also depends on how much knowledge the expert has about the local condition of working waterfront infrastructures. Although it appears that the lack of first-hand knowledge from the expert could limit the source of information to use the SEPAC (see Chapter four, "Expert Consultation" section), it does not necessarily limit the source of information nor obstruct the application of the SEPAC. Techniques, such as the "snowball", approach can further assist in the identification of other potential key experts (Thomson, 1997, as cited in Miller & Brewer, 2003, p.275), which, based on this study, could include any association affiliated, NGO representative, municipal staff or local organization that works closely with the working harbour infrastructures.

As a whole, the evaluation time spent for assessing the working waterfront facilities highly depends on the type of value considerations of the SEPAC. For example, if the "value considerations" requires confidential or sensitive data, then, obtaining such information could take additional time to conduct the assessment. This situation was experienced by

some of the CBCL assessors when applying the CIAT (CBCL Limited, 2012). For example, in order to score the financial and economic component of the tool, it was very time consuming as the data was held by DFO and was not easily accessible. A similar situation was experienced by Joe Hanrahan (NS-DFA Coastal Resource Coordinator), when he tested the CIAT: "although this assessing tool has been kept simple, the required information (i.e. annual seafood value produced) is not readily available to the general public" (CBCL Limited, 2012, p. 89). These trial experiences were taken into consideration when developing the SEPAC. Thus, the value considerations do not depend of a special database, or confidential information, especially since ocean-related recreational activities database appear to do not exist, with the exception of data relating to large cruise ships and sport fishing (Gardner et al., 2005). The most dependable coastal recreational tourist activities that use working waterfront facilities as vital platform from which to launch their services are sport fishing, whale and bird watching, sea kayaking, boat tours in general. Only two Government agencies monitor these coastal recreational activities: the Federal Fisheries and Oceans Department (Fisheries and Oceans Canada, 2012c), and the Nova Scotia Department of Tourism, Culture, and Heritage (Gardner et al., 2005). Yet, the financial contributions of such activities are poorly tracked, and may not provide a reliable database for estimating the monetary value of some of these activities (Gardner et al., 2005). This was one of the main reasons why the author did not include requiring statistical financial information for the SEPAC.

On the other hand, unlike the CIAT, which recommends that assessors could apply the CIAT either by conducting a desktop assessment or by visiting the facility (CBCL Limited, 2012), the author of this paper states that, on-site visits are mandatory to apply the SEPAC. This obligatory requirement, together with the fact that almost all the value considerations are based on *in-situ* assessment (it took the NS-DFA assessors a maximum period of two hours per assessment per facility), makes the SEPAC to be a practical, easy-to-assess, rapid socio-economic pre-assessment criteria.

"*During the assessment of the harbour facilities by employing the SEPAC, the assessment was straightforward. The questions of the SEPAC were clear, as well as the information required was accessible and manageable to assess*" (personal communication, June 10, 2012, Justin Huston)

Finally, as noted in Chapter one the ACAS projects in Nova Scotia involves the use of high technology equipment and software (Atlantic Climate Adaptation Solutions Association, n.d.b). Some of these technologies include the use of optical remote sensing (e.g. LIDAR), GIS analysis, and mapping by using 3D digital laser scanners. The lack of technology, budget limitations or budget cuts should not deter from finding alternative methods to assess vulnerability in Nova Scotia working waterfront infrastructures. As such, both the CIAT and the SEPAC would help to identify, in a cost-effective way, which are the most critical working waterfront infrastructures, as well as, to determine which facility could be more potentially at high risk (in terms of socio-economic value loss) from coastal climate change impacts.

5.2 Incorporation of the Socio-Economic Pre-Assessment Criteria into "Coastal Infrastructure Assessment Tool" and its practical implications in the decision-making to cope with potential coastal climate change effects

In order to understand the practical implications of the SEPAC in terms of decision-making requirements to cope with potential coastal climate change effects on working waterfront infrastructures, the value assessment total scores of both CIAT and SEPAC were evaluated and interpreted based on the Categorical Rating and Ranking approaches.

The evaluation was done by applying the Categorical Rating and Ranking approach to the SEPAC value assessment total scores, CBCL value assessment total scores (only seven facilities), and the combination of both scores. The goal of this evaluation was to see if the working waterfront facilities that got the highest scores from the application of the CIAT were the same facilities that got the higher scores after combining the total scores of the CIAT and the SEPAC. Firstly, the Categorical Rating approach was applied. The results shows that by only taking into account the fishery perspective, Eastern Passage wharf, Fishermen's wharf, and Herring Cove Breakwater would be the most vulnerable/critical infrastructures, in terms of value loss, to face coastal hazards (Consequence level: High) (Table 9, section a). However, the scenario changes if the analysis is based purely from a purely socio-economic perspective. For instance, Eastern passage, Museum wharf, and Zwicker wharf would be the most vulnerable/critical facilities to face coastal climate change

effects. Nonetheless, by evaluating the combination of both perspectives (fishery and socio-economic), the outcomes change considerable. If that is the case, the only most critical infrastructure is the Eastern Passage wharf (Consequence level: Very High). Another interesting outcome comes from the combination of CIAT and SEPAC. Based on the CIAT, Museum wharf had no value under the old system, ending up last in the list of CIAT vulnerable/critical working waterfront infrastructures; however, by assessing such wharf in a more holistic approach (fishery and socio-economic perspective), the level of vulnerability/criticality is raised to a medium level (Table 9, section a). Likewise both the Museum wharf and Zwicker wharf shows a variation in its vulnerability/criticality level. According to the CIAT assessment results, Zwicker wharf is scored with an average value assessment total, therefore, being interpreted in this paper as a wharf that does not encompass lots of fishery economic values (vulnerability/criticality: medium rating). However, by including its socio-economic values, the wharf appears to be important for both the fishery industry, but also for the working waterfront community and general public (vulnerability/criticality level: high rating).

The categorical rating approach provided to the author the chance to partially identify which would be the working waterfront facility that, in case of not being protected from coastal hazards, could involve a serious value loss in terms of fishery-based financial and socio-economic values. However, the categorical rating approach has its own limitations in which it does not identify the critical assets in order of vulnerability/criticality. For example, Herring Cove breakwater, Zwicker wharf, and Fishermen's wharf obtained a consequence level of high, but it was not possible to state clearly which of the three is the most vulnerable/critical.

Categorical evaluation approaches could involve subjective estimations since categories are nominative variables that have no meaningful ordering (personal communication, June 17, 2012, Eric Rapaport); for that reason, the total scores also were evaluated by applying an ordinal approach: the Ranking approach. This approach bases its rational in which a numerical ranking scale, for example: 1, 2, 3, 4, 5, 6, 7, etc. assigns the order of importance in terms of which critical infrastructure contains more values (financial, socio-economic, etc.); therefore, deserving first attention for detailed assessments (e.g. vulnerability, risk assessments), and/or identify potential mitigation/adaptation measures to protect the working waterfront infrastructure. The

results, from the fishery perspective, show that Eastern Passage (ranking 1) and Fishermen's wharves (ranking 2) would be in the top priority, whilst Museum (ranking 6) and Zwicker (ranking 5) wharves would be the least important (Table 9, section b). In contrast, from the socio-economic viewpoint, Museum and Zwicker wharves, together with the eastern passage wharf, are in the first raking positions (Table 9, section b). Combining the two perspectives (fishery and socio-economic), the ranking order changes slightly for the Zwicker wharf in that there is low/no fishery activity, however the socio-economic values it provides to the community (e.g. people can berth their boats, walk on the wharf) indicates that it is a critical working waterfront infrastructure. In the case of the Eastern Passage wharf, the author noted a unique situation, in that both fishery activities and socio-economic activities (e.g. businesses, ferry tours, the wharf as a recreation area to visit) are equally important for the fishing industry.

Conversely to the categorical rating approach, the ranking approach allows for a better understanding of which wharf would be consider first priority, in addition to allowing for further ranking of the remaining wharves. The author considers that this approach is a more functional way to evaluate the value assessment total scores (either through individual accounts or by integrating numerous perspectives). The author also notes that the SEPAC is not a tool that will inform managers on which infrastructure needs more resources (e.g. funds, maintenance, repairmen, adaptation measures), but will help guide towards a better understanding of which working waterfront facility could be at higher risk of value loss if destroyed/damaged by either natural or human-provoked events. In addition, the SEPAC could help prioritise which facility would be selected for a further assessment (e.g. vulnerability, risk, socio-economic) in the future. For instance, "the risk characterization task focuses on investment or implementation priorities; it requires information on the criticality (consequence of loss) for assets so evaluation of the risk benefits or investment can be ranked" (United States Department of Energy, 2002b, p.11).

Both the categorical rating results and the ranking results provides evidence that if the working waterfront infrastructures are assessed from a single-use perspective, the decision-making regarding which infrastructure is at high-risk of value loss would be different when compared to an assessment from a multi-use perspective. The author of this paper argues that working waterfront facilities must be assessed from a multi-use perspective, given that such infrastructures are also used by others (e. g. community,

residents, and visitors). Any benefit (either economic or social) provided for working waterfront facilities should not be ignored when conducting pre-assessments, but be considered as a fundamental component that needs to be include in the evaluation. Based on this study and examples from the literature (Cicin-Sain & Knecht, 1998), working waterfront infrastructures have a tight relationship with both the fishing industry and the community. As a means of improving the manner in which such infrastructures are managed, the author highly supports the expansion of expanding from a single-use perspective to a multi-use/integrated perspective when pre-assessing working waterfront facilities.

On the other hand, independently of the two evaluation approaches (categorical rating and ranking), evaluation approaches by Governmental agencies could be different, based on the interests of the organization. For example, for the Small Craft Harbour Division, as its mandate states the need to concentrate efforts and resources on core harbours to the fishing industry (Fisheries and Oceans Canada, 2012a), the value assessment total scores of the SEPAC would not be relevant as the value assessment total scores of the CIAT, in the hypothetical case both assessments (CIAT and SEPAC) would need to be included as part of the decision-making of harbour facilities As such value total scores are likely to be weighted, thus, designating a higher weight to the scores from the fishery perspective, and a lower weight to the scores from the socio-economic perspective. Table 10 illustrates what would be the vulnerability/criticality ranking of a working waterfront if the value assessment total scores of the CIAT (weight=2/3) and SEPAC (weight = 1/3) are weighted prior ranking them. Figure 15 shows the formula in which the CIAT and SEPAC value total scores were weighted.

$$\sum_{i...n} = C_i \times W_i$$

Where:

C_i = criterion score/score of the factor "i"

W_i = weight of the factor "i"

Figure 15. Formula based on weighting approach to determine the vulnerability/criticality ranking of working waterfront infrastructures

			CIAT		SEPAC		CIAT plus SEPAC		CIAT (weight 2/3) plus SEPAC (weight 1/3)	
			Value total score	Ranking	**Value total score**	Ranking	**Value total score**	Ranking	**Σweithed value total score**	Ranking
Halifax Regional Municipality	Eastern Passage	**SCH**	20	**1**	17	**2**	37	**1**	19	**1**
	Herring Cove	**Breakwater**	15	**3**	8	**6**	23	**4**	13	**3**
	Herring Cove	**Wharf**	14	**4**	6	**7**	20	**5**	11	**4**
Town of Lunenburg	Lunenburg Harbour	**Museum**	0	**6**	19	**1**	19	**6**	6	**5**
	Lunenburg Harbour	**Zwicker**	12	**5**	16	**3**	28	**2**	13	**3**
	Lunenburg Harbour	**Railway**	14	**4**	11	**4**	25	**3**	13	**3**
	Lunenburg Harbour	**Fishermen's wharf**	16	**2**	9	**5**	25	**3**	14	**2**

Table 10. Comparison between the value assessment total scores (CIAT plus SEPAC) evaluated by using only the ranking approach and the weighting approach before the ranking approach

By weighing the CIAT and SEPAC value total scores, the wharfs/small harbours that are considered as top in the ranking (Eastern Passage wharf and Fishermen's wharf) resemble those wharfs that are ranked as the most vulnerable/critical working waterfront facilities when applying only the CIAT. Knowing the variety of socio-economic values and fishery values (even though is not that much as in other wharfs) the Zwicker wharf

encompasses, the author disagrees with the weighting approach because it ranks Fishermen's wharf as more important than Zwicker wharf, when it appears that Fishermen's wharf contains almost only fishery-related values. However, regardless of the weighting approach or the Small Craft Harbour Division mandate, the Federal agency recognizes there are other values that working waterfront infrastructures comprise, besides the fishery-related ones.

"When it comes down to our mandate, it is mostly driven by the impacts on the commercial fisheries; however, it does not say we do not look at the other activities as well. We recognize that harbours are an important part of working waterfront communities, and that there are a lot of different activities that take place there" (personal communication, June 12, 2012, Paul MacDonald).

Unlike the DFO Division, the Provincial Government not only recognizes the benefits that working waterfront offers to the local citizen and visitors, but also considers these benefits as important as the ones provided to the fishery and aquaculture industry (personal communication, May 8, 2012, David Mitchell). In such, the ranking of the value total scores could be seen from either its socio-economic, or fishery and aquaculture perspective, or as a more integrated evaluation (combination of both assessments); and inclusive, it could be used by other more local organizations (e.g. Municipalities, community organizations).

"Separating the vulnerability assessment scores from the socioeconomic scoring allows for a wider range of analysis. The social values can be used in many different ways for different groups, for example, one group may be more interested in tourism and less interested in the vulnerability aspects for commercial fishing" (personal communication, June 12, 2012, Sean Weseloh Mckeane).

Since it could be a difference in interests regarding the management of working waterfront facilities, table 10 shows three hypothetical cases in which the value total scores of the SEPAC, the CIAT, and the combination of both, are weighted differently, and thus, obtaining a different critical infrastructure ranking.

As early mentioned, the author of this paper strongly believes that in terms of vulnerability pre-assessment to working waterfront facilities, these should be focused in a multi-use/integrated way, that is, both the fisheries and socio-economic values are equally

considered within such assessments. Clearly, working waterfront infrastructures not only serve the fishery and aquaculture industry, but the waterfront community and public in general. Hence, offering not only other economic values, but societal values as well (e.g. community identity, opportunity to enjoy marine-related activities, enjoy the seascape), that although challenging to measure in terms of economics, also offer "priceless" benefits to the society. The literature cites that when it comes to the management of resources (for this project the resource would be the harbour facilities), the key to achieve effective management rely on facilitating the use of the resource to all the users (Holechek, Cole, Fisher & Valdez, 2003). Manager and decision-makers should not only recognize working waterfront facilities as multi-use infrastructures (users would be the fishers, community members, and visitors), but also must be administrated as such.

The management of working waterfront infrastructures could benefit in different ways if managers consider the multi-uses/integrated management approach. For example, if managers need to allocate money to one location, then, by considering the value of fisheries and socio-economics collectively, it will provide a better sense of which facilities could encompass greater benefits than others (as in the case of Eastern Passage wharf). Furthermore, by applying the multi-use perspective in decision-making, it could help in avoiding conflict of interests between the fishing community and waterfront community. For example, a transparent approach and interest by regulating agencies could greatly encourage a better participation of local residents towards accepting Federal/Provincial/Municipal decisions related to working waterfront. Especially if they perceive that managerial decisions are impartial and not focused only a single use (e.g. the fishing or tourism industry).

Furthermore, from the practical implications, in terms of decision-making, the SEPAC offers interesting opportunities. For example the SEPAC could be a supplementary driven tool to allow for strategic implementation in dealing with coastal climate change effects (i.e. as a complementary tool to other strategies such as the Coastal Strategy), or as an education tool.

"It would help to conceptualize what type of adaptation strategy could be employed depending on the characteristics of the facility" (personal communication, June 12, 2012, Paul MacDonald).

"From a provincial perspective, as we will implement the Coastal Strategy , coastal community and vulnerability assessment is a vital part that is going to arrange the high tech mapping, on-the-ground assessments, so I can see the socio-economic pre-assessment criteria as a component of the broad vulnerability assessment" (personal communication, June 12, 2012, Justin Huston).

"I can see the benefits of this socio-economic pre-assessment criteria if someone works through a vulnerability assessment, also I think it could be a really good education tool that you could be used by local planners or other municipal staff" (personal communication, June 12, 2012, Sean Weseloh McKeane).

Decision-making must stick into mandates and policies, for that reason until departments adapt their policies and practices, and start to evaluate in a holistic approach all the potential loss regarding coastal climate change effects, "they will remain unprepared for the impacts of a changing climate; adaptation efforts could be more costly and less effective; and departmental mandates to protect ecosystems, infrastructure, communities, or the health of Canadians may go unfulfilled" (Office of the Auditor General of Canada, 2010, p.13).

Finally, the author believes that the outcomes obtained to respond the research questions reveal that it is possible to pre-assess the vulnerability of working waterfront to coastal climate change effects in a cost-effective way. Additionally, the assessment results demonstrate that the SEPAC can contribute to get a sense of the potential socio-economic values loss. As well as, it shows that the mere fact that community and public get several benefits from the working waterfront facilities, makes it necessary to take into consideration an integrated managing approach when decision-making such facilities.

5.3 Recommendations

The objective of this project was to develop a pre-assessment that can assess the socio-economic values working waterfront provides beyond the fishery purposes. The pre-assessment tool was prepared for the Nova Scotia Department of Fisheries & Aquaculture. Based on the findings of this study, the following six recommendations are proposed:

Recommendation 1: Removing the zero value in the economic scoring section of the CIAT

Overall the CIAT appears to be a successful pre-assessment tool insofar that it assesses fishery-related values that working waterfront facilities could encompass. However, while developing the SEPAC, it was noted that within the "Economic Scoring" section of the CIAT, (specifically, the value consideration that evaluates the annual seafood landed/produced at the working waterfront facility) a "zero value" is provided as a possible response option. In this context, having a zero value being assigned a score could be erroneous because something that has "no value" or "does not exist" cannot be valued. As such, it is recommended that the zero value should be removed from this section of the CIAT.

Recommendation 2: Expanding the number and location of testing sites for the SEPAC, while taking into consideration possible seasonal trends

Unlike the CIAT, which was implemented at thirty-one working waterfront infrastructure locations across coastal ACAS areas in Nova Scotia, the SEPAC was only tested at seven sites due to timing and logistics. Therefore it would be very beneficial to trial the SEPAC in more ACAS areas, to confirm the effectiveness on the SEPAC, and identify other socio-economic values that might be missing from the SEPAC design. The sites for these trials should also include working waterfront facilities located in coastal rural locations, as these areas are often overlooked because of restricted budgets and the high cost of the technology used in coastal vulnerability assessments. Furthermore, the trials should also be conducted during high tourist seasons (summer, autumn and fall) and low periods (winter) to determine whether there are any important seasonal trends and/or differences across the value total scores.

Recommendation 3: Using the ranking approach to analyze data obtained from the SEPAC and CIAT pre-assessments

As opposed to the rating approach, the ranking approach was found to be the more appropriate method for the analysis of both the CIAT and SEPAC data. As such it is recommended that regardless of whether the value assessment total scores are weighted or not, the ranking approach provides the most rapid and effective way to identify which wharves/small harbors are the most vulnerable/critical, based on loss of fishing and socio-economic values. Consequently these locations could require a more detailed assessment in the future.

Recommendation 4: Continual monitoring of socio-economic information by Government agencies

The discontinuation of the Coastal Community Network (CCN) left a large gap in terms of being able to obtain information on socio-economic activities taking place at and/or nearby working waterfront facilities. As the network was partly comprised of Government organizations, it was recognized by the Provincial Government as a reliable source for providing information on working waterfront communities and associated wharves. As such, it is recommended that Government agencies should continue to monitor and gather this type of information, either by working with other NGOs or local organizations, or by establishing a branch within the NS-DFA that would be tasked with this role.

Recommendation 5: Systematically collecting and integrating sources of socio-economic information currently held by different government agencies.

In contrast to CIAT, which requires confidential information (e.g. value of seafood produced), the SEPAC does not require similar sensitive data. To enhance the diversity of data sources and provide a comprehensive approach to information and knowledge management, it is recommended that Federal and Provincial government agencies (for example DFO, and the Nova Scotia Department of Tourism, Culture, and Heritage) should develop a framework and process that allows for data to be collected, managed and shared in a systematic manner. This information (e.g. monetary value for recreational activities,

such as bird and whale watching, kayaking, sport fishing etc.) would be readily available for government agencies if there were a need to conduct more detailed assessments in the future.

Recommendation 6: Policies and mandates for vulnerability assessments of working waterfront infrastructures should include a multi-uses/integrated management approach.

The DFO has identified that one of the most critical risks associated with climate change corresponds to sea level rise, in which Canada will be required to not only assess the vulnerability of its coastal working waterfront infrastructures, but also to adapt them to climate variability (Office of the Auditor General of Canada, 2010). However, until policies and mandates have explicit requirements for taking a multi-use or integrated approach for conducting vulnerability assessments, government agencies will be limited in their ability to provide a more comprehensive analysis. Therefore it is recommended that policies and mandates related to working waterfront infrastructures must be adapted to allow for more integrated decision-making, in which all uses (fishery and other socio-economic benefits) are taken into consideration.

CHAPTER 6: CONCLUSION

Since the first report of the Intergovernmental Panel on Climate change about the climate and future projections, the scientific community has been deepening in the understanding of the potential negative consequences. Coastal areas have been categorized as the most vulnerable because several of the climate change effects relate to coastal hazards (e.g. intensity and more frequent storm, storm surges, sea level rise, accelerated coastal erosion). The Government of Nova Scotia recognizes that there is a need to understand such effects but within the local context, for example, how such effects could affect coastal vital infrastructures such as working waterfront facilities. In such, the Nova Scotia Department of Fishery and Aquaculture, through CBCL Limited, released the first screening tool (Coastal Infrastructure Assessment Tool (CIAT) which evaluates the values a working waterfront facility could loss if it is damaged or destroyed by coastal hazards.

"A working waterfront consists of sites or facilities that provide physical access to the sea for ocean dependent-uses and business, as well as all related infrastructure and services, which may or may not occur at the water's edge, e.g. processing plants, and lighthouse etc." (Nova Scotia Fisheries, n.d., as cited in CBCL Limited, 2009a, p.116). This project shows that, from the fishery and aquaculture perspective, such infrastructures play a vital role in the livelihood of many Nova Scotia coastal communities. However, fishery-based values are not the only one benefits harbour facilities provide. The literature indicates that working waterfront facilities also offer societal and non-fishery-based economic values such as recreational values, community identity, well-being, and health benefits to the local community and people in general.

Given the importance of working waterfront facilities to both the fishery industry and the local community and people, the author considers that it was imperative to include in the CIAT an additional criteria that could evaluates the socio-economic benefits of working waterfront infrastructures. The testing process of the developed SEPAC supported that the SEPAC is a practical, cost-effective and rapid assessment tool that clearly reflects the socio-economic values working waterfront facilities encompass. Small Craft Harbour and NS DFA believes the SEPAC is a useful tool informing decision-making in the future. Moreover, the results obtained from the testing demonstrate that there is a difference

between assessing the facility from a purely fishery perspective, than assessing the facilities from a more integrated perspective (fishery plus socio-economic).

Finally the author understands that each Government agency would have to follow its mandates, in a hierarchical order, if the hypothetical case pre-assessments are realized. Nonetheless, the author believes that by assessing working waterfront facilities in an multi-uses approach, would not only benefit different users, but also could help to build a healthy relationship between Government (Federal, provincial, local), users, and community.

REFERENCES

Adger, N., Aggarwal, P., Agrawala, S., Alcamo, J., Allali, A., Cruz, R. V.,…Stone, J. (2007). Intergovernmental panel on climate change 2007: Impacts, Adaptation and Vulnerability Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Summary for Policymakers. M. Perry, O. Canziani, J. Palutikof, P. V. D. Linden, & C. Hanson (Eds.). Cambridge University Press. Retrieved from http://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html

Atlantic Climate Adaptation Solutions Association (ACASA). (n.d.a). *Partners*. Retrieved from http://atlanticadaptation.ca/partners

Atlantic Climate Adaptation Solutions Association (ACASA). (n.d.b). *An assessment of coastal infrastructure relevant to the fishing and aquaculture industries in ACAS study areas.* Retrieved from http://atlanticadaptation.ca/node/218

Atlantic Climate Adaptation Solutions Association (ACASA). (n.d.c). *Increasing climate change adaptation capacity in Atlantic Canada*. Retrieved from http://atlanticadaptation.ca/objectives

Baker, G. B. (2005). A vulnerability assessment methodology for critical infrastructure sites. *Proceeding of the DHS Symposium: R&D Partnerships in Homeland Security*. Boston, Massachusetts. Apr. 2005. Retrieved from http://works.bepress.com/george_h_baker/2

Barrow, C. J. (1997). *Environmental and social impact assessment: an introduction*. New York: Oxford University Press.

Belluck, D. A., Hull, R. N., Benjamin, S. L., Alcorn, J., & Linkov, I. (2007). Environmental security, critical infrastructure and risk assessment. In I. Linkov, G. A. Kiker, and R. J. Wenning (Eds.), *Environmental security in harbours and coastal areas* (3-17). Netherlands: Springer

Bras d'Or Yatch Club. (2011). *Bras d'Or yatch club racing program*. Retrieved from http://www.brasdoryachtclub.ca/racing.cfm

CBCL Limited. (2009a). Working waterfronts . In *The 2009 state of Nova Scotia's coast technical report*. Report prepared for Nova Scotia Department of Fisheries and Aquaculture, Halifax, Nova Scotia. Retrieved from Government of Nova Scotia: http://www.gov.ns.ca/coast/documents/report/Coastal-Tech-Report-Nov-09.pdf

CBCL Limited. (2009b). Public coastal access. In *The 2009 State of Nova Scotia's Coast Technical Report.* Report prepared for Nova Scotia Department of Fisheries and Aquaculture, Halifax, Nova Scotia. Retrieved from Government of Nova Scotia: http://www.gov.ns.ca/coast/documents/report/Coastal-Tech-Report-Nov-09.pdf

CBCL Limited. (2012). *Assessment of infrastructure relevant to the fishing and aquaculture industries*. Retrieved from ACASA:

http://atlanticadaptation.ca/sites/discoveryspace.upei.ca.acasa/files/Fisheries%20and%20Aquaculture%20Infrastucture.pdf

Chalofsky, N. (1999). *How to conduct focus group*. Virginia: American Society for Training and Development

Church, J. A., White, N. J., Aarup, T., Wilson, W. S., Woodworth, P. L., Domingues, C. M., …Lambeck, K. (2008). Understanding global sea levels: past, present and future. *Sustainability Science, (3)*, 9-22. doi: 10.1007/s11625-008-0042-4

Cicin-Sain, B. & Knecht. R. (1998*). Integrated coastal and ocean management, concepts and practices*. Washington, D.C.: Island Press.

Fisheries and Oceans Canada. (2006). *Small craft harbours divestiture grants programme evaluation and audit.* Retrieved from http://www.dfo-mpo.gc.ca/ae-ve/evaluations/05-06/6b013-eng.htm

Fisheries and Oceans Canada. (2009). *Small craft harbours vision*. Retrieved from http://www.dfo-mpo.gc.ca/sch-ppb/vision-eng.htm

Fisheries and Oceans Canada. (2010*). Small craft harbour maps*. Retrieved from http://www.dfo-mpo.gc.ca/sch-ppb/maps/maps-home-accueil-eng.htm

Fisheries and Oceans Canada. (2011). *Evaluation of the small craft harbours divestiture class grant program (SCH-DCGP*). Retrieved from http://www.dfo-mpo.gc.ca/ae-ve/evaluations/10-11/6b138-eng.htm

Fisheries and Oceans Canada. (2012a). *Who we are*. Retrieved from http://www.glf.dfo-mpo.gc.ca/Maritimes-Gulf/SCH/Who-We-Are

Fisheries and Oceans Canada. (2012b). *Harbour authority report*. Retrieved from http://www.dfo-mpo.gc.ca/sch-ppb/hareport-rapportap-eng.asp

Fisheries and Oceans Canada. (2012c). *Survey of recreational fishing in Canada 2010*. Retrieved from http://www.dfo-mpo.gc.ca/stats/rec/can/2010/RECFISH2010_ENG.pdf

Fundy Group Publications. (n.d.). *Groundhog '76: the worst storm in the history of south-western Nova Scotia*. Retrieved from http://members.shaw.ca/jan.maynard/groundhog.html

Gardner, M., Fraser, R., Milloy, M., & Frost, J. (2005). *Economic value of the Nova Scotia ocean sector*. Retrieved from http://www.gov.ns.ca/econ/docs/2005_Ocean_Sector_Study_NS.pdf

Government of Canada. (2003). *Climate change achieving our commitments together: climate change action plan*. Retrieved from http://publications.gc.ca/collections/Collection/En56-183-2002E.pdf

Government of Nova Scotia. (2010). *2010 Nova Scotia's coastal consultation*. Retrieved from http://www.gov.ns.ca/coast/documents/WhatWeHeard.pdf

Government of Nova Scotia. (2011). *2011 Draft coastal strategy.* Retrieved from http://www.gov.ns.ca/coast/documents/draft-coastal-strategy2011oct.pdf

Holechek, J. L., Cole, R. A., Fisher, J. T., & Valdez, R. (2003). *Natural resources, ecology, economic, and policy*. New Jersey: Person Education.

House of the Commons Canada. (2009). *Small craft harbours: an essential infrastructure managed by and for fishing communities*. Report of the standing committee on fisheries and oceans. Retrieved from http://publications.gc.ca/collections/collection_2009/parl/XC51-402-1-1-01E.pdf

Intergovernmental Panel on Climate Change (IPCC). (1996). Climate change 1995: impacts, adaptations and mitigation of climate change: scientific technical analysis. Retrieved from http://www.ipcc.ch/ipccreports/sar/wg_II/ipcc_sar_wg_II_full_report.pdf

Intergovernmental Panel on Climate Change (IPCC). (2007a). Climate change 2007: the physical science basis. Contribution of working group I to the fourth assessment report of the intergovernmental panel on climate change. S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, & H. L. Miller (Eds.). Cambridge University Press. Retrieved from http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html

Intergovernmental Panel on Climate Change (IPCC). (2007b). Climate change 2007: synthesis report. Contribution of working groups I, II and III to the fourth assessment report of the intergovernmental panel on climate change. R. K.

Pachauri & A. Reisinger (Eds.). Retrieved from http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html

Jensen, C. R., & Guthrie, S. P. (2006). Outdoor recreation in America. United States of America: Human Kinectis.

Kont, A., Jaagus, J., & Aunap, R. (2003). Climate change scenarios and the effect of sea-level rise for Estonia. *Global and Planetary Change (36*), 1 –15. doi doi.org/10.1016/S0921-8181(02)00149-2

Levina, E. & Tirpak, D. (2006). *Adaptation to climate change: key terms*. Prepared for the Organisation for Economic Co-Operation and Development. Paris, France. 24p.

McInnes, D., De Soussa, E., Munro, I. (2006). "*One plank at a time" volunteer harbour management in Nova Scotia*. Retrieved from http://library.imaginecanada.ca/files/nonprofitscan/kdc-cdc/coastal_communities_one_plank.pdf

McLean, D. D., & Hurd, A. R. (2012). *Kraus' recreation and leisure in modern society*. United States of America: Jones & Barlett Learning, LLC.

Means, J., & Adams, T. (2005). Brainstorming. In, *Facilitating the project lifecycle: the skills & tools to accelerate progress for project managers, facilitators, and six sigma project teams* (202-205). San Francisco: John Wiley & Sons, Inc.

Meehl, G.A., Stocker, T.F., Collins, W.D., Friedlingstein, P., Gaye, A.T., Gregory, J.M.,…Zhao, Z. C. (2007). 2007: Global Climate Projections. In Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (chap.10). Retrieved from http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter10.pdf

Miller, R. L., & Brewer, J. D. (2003). *The A-Z of social research: A dictionary of key social science research concepts.* London: SAGE.

Morena, M. (2012). The waterfront: urban scenarios. In, *Morphological, technological and functional characteristics of infrastructures as a vital sector for the competitiveness of a country system* (77-113). Rimini: Maggioli S.p.A.

Natural Resource Canada. (2007). Hurricane Juan (September 29, 2003). Retrieved from http://www.nrcan.gc.ca/earth-sciences/natural-hazard/other-natural-hazards/storm-impact/juan/8779

Nicholls, R. J., & Cazenave, A. (2010). Sea-level rise and its impact on coastal zones. *Science, 328*(5985), 1517-1520.doi:10.1126/science.1185782

Nicholls, R.J., Wong, P. P., Burkett, V. R., Codignotto, J. O., Hay, J. E., McLean, R. F., Ragoonaden, S., & Woodroffe, C. D. (2007). Coastal systems and low-lying areas. In M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (Eds.), Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the

Intergovernmental Panel on Climate (pp. 315-356). Retrieved from http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch6.html

Noble, B. (2005). *Introduction to Environmental Impact Assessment: Guide to Principles and Practice*. Canada: Oxford University Press.

Nova Scotia Department of Environment. (2009). *Toward a greener future: Nova Scotia's climate change action plan*. Retrieved from http://climatechange.gov.ns.ca/doc/ccap.pdf

Oakley, S. (2005). Working port or lifestyle port? a preliminary analysis of the port Adelaide waterfront redevelopment. *Geographical Research, 43*(3), 319–326. doi: 10.1111/j.1745-5871.2005.00331.x

Office of the Auditor General of Canada. (2010). Adapting to climate impacts. In *Report of the Commissioner of the Environment and Sustainable Development to the House of Commons - Fall 2010.* Retrieved from http://publications.gc.ca/collections/collection_2011/bvg-oag/FA1-2-2010-0-eng.pdf

Parliament of Canada. (n.d.). *Government of Canada response to the report of the standing committee on fisheries and ocean and for fishing communities*. Retrieved from http://www.parl.gc.ca/HousePublications/Publication.aspx?Mode=1&Parl=40&Ses=2&Language=E&DocId=4415251&File=0

Plummer, R. (2009). *Outdoor recreation*. New York: Routledge

Polar bear dip. (2011, January 1). Polar bear dip nets cash for N.S. food banks. *CBC News*. Retrieved from http://www.cbc.ca/news/canada/nova-scotia/story/2011/01/01/ns-polar-bear-dip.html

Praxis Research & Consulting Inc. (2004). *Between the land and the sea: the social and economic importance of wharves and harbours in Nova Scotia*. Pictou, NS. Xvi + 112pp.

Pugwash Village. (n.d.). Pugwash volunteer fire department mackerel tournament. Retrieved from http://www.pugwashvillage.com/macktourn.html

Roberts, I. (2001). *Leisure and recreation*. Oxford: Heinemann Educational Publishers.

Rotorua District Council. (2004). *Definitions*. Retrieved from http://www.rdc.govt.nz/YourCouncil/CouncilDocuments/DistrictPlan/~/media/RDC/Files/CouncilDocuments/Plans/DistrictPlan/Part19_Definitions_24July2010.ashx

Sairinen, R., & Kumpulainen, S. (2006). Assessing social impacts in urban waterfront regeneration. *Environmental Impact Assessment Review, 26*(1), 120-135. doi: 10.1016/j.eiar.2005.05.003

Sarwar, G., & Khan, M. (2007). Sea level rise: a threat to the coast of Bangladesh. International Asian Forum. *International Quarterly for Asian Studies, 38*(3), 375-400. Retrieved from

http://ezproxy.library.dal.ca/login?url=http://search.proquest.com/docview/212217104?accountid=10406

Shelby and Harris (1985). Comparing methods for determining visitor evaluations of ecological impacts: site visits, photographs, and written descriptions. *Journal of Leisure Research, 17*(1), 57-67.

The Canadian Press. (2012, May 24). Canadian hurricane centre predicts 9 to 15 storms in 2012. *CBC News*. Retrieved from http://www.cbc.ca/news/canada/nova-scotia/story/2012/05/24/ns-hurricane-outlook-2012.html

Toews, C. (2005). *Coastal area management in Nova Scotia: building awareness at the municipal level*. Retrieved from http://www.ecologyaction.ca/files/images/file/RCIP_Coastal_Report.pdf

Torkildsen, G. (2005). *Leisure and recreation management*. New York: Routledge.

United States Department of Energy. (2002a). *Energy Infrastructure Risk Management Checklists for Small and Medium Sized Energy Facilities* (Draft). 26 pp.

United States Department of Energy. (2002b). *Vulnerability Assessment Methodology, Electric Power Infrastructure* (Draft). 155 pp.

Vasseur, L., & Catto, N. (2008). Atlantic Canada. In J. Lacroix, D. S. Lemmen & F. J. Warren. (Eds.), *From impacts to adaptation: Canada in a changing climate 2007* (119-170). Retrieved from

http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca.earth-sciences/files/pdf/assess/2007/pdf/ch4_e.pdf

Veatch, J. D., James, J. W., May, T. T., Wood, T. M, & Kruse, E. M. (1999). An airport vulnerability assessment methodology. *Proceeding of the IEEE 33rd Annual 1999 International Carnahan Conference on Security Technology,* Madrid, 134-151. doi: 10.1109/CCST.1999.797905

Walsh, D. (1995). Impact of marine recreation in the Americas: how much is too little-how much is too much?. In N. Della Croce, S. Connell & R. Abel (Eds.), *Coastal ocean space utilization III* (pp.174-182). London: E & FN Spon, an inprint of Chapman & Hali.

Woolley, H. (2003). *Urban open spaces*. London: Spon Press.

Appendix A. Coastal Infrastructure Assessment Tool (CBCL Limited, 2012)

Worksheet for

Assessing Coastal Infrastructure

Relevant to the Fishing and Aquaculture Industries

in Relation to Climate Change Imapcts

Site Location:	
Date:	
Assessor:	
Name of Structure:	
Current Use:	

VULNERABILITY ASSESSMENT	Circle the applicable answer.
Is the structure you are reviewing:	
less than 2.0 metres above high tide (i.e. exposed to storm surge damage and sea level rise) ?	Yes / No
exposed to wave damage ?	Yes / No
exposed to wind damage ?	Yes / No
exposed to sea ice damage ?	Yes / No
exposed to river flood damage ?	Yes / No
located along an eroding shoreline or on unstable soil ?	Yes / No
Does the structure depend on other vulnerable infrastructure for access (e.g. low-lying access road or causeway) or for safe operation (e.g. harbour entrance breakwater) ?	Yes / No

If you answer yes to any of the questions above, please proceed to Section 2. If you answered no to all the questions above, this facility does not need to be assessed further.

VALUE ASSESSMENT		Circle the number that is across from the applicable answer.
Financial Scoring		
Approximate replacement value of the facility and/or structure(s)	Less than 1 million $	1
	1 to 5 million $	2
	Greater than 5 million $	3
Remaining life of the facility and/or structure(s)	Less than 5 years	1
	5 to 20 years	2
	Greater than 20 years	3
Economic Scoring		
Number of fishing boats using the facility and/or structure(s)	None	1
	1 to 20 boats	2
	More than 20 boats	3
Annual seafood value produced, landed, or processed at the facility or at facilities serviced by the structure	0 to $500,000	1
	$500,000 to 1 million $	2
	Greater than 1 million $	3
Number of jobs provided by the facility	None	1
	1 to 20 jobs	2
	Greater than 20 jobs	3
Utility Scoring		
Is there a facility nearby that is able to offer the same services?	Yes	1
	Yes, but not immediately accessible	2
	No	3
Does the nearby facility have additional capacity available?	Yes, imemdiately available	1
	Yes, if significant additional investment is made	2
	No	3
Value Assessment Total	(Total the circled answers)	**This score can be used to compare the value of different facilties. It should only be used to guide where a more detailed assessment is required.**

Appendix B. Working Waterfront Infrastructures assessed by applying CIAT (CBCL limited, 2012)

Worksheet for

Assessing Coastal Infrastructure

Relevant to the Fishing and Aquaculture Industries

in Relation to Climate Change Imapcts

			Lunenburg																Chignecto Isthmus
Site Location:			Lunenburg	Lunenburg	Lunenburg	Lunenburg	Lunenburg	Lunenburg	Lunenburg	Lunenburg	Lunenburg	Lunenburg	Lunenburg	Bayport	Feltzen South	Kraut Pt.	Dublin Shore	Bush Is.	No Relevant infrastructure found
Date:			18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	
Assessor:			BH	BH	BH	BH	BH	BH	BH	BH	BH	BH	BH	BH	BH	BH	BH	BH	
Name of Structure:			Highliner	Museum	Adams & Knickle	Zwicker	Clearwater	Picton Castle	Railway Wharf	Marine Institute	Smith & Rhuland	Fisherman's Wharf	Foundry	SCH	SCH	SCH	SCH	SCH	
Current Use:			fish plant & wharves	wharves	wharves	wharves	wharves	wharf	wharf	wharves	shipyard	wharf	Ship repairs	wharf	harbour	harbour, fish plant	harbour	harbour	
VULNERABILITY ASSESSMENT	**Circle the applicable answer.**																		
Is the structure you are reviewing:																			
less than 2.0 metres above high tide (i.e. exposed to storm surge damage and sea level rise) ?	Yes / No		Y	N	Y	Y	Y	Y	Y	N	?	Y	Y	Y	Y	Y	Y	N	
exposed to wave damage ?	Yes / No		Y	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	N	
exposed to wind damage ?	Yes / No		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
exposed to sea ice damage ?	Yes / No		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
exposed to river flood damage ?	Yes / No		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
located along an eroding shoreline or on unstable soil ?	Yes / No		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Does the structure depend on other vulnerable infrastructure for access (e.g. low-lying access road or causeway) or for safe operation (e.g. harbour entrance breakwater) ?	Yes / No		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
If you answer yes to any of the questions above, please proceed to Section 2. If you answered no to all the questions above, this facility does not need to be assessed further.																			
VALUE ASSESSMENT	**Circle the number that is across from the applicable answer.**																		
Financial Scoring																			
Approximate replacement value of the facility and/or structure(s)	Less than 1 million $	1																	
	1 to 5 million $	2			2	2	2	2	2		3	2	3	2	2	3	2		
	Greater than 5 million $	3	3																
Remaining life of the facility and/or structure(s)	Less than 5 years	1						1											
	5 to 20 years	2			2		2		2		2		2			2	2		
	Greater than 20 years	3	3			3						3		3	3				
Economic Scoring																			
Number of fishing boats using the facility and/or structure(s)	None	1				1		1			1		1						
	1 to 20 boats	2	2		2		2		2			2		2	2	2	2		
	More than 20 boats	3																	
Annual seafood value produced, landed, or processed at the facility or at facilities serviced by the structure	0 to $500,000	1				1		1			1		1						
	$500,000 to 1 million $	2			3		3		3			3		2	3	3	2		
	Greater than 1 million $	3	3																
Number of jobs provided by the facility	None	1																	
	1 to 20 jobs	2				2		2	2		1			2			2		
	Greater than 20 jobs	3	3		3		3					3	3		3	3			
Utility Scoring																			
Is there a facility nearby that is able to offer the same services?	Yes	1			1	1	1		1			1							
	Yes, but not immediately accessible	2						2											
	No	3	3								3		3	3	3	3	3		
Does the nearby facility have additional capacity available?	Yes, immediately available	1																	
	Yes, if significant additional investment is made	2			2	2	2	2	2			2							
	No	3	3								3		3	3	3	3	3		
Value Assessment Total	(Total the circled answers)		20		15	12	15	11	14		14	16	16	17	19	19	16		

Appendix B. Working Waterfront Infrastructures assessed by applying CIAT (CBCL limited, 2012) (continuation)

Worksheet for

Assessing Coastal Infrastructure

Relevant to the Fishing and Aquaculture Industries

in Relation to Climate Change Imapcts

		Halifax Regional Municipality (Halifax Harbour)				Oxford-Port Howe	Minas Basin	Yarmouth									
Site Location:		Herring Cove	Herring Cove	Eastern Passage	Bedford Hwy	Pugwash	Delhaven	Chebogue	Yarmouth Bar	Chegoggin	Lobster Rock	Yarmouth Marine Terminal	Sweeney	Sweeney Museum	Sandford	Port Maitland	Cape St. Marys
Date:		18-Jan-12	18-Jan-12	18-Jan-12	18-Jan-12	19-Jan-12	15-Jan-12	19-Jan-12	19-Jan-12	19-Jan-12	19-Jan-12	19-Jan-12	19-Jan-12	19-Jan-12	19-Jan-12	19-Jan-12	19-Jan-12
Assessor:		VL	VL	VL	VL	VL	BH	BH	BH	BH	BH	BH	BH	BH	BH	BH	BH
Name of Structure:		Breakwater	Wharf	SCH	Fisherman's market	SCH	SCH	SCH	SCH	SCH	wharf	wharf	wharf	wharf	SCH	SCH	SCH
Current Use:		wave protection for inner harbour	wharf for fish landing	wharves fish plant	fish processing and retail	wharf oil storage	wharf	harbour	harbour	harbour	wharf	harbour	wharf	fish plant, wharf	harbour	harbour	harbour
VULNERABILITY ASSESSMENT	**Circle the applicable answer.**																
Is the structure you are reviewing:																	
less than 2.0 metres above high tide (i.e. exposed to storm surge damage and sea level rise) ?	Yes / No	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	N	Y
exposed to wave damage ?	Yes / No	Y	Y	Y	N	Y	N	Y	Y	Y	N	N	N	N	Y	Y	Y
exposed to wind damage ?	Yes / No	N	N	N	N	Y	N	N	Y	N	N	N	N	N	N	N	N
exposed to sea ice damage ?	Yes / No	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
exposed to river flood damage ?	Yes / No	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
located along an eroding shoreline or on unstable soil ?	Yes / No	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Does the structure depend on other vulnerable infrastructure for access (e.g. low-lying access road or causeway) or for safe operation (e.g. harbour entrance breakwater) ?	Yes / No	N	N	N	N	N	N	N	Y	N	Y	Y	Y	Y	N	N	N
If you answer yes to any of the questions above, please proceed to Section 2. If you answered no to all the questions above, this facility does not need to be assessed further.																	
VALUE ASSESSMENT	**Circle the number that is across from the applicable answer.**																
Financial Scoring																	
Approximate replacement value of the facility and/or structure(s)	Less than 1 million $ 1 1 to 5 million $ 2 Greater than 5 milion $ 3	2	2	3		2	2	2	3	2	3	3	2	2	3	3	2
Remaining life of the facility and/or structure(s)	Less than 5 years 1 5 to 20 years 2 Greater than 20 years 3	3	2	3		2	2	3	2	3	3	2	2	3	2	2	3
Economic Scoring																	
Number of fishing boats using the facility and/or structure(s)	None 1 1 to 20 boats 2 More than 20 boats 3	2	2	3		2	2	2	3	2	2	2	2	2	2	2	2
Annual seafood value produced, landed, or processed at the facility or at facilities serviced by the structure	0 to $500,000 1 $500,000 to 1 million $ 2 Greater than 1 million $ 3	1	1	3		2	3	3	3	2	3	3	1	3	3	3	3
Number of jobs provided by the facility	None 1 1 to 20 jobs 2 Greater than 20 jobs 3	2	2	3		2	2	3	3	2	3	3	2	3	3	3	3
Utility Scoring																	
Is there a facility nearby that is able to offer the same services?	Yes 1 Yes, but not immediately accessible 2 No 3	3	3	3		3	3	2	3	2	2	2	2	3	3	3	3
Does the nearby facility have additional capacity available?	Yes, imemdiately available 1 Yes, if significant additional investment is made 2 No 3	2	2	2		3	3	2	3	2	2	3	2	2	3	3	3
Value Assessment Total	(Total the circled answers)	15	14	20		16	17	17	20	15	18	18	13	18	19	19	19

Appendix C. Two-page Questionnaire Used for the Expert Consultation

Name:

Job Position:

Site location of infrastructure:

Type of infrastructure (e.g. wharf, small-craft harbour, breakwater):

The following question will be answer by using the best of your knowledge. However, in case you need help to answer any of the questions, you are allowed to consult other experts in your department. Please, feel free to write as much as you want when answering the questions. Also, if there is any information that you consider relevant and/or related to the question, please feel free to write about it. Base your answer according to the delimited area shown in the map.

1. **Have you visited the site of interest?**
   Answer: (_) Yes (_) No
   Comment:_____
   _____
   _____

2. To the best of your knowledge, have you seen:
   People visiting the site for following recreation purposes: (check as my that apply)
   __ People walking __People taking pictures __People fishing
   __ Sitting __ People walking their pets

   Please list other activities you know of:
   _____
   _____

   Comment:_____
   _____
   _____

3. To the best of your knowledge,
   Are you aware if recreational companies using the facility as departure(D)/parking(P)/storage (S) point. If so, what type of recreational companies?, check all that apply

   _____ferry _____sea kayak/canoe _____sailing
   _____fishing/whale/ bird watching _____other harbour tours

Please list others you may know of

_____
_____

Comment:_____
_____
_____

Are you aware if the facility is used (non- for-profit business): as a departure(D)/parking(P)/storage(S) place for, check all that apply:

_____sea kayak/canoe _____ sail boats _____motor boats
_____ dinghies_____jet ski _____cargo van

Please list others you may know of

_____
_____

Please explain how the facility is being used

_____
_____
_____

4. **Is there any type of festival or event that use the facility or that happen close to the facility at any time of the year?**
   How many events? ____None _____1-3 ____3-5 ____more than 5
   Comment:_____
   _____
   _____

5. **Type of business that could depend/depend/ or highly depend of the existence of the facility:**

   ____ restaurants ____ fish markets ____ handcraft stores ____ bed & breakfast ____shipbuilding ____ hardware _____Please list others you may know

   Please explain why the selected business(es) could depend/depend/ or highly depend of the existence of the
   facility:_____
   _____
   _____

6. **Have you seen something else that is not listed in the questions? (any other relaxing/recreational activity, business, etc. that happen in the facility itself or in the delimited area (see map))**
   _____
   _____
   _____

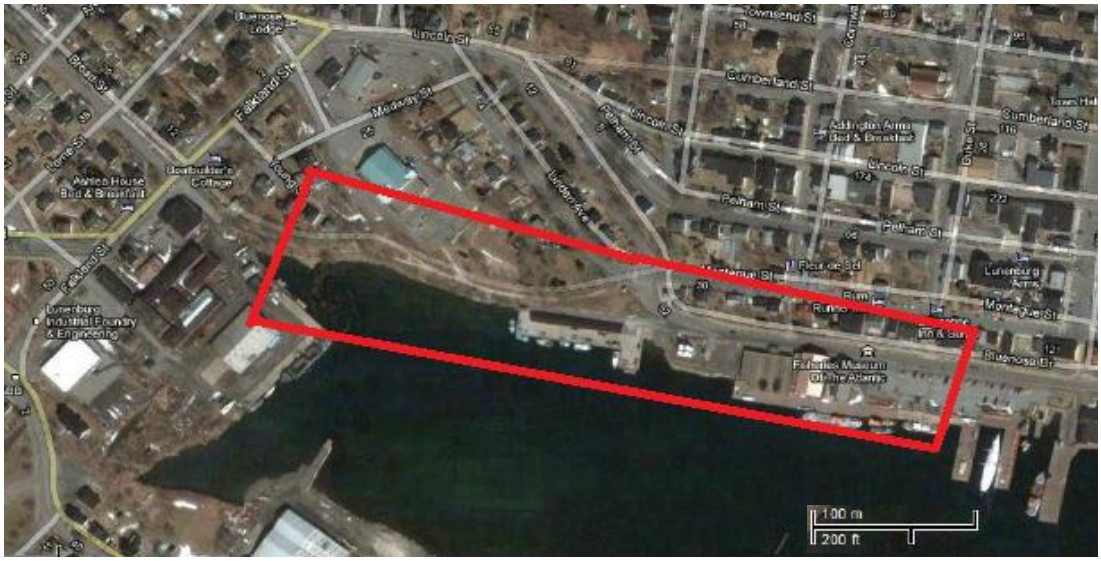
Appendix D. Working Waterfront Infrastructure Testing Areas

Halifax regional Municipality – Eastern Passage wharf

Halifax regional Municipality – Herring Cove Breakwater

Halifax regional Municipality – Herring Cove

Appendix D. Working Waterfront Infrastructure Testing Areas (continuation)



Lunenburg Harbour – Fishermen's wharf

Lunenburg Harbour – Museum wharf

Appendix D. Working Waterfront Infrastructure Testing Areas (continuation)

Lunenburg Harbour – Zwicker wharf

Lunenburg Harbour – Railway wharf

Appendix E. Categorical Rank Assignation to the Value Assessment Total Scores

Financial Scoring			
Approximate replacement value of the facility and/or structure(s)	Less than 1 million $	1	1
	1 to 5 million $	2	2
	Greater than 5 million $	3	3
Remaining life of the facility and/or structure(s)	Less than 5 years	1	1
	5 to 20 years	2	2
	Greater than 20 years	3	3
Economic Scoring			
Number of fishing boats using the facility and/or structure(s)	None	1	1
	1 to 20 boats	2	2
	More than 20 boats	3	3
Annual seafood value produced, landed, or processed at the facility or at facilities serviced by the structure	0 to $500,000	1	1
	$500,000 to 1 million $	2	2
	Greater than 1 million $	3	3
Number of jobs provided by the facility	None	1	1
	1 to 20 jobs	2	2
	Greater than 20 jobs	3	3
Utility Scoring			
Is there a facility nearby that is able to offer the same services?	Yes	1	1
	Yes, but not immediately accessible	2	2
	No	3	3
Does the nearby facility have additional capacity available?	Yes, imemdiately available	1	1
	Yes, if significant additional investment is made	2	2
	No	3	3
Value Assessment Total	(Total the circled answers)		

∑ Scores = 7
Categorical Rank 1 correspond to **value assessment total scores from 1 - 7**

∑ Scores = 14
Categorical Rank 2 correspond to **value assessment total scores from 8 -14**

∑ Scores = 21
Categorical Rank 3 correspond to **value assessment total score s from 15-21**