

A Cost-Benefit Analysis – Proposed Tuvaijuittuq Marine Protected Area

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A Cost-Benefit Analysis - Tuvaijuittuq Marine Protected Area

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Executive Summary

Context

The proposed Tuvaijuittuq MPA is considered globally, nationally and regionally unique due to the presence of multi-year pack ice and is believed to be a critically important habitat for Arctic under-ice communities. It may also play an important role for ice-dependent species (such as beluga, narwhal, walrus, seals, and polar bears). This area represents a portion of the Canadian High Arctic projected to retain multi-year ice in the long term and will likely become an important refuge for ice-associated biota as sea ice loss continues throughout the Arctic due to climate change.

In 2011 three Ecologically and Biologically Significant Areas were identified by the Department of Fisheries and Oceans (DFO) in the proposed MPA. A portion of this area has also been selected by the Parks Canada Agency (PCA) as a candidate site for their system of national marine conservation areas.

The cost benefit analysis (CBA) provides an analysis of the potential socio-economic impacts associated with the proposed Marine Protected Area (MPA) Ministerial Order regulations.

Methodology and Data

The methodology adopted for the analysis is the Total Economic Valuation (TEV) technique (see Matrix 1), which relates all benefits to human welfare measures. The economic valuation method was chosen because (i) it is defined as the sum of benefits involved and can be used to assess economic benefits quantitatively or qualitatively; (ii) it allows for a robust measurement and comparison of values and presents these values in terms that people are familiar with; and (iii) it is both logical and comprehensive, due to its foundations in microeconomic theory, emphasis on marginal values, and inclusion of all aspects of the associated values.

The data used to develop the community profiles around the proposed Tuvaijuittuq MPA primarily came from the 2016 Census Community Profiles. Other sources of information and data came from the Government of Canada, Government of Nunavut, industry and corporations, boards, academic researchers and consultants. The Socio-Economic Overview and Assessment of the High Arctic Basin Area of Interest report (henceforth referred to as DFO (2018)) characterizes the social, cultural and economic activities in the vicinity of the area of interest and interactions with the ecosystem. While a non-exhaustive search of the existing literature provided very limited data on the proposed Tuvaijuittuq MPA, where appropriate, the report used information available at relevant publically accessible websites and in the literature as secondary sources of information.

Baseline Economic and Policy Profile

The economic activities that are currently on-going in the area were identified based on information from one year prior to the potential establishment of the MPA, as well as any future activities that would be allowed to continue in the proposed MPA.

The baseline takes into account existing federal, provincial and territorial management measures in force in the area. This also reflects the current ongoing current human activities, if any, and expansion/growth of activities. An assessment of the activities occurring in the area over the last 12 months indicated:

- There are no active commercial fisheries in the potential Tuvaijuittuq MPA.
- There are no active recreational fisheries or aquaculture activities within the potential MPA.
- Information on subsistence harvesting activities were not available for the potential MPA. However, according to available information and conversations with nearby communities there is no evidence that there is subsistence harvesting from communities closest to the potential MPA due to its distance from nearby communities.

- According to the ‘Nunavut, Mineral Exploration, Mining, and Geoscience Overview 2018 Report’ mining activities, such as mineral exploration and mine production within the potential MPA are not taking place.
- Natural Resources Canada (NRCan) (2019) reported “...the in-place petroleum resource potential of the proposed Tuvaijuittuq MPA is estimated in a low to high range of 10 million barrels oil equivalent (MMBOE) in-place to 43 billion barrels oil equivalent (BBOE) in-place, respectively.” The report further adds that due to “...the geographic remoteness and sea ice cover, no offshore wells have ever been drilled in the Study Area”. In addition, a moratorium on new oil and gas exploration licencing applies to the area (2016 – 2021) in which the potential MPA is located, which further limits the potential for oil and gas exploration and production.
- There are no vessels moving through the proposed Tuvaijuittuq MPA. Additionally, the proposed Tuvaijuittuq MPA is situated far from any route to other communities, so there is no known resupply activity through the area. A data analysis conducted by Maerospace (2019) concluded that satellite automatic identification system (AIS) data provided no indication of vessel traffic in the area from March 2017 to November 2018.
- There is no tourist or recreational activities taking place within in the potential MPA. The one tourism site adjacent to the area is Quttinirpaaq National Park, on the northern tip of Ellesmere Island.
- There is some scientific research and National Defence activities that occur in the area.

Regulatory Scenario

The regulatory scenario for the potential MPA by way of Ministerial Order engages “Freezing the Footprint” which means not increasing the impact of human activities beyond ongoing activities in a marine area identified in the regulations for the potential MPA. This means that only the following will be allowed in the proposed MPA:

- Ongoing activities that have occurred or were authorized over the twelve months prior to the designation would be allowed to continue;
- Constitutionally protected Aboriginal rights under the Nunavut Land Claims Agreement;
- Scientific research;
- Activities for the purposes of safety, security and emergency activities, and;
- Certain activities carried out by a foreign national, entity, ship or state, would be allowed in the proposed MPA.

Additionally an Inuit Impact Benefit Agreement (IIBA) is being negotiated for the Tallurutiup Imanga National Marine Conservation Area (TINMCA) and will include an Article for Tuvaijuittuq.

Thus, the proposed MPA would serve, as a stop-gap measure by prohibiting new activities to take place for a period five years. This period would allow for further research and consultations to inform the decision to either establish an *Oceans Act* MPA or implement other management measures that provide long-term protection.

Costs of Establishing the Potential MPA

The analyses in the CBA report evaluates scenarios both with (regulatory), and without (baseline) the potential MPA Ministerial Order Regulations for this area, holding other variables constant. The CBA report estimates the incremental costs and benefits to Canadians that result from establishing the potential MPA in this area.

As noted above, negligible current and potential activities were identified. As such the establishment of the proposed MPA is unlikely to impose any costs to Canadians or industry in the form of foregone revenue or higher costs of operation. Due to the constitutionally protected rights under the Nunavut Agreement there would be no incremental impacts on Indigenous communities.

Based on the information provided by the regional Oceans Program, the total federal government costs related to monitoring, enforcement, administration and scientific research is estimated to be \$2.56 million per year over the five year period. Assuming 2019 as the base year and a discount rate of 7%, the study calculated that the present value of the total costs would be \$11.23 million. Additionally there will be costs for the IIBA, however these costs are currently unknown.

Benefits of establishing the proposed MPA

It is believed that the proposed MPA provides invaluable direct and indirect services to society by supporting Arctic marine and ice-associated ecosystems and biodiversity. Measuring these ecosystem services is difficult, as thus far there has not been sufficient guidance on how to measure such intrinsic benefits. As preservation (i.e., maintaining at current levels) and increases in ecosystem services benefits occur over long-term protection, it is quite unlikely these values will change over the five year time period for the proposed MPA. However conducting more marine scientific research in the area may provide valuable information that could help the efforts to maintain and possibly improve ecosystem services benefits in the longer term.

The communities nearest the proposed MPA and people residing elsewhere in Canada are expected to derive non-use value from the services provided by the area. Preservation (i.e., maintaining at current levels) and increases in non-use values occur over a period longer than five years. However it is likely that non-use values may increase slightly once people are aware of the fact that steps are being taken through the proposed MPA to conserve fish and marine mammals and seabirds within the five year time period. Moreover, conducting more marine scientific research in the area may provide valuable information that increases non-use values in the future.

The efforts taken to protect the proposed Tuvaijuittuq MPA may also help to preserve any the archaeological, historical and cultural heritage within or adjacent to the proposed area. Preserving natural and cultural resources would benefit Canadians as they learn about the cultural values that exist within the proposed Tuvaijuittuq MPA.

Should the area be established, there will be benefits accrued from the IIBA and general management of the area. However these are currently undefined, but are expected to include topics such as governance and management structures, Inuit led research and monitoring, Inuit harvesting rights and protection of cultural and archeological sites.

Limitations

Limitations associated with this report include a lack of information. While obtaining and analyzing information for the purpose of this report, the most notable limitations identified are:

- i. Lack of detailed and specific information for the area;
- ii. Outdated information (lack of recent information);
- iii. Including detailed subsistence harvest figures (if any) from solely within the proposed MPA was not possible due to a lack of specific information available. This is also a data gap for all marine mammals and additional information is required. Correspondence with communities around the area would greatly help to aid in the development of a more precise report.

These limitations have been mitigated to some extent through qualitative discussions to illustrate the expected economic and social outcomes. However, the appropriate remedy for these limitations would be further research and community input. Despite data limitations and uncertainties associated to the report, it provides information which may be found useful for decision making processes, such as regulatory intent for interim protection. Also, this assessment does not include future feasibility assessment work planned to inform consideration of permanent marine protection measures, or other costs not specific to establishment of the proposed MPA by way of Ministerial Order.

Introduction

The proposed Tuvaijuittuq MPA includes the marine waters off northern Ellesmere Island starting from the low water mark and extending to Canada's Exclusive Economic Zone (Figure 1). The proposed Tuvaijuittuq MPA is largely situated off-shore and primarily consists of multiyear pack-ice.

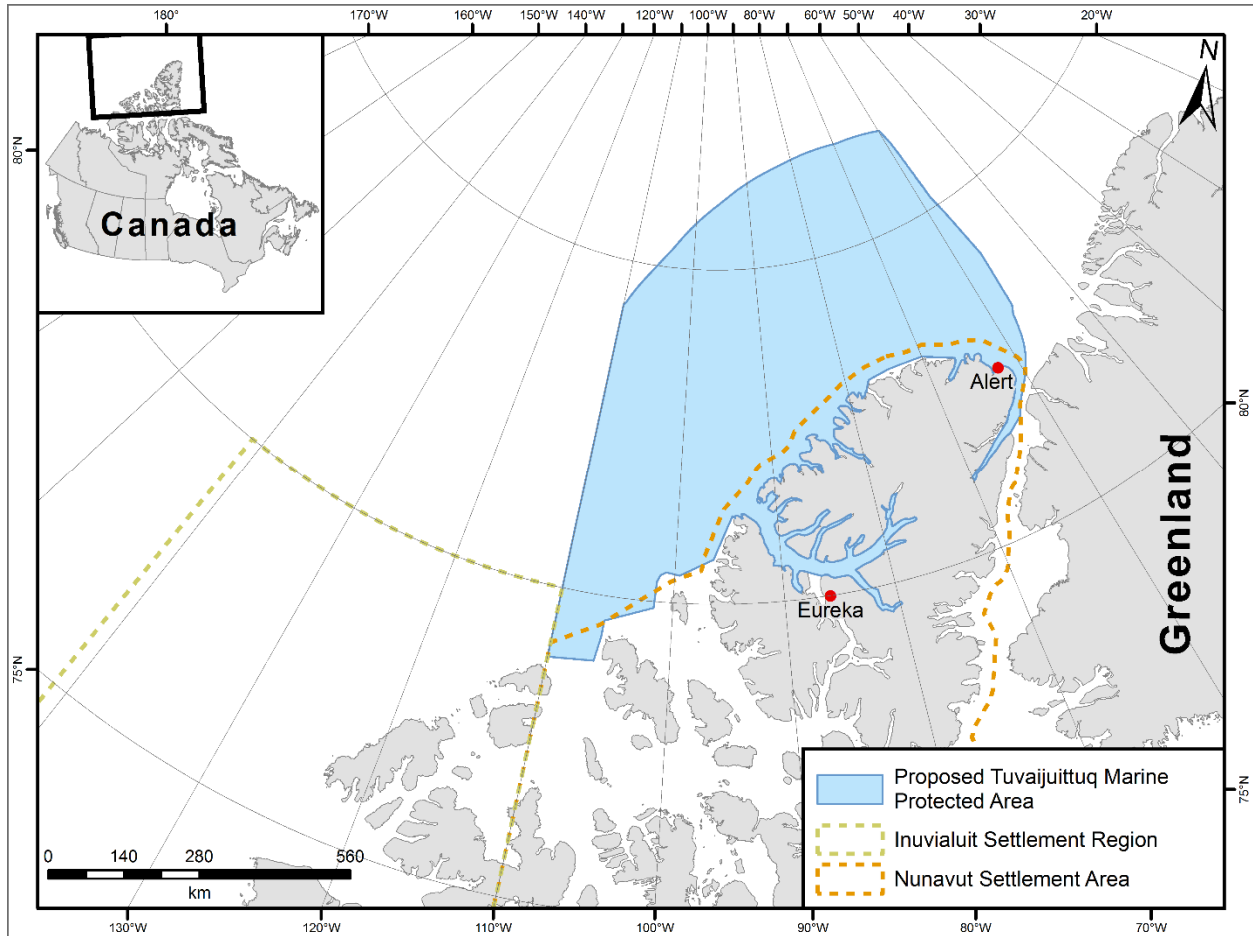


Figure 1. Map of proposed Tuvaijuittuq Marine Protected Area

Within the proposed MPA three Ecologically and Biologically Significant Areas (EBSAs) were identified by Fisheries and Oceans Canada (DFO, 2011) (see annex 1). It is expected to be one of the last areas in the world to retain multiyear pack ice under a changing climate. It is also likely to be important habitat for ice-dependent marine species which may include Whales, Polar Bears and Seals (DFO, 2018).

The proposed Tuvaijuittuq MPA's remoteness and climate prevents all but direct impact by humans. However, climate warming is expected to result in melting of surrounding ice, making this area more accessible and potentially impacted by marine activities. Pre-emptively protecting this unique, pristine environment could minimize future environmental impacts and associated costs to the area and the wildlife in the proposed Tuvaijuittuq MPA over the long-term.

The impetus for this analysis is that with the establishment of a marine protected area (MPA), both positive and negative impacts can be expected on Canadians. From society's point of view, MPAs are

public investments of marine resources (Sanchirico, 2000) and, therefore, the decision must be guided by the benefit it accrues and the cost it incurs. As such, federal regulatory policy requires that a cost-benefit analysis (CBA) be conducted to identify and then monetize, where possible, the incremental impacts expected with the establishment of the proposed MPA.

The CBA is considered to be an integral part of the MPA by Ministerial Order designation process as well as the federal regulatory process encapsulated in the Cabinet Directive on Regulations (CDR). The CDR requires, among other things, an analysis of the incremental costs and benefits of regulation, including the potential positive and negative socio-economic impacts on industry, consumers, Indigenous groups and government and how these impacts may be distributed across affected parties, sectors of the economy and regions of Canada. The analysis contained in this report will be used to inform decision makers and in preparing the Regulatory Impact Analysis Statement (RIAS) required by the CDR.

Objective of the report

The objective of this report is to provide an analysis of the potential socio-economic impacts associated with the proposed MPA (by way of Ministerial Order) regulations MPA.

The objectives of the report are to: (i) provide a baseline scenario of economic activities currently occurring in the area; and (ii) analyze the net economic benefits generated by the development of the MPA either qualitatively or quantitatively, if feasible. The findings of the report will contribute to the development of the regulatory package for designating the proposed Tuvaijuittuq MPA.¹

Structure of the report

The report is organized as follows: section 2 presents a demographic profile of the report area; section 3 discusses the methodology adopted including assumptions and data sources used; section 4 presents socio-economic profiles by economic sectors; section 5 presents the overview of the ecosystem services, option and non-use values; section 6 presents the overview of social and cultural values; section 7 presents the baseline scenario; section 8 presents the regulatory management scenario (conservation objectives and regulatory intent); section 9 analyzes costs and benefits of designation of the area; and section 10 draws conclusions and identifies obstacles and limitations of the study.

Section 2: Demographic profile

The majority of the proposed Tuvaijuittuq MPA itself is located offshore, and as such, is uninhabited by humans. Resolute Bay, rise Fiord and Arctic Bay are the closest communities to the proposed Tuvaijuittuq MPA. While not a community in the traditional sense, Canadian Forces Station (CFS) Alert is the northernmost permanently inhabited location in the world and is directly adjacent to the proposed Tuvaijuittuq MPA. Eureka is a weather observation station south of CFS Alert on Ellesmere Island, which has residence.

CFS Alert is a military base and research station on the northern tip of Ellesmere Island. CFS Alert is supplied weekly by air with about 60 residents (120 residents in the summer), half of which are military personnel and half civilian support staff. Civilian personnel are stationed at Eureka for six-month

¹ The proposed MPA will be designated using a Ministerial Order and is different from the traditional *Oceans Act* MPA which is established using Governor in Council Regulations.

periods, while support staff follow a two-month on, two-month off rotation schedule (Allemang, 2015). Environment and Climate Change Canada normally staff two positions at CFS Alert (Chung, 2017). Eureka has a rotating staff of about eight people (about 30 personnel in the summer) and is supplied by air every three weeks (Otis, 2016).²

Resolute Bay, Grise Fiord and Arctic Bay are the nearest non-military, non-science communities to the proposed MPA. Grise Fiord is the northernmost Inuit settlement located almost 800 km south of CFS Alert on Ellesmere Island and is over 600 km south and east of the proposed Tuvaijuittuq MPA. According to the 2016 census, the population of Grise Fiord was 129 people. About 77% of the population is age 15 or older and about 93% of the population is Inuit. The community has an employment rate of 70%. Most of the working population is employed in the fields of sales and service, education, law and social, community and government services, and trades, transport and equipment operator occupations.

Resolute Bay is almost 400 km southwest of Grise Fiord on the southern end of Cornwallis Island. It is over 600 km southeast of the proposed Tuvaijuittuq MPA. According to the 2016 census, Resolute’s population was 198, of which about 69% are age 15 or over and about 87% are Inuit. Resolute Bay has an employment rate of 54%. Most of the employed work in sales and service, education, law and social, community and government services, and trades, transport and equipment operator occupations. Arctic Bay is located approximately 381 km south of Grise Fiord on the northern part of the Borden Peninsula on Baffin Island. Based on the 2016 census, Arctic Bay’s population was 868, which about 62% are age 15 or over and about 95% are Inuit. Arctic Bay has an employment rate of 57%. Most of the employed work in sales and service, education, law and social, community and government services, and trades, transport and equipment operator occupations.

Community Demographics³

	Grise Fiord	Resolute	Arctic Bay
Population	129	198	868
Age 15+ (%)	77	69	62
Inuit (%)	96	87	95
Employment Rate (%)	70	54	57

Resolute, Grise Fiord and Arctic Bay have mixed economies featuring both “land-based” economy (e.g., fishing, hunting and trapping, sewing, arts and crafts, informal childcare) and wage economy (Vard, 2016; Ningeongan, 2017; Grise Fiord (undated), Conference Board of Canada, 2001).

² Fort Conger was a settlement and research base southeast of CFS Alert on Ellesmere Island. It was used between 1875 and 1935 and is now uninhabited (Bertulli et al, 2013). Isachsen is an abandoned weather station on Ellef Ringnes Island, just to the southeast of the proposed MPA, which was active from 1948 to 1978 (Historica Canada).

³ Source: 2016 census.

Section 3: Methodology

The purpose of the socio-economic analysis is to assess the benefits and costs of establishing an MPA (by way of Ministerial Order) in the proposed area and the distribution of these benefits and costs among the stakeholders. The Framework for Integrating Socio-Economic Analysis in the MPA Establishment process (henceforth referred to as DFO, 2016), and the accompanying guidance documents developed by Treasury Board of Canada Secretariat (TBS) (henceforth referred to as TBS, 2007), inform the scope and content of the analysis.

The methodology adopted for the analysis is the Total Economic Valuation (TEV) technique (see Matrix 1), which relates all benefits to human welfare measures. The economic valuation method was chosen because (i) it is defined as the sum of benefits involved and can be used to assess economic benefits quantitatively or qualitatively; (ii) it allows for a robust measurement and comparison of values and presents these values in terms that people are familiar with; and (iii) it is both logical and comprehensive, due to its foundations in microeconomic theory, emphasis on marginal values, and inclusion of all aspects of the associated values. Moreover, since the TEV approach is followed by economists in valuing environmental goods and services, the relevant literature could be consistently analyzed using this framework.

In the study, the TEV framework considers that the benefits provided by the proposed Tuvaijuittuq MPA are linked to both use and non-use values:

$$TEV = Use\ Value + Non-use\ Value$$

The use values are subdivided into current and future use values. Current use values are sub-categorized as direct and indirect use values. Finally, direct use values are sub-categorized as extractive and non-extractive use values.

Under the category of use values, extractive use values include activities such as commercial and recreational fishing, and non-extractive use values include activities such as wildlife watching. Indirect use values generally include ecosystem services and biodiversity. The future use values include option value to use the resource in future for commercial and/or recreational activities, as well as possible sources of research value. Finally, non-use values include bequest value (also known as legacy value) and existence value (Hayder, 2014; 2019).⁴

Following the MPA timeframe, the time period considered for the analysis is five years from the base year of 2019, determined in consultation with the regional Oceans Program involved in the establishment process. When the Ministerial Order MPA is in place, there will be a five-year time frame to conduct further study and potentially establish an *Oceans Act* MPA through Governor in Council (GiC) regulation. At this time the Ministerial Order will expire.

As like other public investments, the potential benefits and costs of MPAs are realized in the short and long run, a CBA must be generally undertaken for the long run⁵. However in this case, and in

⁴ See Matrix 1 for details.

⁵ For instance, closing a significant catch area may reduce the total catch in the short run but total catch levels might increase in the long run as population begin to recover in the MPA and spillover to the remaining fishable waters increases. The length of the long run varies depending on the biological characteristics of the fish and the response of the fishermen to the economic and biological conditions (Sanchirico, 2000).

consultation with DFO regional Oceans Program, the time period considered for the analysis is 5 years from the base year of 2019, as per the MPA time frame (5 years).

Money today, even in an inflation-free economy, is always worth more than money obtained in the future, because of its earning potential as well as the gratification of having money now rather than tomorrow. The study, therefore, extrapolates data from the base year of 2019 using the discount rate of 7%, as recommended in DFO 2016. For purpose of the CBA, the values are finally adjusted using the net present value (NPV) approach. The discount formula used for present value is:

$$NPV = NFV_t / (1+i)^t$$

NPV is the net present/current value, NFV_t the net future value in year t , and i is the discount rate.

Scenarios

Since there is no feasible way to separate out the impacts of the proposed Tuvaijuittuq MPA and other influences in the area (e.g. climate change), the analyses in the report were premised on scenarios both with (regulatory), and without (baseline) the proposed Tuvaijuittuq MPA, holding other variables unchanged.

The report analyzed the baseline and regulatory scenario in accordance with the recommendations of Treasury Board Secretariat of Canada (2007 Interim). The baseline reflects the current situation, including ongoing current human activities, if any, and expansion/growth of activities. This also takes into account existing management measures operating in the area. The regulatory scenario includes prohibitions and exemptions which are applied to the baseline scenario.

The regulatory scenario (i.e., proposed MPA (by way of Ministerial Order)) engages “Freezing the Footprint” which means not increasing the impact of human activities beyond ongoing activities in a marine area identified in the regulations for the proposed MPA by Ministerial Order (i.e., ongoing activities continue, prohibit new activities, etc.).⁶ The Ministerial Order will only be available to Minister of Fisheries and Oceans if Bill C-55 receives Royal Assent. The proposed MPA would provide a stop-gap measure by prohibiting new activities to take place (i.e., freezing the footprint) within the area for up to five years at which point either a permanent protected area must be established or the Ministerial Order be repealed. The activities that take place in the area over the year prior to establishing the proposed MPA as well as any activities that are allowed to occur in the years coming will continue to be allowed.

A few steps were taken in order to determine the baseline socio-economic activities occurring within the proposed Tuvaijuittuq MPA. The first step was to identify socio-economic activities in the proposed MPA within the last five years.⁷ The next step was to determine the occurrence of those socio-economic activities within the proposed MPA, over the last twelve months. This twelve month assessment constitutes as the baseline of socio-economic activities. Future potential economic activities for the regulatory scenario were restricted to those for which business plans were in place and for which

⁶ <http://www.dfo-mpo.gc.ca/oceans/conservation/act-loi-eng.html>

⁷ The time line of five years was chosen to ensure an up to date inventory of information. The pace of change in the Arctic is rapid and the inclusion of older information does not aid in the determination of current activities. A five year timeline allows for some potential trend analysis of recent activities.

evidence of intent (e.g., leases, permits, submission of plans for approvals, etc.) to undertake the activity has been established.

Data Sources

The data used to develop the community profiles around the proposed Tuvaijuittuq MPA primarily came from the 2016 Census Community Profiles. Other sources of information and data came from the Government of Canada, Government of Nunavut, industry and corporations, boards, academic researchers and consultants. The Socio-Economic Overview and Assessment of the High Arctic Basin Area of Interest report (henceforth referred to as DFO (2018)) characterizes the social, cultural and economic activities in the vicinity of the area of interest and interactions with the ecosystem. This assessment provides information that has been used to develop the baseline scenario in the current report. The information presented in DFO (2018) has also been useful to make assumptions and evaluate the impacts of the proposed Tuvaijuittuq MPA by the economic sector from a cost-benefit perspective.

While a non-exhaustive search of the existing literature provided very limited data on the proposed Tuvaijuittuq MPA, where appropriate, the report used information available at relevant publically accessible websites and in the literature as secondary sources of information. Moreover, where information on a particular impact was unavailable, the report made a qualitative assessment of the impact based on rational judgment.

Section 4: Baseline Socio-Economic Profile – Economic Sectors

This section describes the uses of the proposed Tuvaijuittuq MPA which constitutes part of the baseline scenario⁸ used to analyze the potential effects of the proposed protection of the MPA.

Commercial Fishing

Based on available information, there is no commercial harvests of fish species and no recorded fishing vessel traffic (Dawson et al., 2018; Maerospace 2019) within the proposed Tuvaijuittuq MPA. This is in part due to high costs of harvesting in such a remote ice covered environment. Moreover, little information exists on fish species presence and abundance. Greenland Halibut, Arctic Char and Arctic Cod have been reported from the Canadian Arctic Archipelago (Nunami Stantec, 2011). While Greenland Halibut and shrimp catches near Pond Inlet appear promising for commercial uses (Pers. comm. Hedges, 2018), their presence, distribution and abundance in the proposed Tuvaijuittuq MPA are currently unknown. While Arctic cod have been observed in the area, information on population size and distribution are unknown.

Subsistence Harvesting

Based on available information, DFO harvest records, and conversations with communities (with the regional Oceans Program in 2019) for the proposed Tuvaijuittuq MPA no subsistence harvesting activities were identified to occur in or directly adjacent to this area in recent years.

Available information indicates that subsistence harvesting by communities closest to the proposed Tuvaijuittuq MPA is very limited due to its distance from nearby communities (Nunami Stantec, 2011). For example, both Resolute Bay and Grise Fiord are over 600 km away from the proposed Tuvaijuittuq MPA. Based upon available reports, this area is outside the major travel routes and the outer extent of Inuit land use (see Annex 2) (Aarluk, 2009; NCRI, 2012; Nunami Stantec, 2011). CFS Alert and Eureka do not harvest for subsistence purposes as they are supplied from the south. Information on subsistence harvest activities from solely within the proposed MPA is a data limitation that should be considered in future assessment work.

Information on marine mammal use of the area is very limited, it is thought that marine mammals exist in low numbers within the proposed Tuvaijuittuq MPA – including Bearded and Ringed Seals (Pers. comm. Ferguson, 2018). Other marine mammals such as Beluga, Narwhal and Bowhead whales, and Walrus may migrate through the proposed Tuvaijuittuq MPA (Pers. comm. Ferguson, 2018). Walrus have been observed in Archer Fiord along northeastern Ellesmere Island in late August; however, further investigation is needed to determine the population to which they belong (e.g., East Greenland, High Arctic or Central Arctic) (Yurkowski et al. in press). Ringed and Bearded Seal were also observed in that area. Consequently, it is possible that species harvested by the communities of Resolute Bay and Grise Fiord and Arctic Bay may use the proposed Tuvaijuittuq MPA for critical stages of their life-cycles. To date, marine mammal distribution and behaviour in the proposed Tuvaijuittuq MPA has not been investigated (Pers. comm. Ferguson, 2018).

⁸ The baseline reflects the current situation, including ongoing current human activities, if any, and expansion/growth of activities. The socio-economic activities that occurred within the proposed MPA, over the last twelve months, constitutes as the baseline of socio-economic activities.

Test fisheries for marine fish species and invertebrates have been conducted at Grise Fiord, Resolute Bay, Arctic Bay and Pond Inlet (Pers. comm. Hedges, 2018). Shrimp, whelk and sea urchin catches near Grise Fiord, Resolute Bay and Arctic Bay were encouraging as potential for subsistence foods (Pers. comm. Hedges, 2018). Greenland Halibut and shrimp catches near Pond Inlet appear promising for subsistence uses (Pers. comm. Hedges, 2018). Greenland Halibut may occur in the proposed Tuvaijuittuq MPA and movement of individuals from the area to Baffin Bay and Pond Inlet is likely given movement patterns observed within the species (Pers. comm. Hedges, 2018). Arctic Cod is a fundamental species in Arctic marine ecosystems as prey for other marine fish species, birds and marine mammals (Pers. comm. Hedges, 2018). While Arctic Cod have been observed in the proposed Tuvaijuittuq MPA, their importance in the diets of marine mammals and other species is poorly understood. It is likely that Arctic Cod observed in the proposed Tuvaijuittuq MPA are distributed throughout adjacent waters where they support harvested marine mammal, bird and fish species. The distributions of ecologically important marine invertebrates (e.g., shrimp, whelk, echinoderms) in the proposed Tuvaijuittuq MPA may also extend into adjacent areas (Pers. comm. Hedges, 2018).

Recreational Fisheries and Aquaculture Activities

There are currently no active recreational fisheries or aquaculture activities within the proposed Tuvaijuittuq MPA, and the communities of Grise Fiord, Arctic Bay or Resolute Bay are not known to undertake these activities within the proposed Tuvaijuittuq MPA (Nunami Stantec, 2011). This is likely due to the area's remoteness and harsh climate.

Resource Extraction

Mining Exploration and Production

The presence of coal in the in the High Arctic has been known for over 150 years. While historical exploration in the High Arctic has identified many areas with significant coal accumulation, such as the Fosheim Peninsula, Vesle Fiord, Strathcona Fiord and Stenkul Fiord areas (Adams, 2014) the Nunavut, Mineral Exploration, Mining, and Geoscience Overview 2018 report does not indicate current mining activity, such as mineral exploration or mine production within the proposed Tuvaijuittuq MPA. The overview report shows no active mining projects in the area near the proposed Tuvaijuittuq MPA.

Canada Coal had coal licences on Axel Heiberg and Ellesmere Island near and adjacent to the proposed Tuvaijuittuq MPA. These licences are now expired (Pers. comm. Sharpe, 2018).

Oil and Gas Exploration and Production

The U.S. Geological Survey has identified high potential for oil and gas development in the eastern portion of the proposed Tuvaijuittuq MPA (see Annex 3). There is a significant discovery licence (SDL) located on Ellesmere Island that is near the proposed Tuvaijuittuq MPA. SDL 077 is held by Suncor Energy Incorporated, since March 19, 1987 (Crown-Indigenous Relations and Northern Affairs Canada, Geoviewer accessed February 28, 2019). Any company wanting to explore oil and gas in the Canadian Arctic offshore region must obtain an exploration licence.⁹ Natural Resources Canada (NRCan) (2019)

⁹ Managing oil and gas resource development in the northern offshore waters is a federal responsibility. Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) has the statutory responsibility for petroleum management (Northern Oil and Gas Annual Report, 2016). The National Energy Board (NEB) regulates onshore and offshore drilling (NEB, 2017).

reported “no existing offshore oil and gas licences and no known upcoming Call for Bids or proposed project activities in Canada’s Arctic, including the Study Area.” The report does show multiple oil and gas wells adjacent and closely located to the proposed Tuvaijuittuq MPA.

Outside (and adjacent to) the proposed Tuvaijuittuq MPA, two of the largest undeveloped gas fields in Canada are in the Sverdrup Basin, but cost and logistics make development difficult. There are 20 significant development licences in the basin, mostly owned by SunCor, and no production licences. There was an oil field, now abandoned, in the Bathurst Island area that was in operation from 1985 to 1996. These licenses are very far away from the area and will likely have no direct effects on the proposed Tuvaijuittuq MPA if production begins in the future (Gavrilchuk and Lesage, 2014).

Natural Resources Canada (NRCan) (2019) reported that “the in-place petroleum resource potential of the proposed Tuvaijuittuq MPA is estimated in a low to high range of 10 million barrels oil equivalent (MMBOE) in-place to 43 billion barrels oil equivalent (BBOE) in-place, respectively.” The large variance of the petroleum resource range is reported to be due to the uncertainty of all the geological elements necessary to generate and trap petroleum potential in the Study Area. The report adds due to “the geographic remoteness and sea ice cover, no offshore wells have ever been drilled in the Study Area.”

Should the moratorium be lifted (in December 2021), commodity prices rise significantly, resource demand increase and the area become more accessible due to climate change, there is potential for future oil and gas development in the proposed Tuvaijuittuq MPA. However, limited infrastructure and the remoteness of the area would make oil and gas extraction operations difficult.

Commercial Shipping and Other Vessel Activities

There are no vessels moving through the proposed Tuvaijuittuq MPA. Additionally, the proposed Tuvaijuittuq MPA is situated far from any route to other communities, so there is no known resupply activity through the area.

The satellite automatic identification system (AIS) data for the area between March 2017 to November 2018 resulted in 353 unique maritime mobile service identities¹⁰ (MMSIs) within the proposed Tuvaijuittuq MPA. However, a data analysis conducted by Maerospace (2019) concluded that satellite automatic identification system (AIS) data provided no indication of vessel traffic in the proposed Tuvaijuittuq MPA during the time period of March 2017 to November 2018.

Recreational and Tourism Activities

No known tourist or recreational activities are taking place within in the proposed Tuvaijuittuq MPA. This is likely due to the area’s remoteness and harsh climate. There is no known pleasure craft use in the proposed Tuvaijuittuq MPA (Dawson et al, 2018).

The one tourism site adjacent to the proposed Tuvaijuittuq MPA is Quttinirpaaq National Park,¹¹ on the northern tip of Ellesmere Island. It is open and staffed from May to August and is accessible only by chartered flight and only after mandatory registration and orientation. It allows backpacking, ski-touring,

¹⁰ A Maritime Mobile Service Identity is a series of nine digits which are sent in digital form over a radio frequency channel in order to uniquely identify ship stations, ship earth stations, coast stations, coast earth stations, and group calls.

¹¹ <https://www.nunavuttourism.com/things-to-see-do/parks-special-places/quttinirpaaq-national-park/>

mountaineering, and climbing. Ward Hunt Island, along the north of the park, can also be used as a launch point for an Arctic expedition as it is only 720 km from the North Pole. There are few visitors to the park, with only 23 tourists in 2014, compared to five in 2013 (Struzik, 2016).

Other Sectors (Scientific Research, National Defence and Canadian Coast Guard)

Due to the logistics of working in a remote ice covered environment and the expense of conducting research in the area (Nunami Stantec, 2011), until recently, there was limited research conducted to characterize fish communities and to have a greater understanding of the ecosystems of the area. Licences have been issued in the distant past (over ten years ago) for research purposes. However preliminary data collected during DFO's 2019 Multidisciplinary Program (MAP)-Last Ice will inform future research programs. While non-commercial species such as cod have been observed in the area, information on population size and distribution are unknown.

Both CFS Alert and Eureka are scientific outposts. CFS Alert hosts the Dr. Neil Trivett Global Atmosphere Watch Observatory, which records and monitors atmospheric measurements, air toxics, stratospheric ozone, and air quality. Eureka is home to the Polar Environment Atmospheric Research Laboratory which enables a wide range of Arctic atmosphere and climate science studies (Canada, 2015; Historica Canada).

There is ongoing scientific research and National Defence activities occurring in the area.

Recent scientific work by DFO includes preliminary observations made during the 2018 MAP-Last Ice program that indicated that the ocean bottom in at least some areas of the proposed Tuvaijuittuq MPA supports echinoderms, corals and bivalves; however, the extent to which these communities exist and their ecological importance have not been investigated. While research efforts pertaining to invertebrate communities in the proposed Tuvaijuittuq MPA are currently focused on ice-associated and pelagic species, preliminary investigations of benthic communities during the 2019 field season will inform future research efforts.

Inuit led research and monitoring is also planned for the proposed Tuvaijuittuq MPA and is anticipated to significantly contribute to the current knowledge base.

There are Quttinirpaaq National Park Reserve research sites at Ward Hunt Island and Tanquary Fiord on Ellesmere Island (Nunami Stantec, 2011).

Section 5: Overview of Ecosystem Services, Option and Non-Use Values

Ecosystem Services

Ecosystem services are indirect functions of the environment that provide valued goods and services used by people (Loomis et. al, 2000). These services include food, fibre and fuel but also the largely unpriced services of clean air and clean water, natural hazard protection, pollination, and spiritual sustenance (World Resources Institute, 2008). An ecosystem's economic value is generated by the combination of services provided by the ecosystem, which include provisioning (e.g., food), regulating (e.g., climate regulation) and cultural services, in conjunction with capital (e.g., investments, equipment, labour) (O'Garra, 2017).

It is believed that the proposed Tuvaijuittuq MPA provides invaluable direct and indirect services to society through maintaining ecosystems and biodiversity. Additional knowledge is required to determine how migratory species are using the area as well as the area's contribution to the biodiversity of the surrounding waters.

It is harder to define the indirect services of ecosystems and biodiversity because they are much more intangible (Krantzberg and de Boer, 2008, 2006). For example, the proposed Tuvaijuittuq MPA provides clean, breathable air by regulating gases (e.g., carbon dioxide) and protects the general maintenance of a habitable planet by regulating the local weather and climatic conditions of the region. These services are typically categorized in the literature as follows:¹² gas regulation; local climate regulation; water regulation; disturbance prevention; soil formation/retention; waste treatment; nutrient cycling; and habitat, refugium and nursery (Hayder, 2014).¹³

There is economic value of climate regulation services provided by sea ice and permafrost in the Arctic. As an illustrative example only, climate regulation services in the Arctic such as methane capture and reflecting sunlight into space (ice-albedo effect), has an annual value of billions of dollars. The annual per capita value to global beneficiaries (outside of Arctic communities)¹⁴ is \$29.27 (2016 \$US) (O'Garra, 2017).

Greenland Halibut may occur in the proposed Tuvaijuittuq MPA and movement of individuals from the area to Baffin Bay and Pond Inlet is likely given movement patterns observed within the species (Pers. comm. Hedges, 2018). Arctic Cod is a fundamental species in Arctic marine ecosystems as prey for other marine fish species, birds and marine mammals (Pers. comm. Hedges, 2018). The distributions of ecologically important marine invertebrates (e.g., shrimp, whelk, echinoderms) within the proposed Tuvaijuittuq MPA may also extend into adjacent areas (Pers. comm. Hedges, 2018).

Measuring these ecosystem services is difficult, as thus far there has not been sufficient guidance on how to measure such intrinsic benefits.

Option Value¹⁵

Neither economic theory nor empirical literature provides adequate information to quantify the option value of future use of the resources of the proposed Tuvaijuittuq MPA (e.g. possibility of commercial/recreational fishing in the future) (Hayder, 2014). However, it should be noted that assets with less perfect substitutes are likely to have larger option values (Marbek, 2010a). The proposed Tuvaijuittuq MPA and associated unique biodiversity characteristics might be a case in point.

¹² For a detailed discussion on specific ecological services, see Marbek (2010a).

¹³ It is imperative to recognize that all the economic and other benefits derived by society are somehow linked to a healthy ecosystem. For instance, a healthy ecosystem ensures suitable habitats for fish populations and thus enables subsistence harvesters and recreational anglers to fish (Hayder, 2014).

¹⁴ The study referenced does not include the population of the Arctic communities to avoid double counting. The study assumed that climate regulation is partially accounted for in final goods such as subsistence and commercial fisheries, polar bear hunting, existence values for beluga whales and polar bears. The study assumed 50% of the full economic value of these final services has been provided by climate regulation services provided by Arctic snow, ice and permafrost, and this amount has been deducted from the climate regulation value.

¹⁵ **Option value:** The amount someone is willing to pay to keep open the option of future use of the resources (e.g. possibility of commercial/recreational fishing in the future).

Non-Use Value

Non-use values are the value people derive from a good or resource, independent of any use people might make from that good/resource, including the conservation of the ecosystem for future generations (e.g., future biodiversity) also known as bequest value and existence value arising from people intrinsically valuing the existence of the ecosystem regardless of its use.¹⁶ Existence value includes the benefits from knowing that the resources are being used by others as well as cultural values for an economy.

The communities nearest the proposed Tuvaijuittuq MPA and people residing elsewhere in Canada are expected to derive non-use value from the services provided by the area.

Information on marine mammal use of the area is very limited, marine mammals are thought to exist in low numbers within the proposed Tuvaijuittuq MPA – including Bearded and Ringed Seals (Pers. comm. Ferguson, 2018). Other marine mammals such as Beluga, Narwhal and Bowhead whales, and Walrus may migrate through the proposed Tuvaijuittuq MPA (Pers. comm. Ferguson, 2018).

The examples below provide some context on the value of non-use values for marine mammals. It should be noted these examples are for geographical areas much larger than the proposed Tuvaijuittuq MPA. The values attributed to this area would be a proportion of these examples.

As an example, O'Garra (2017) estimated the annual value per capita existence value for Beluga whale populations as \$96.30 (2016 \$US), for arctic nations with Beluga populations. The same study also estimated the annual value per capita existence value for Polar bear populations as \$316.80 (2016 \$US) for Canadian residents.

Whitford (2006) examined Loomis and White's (1996) meta-analysis of U.S. households' willingness-to-pay (WTP) studies for Pacific endangered species and whales and the work of others. Whitford argued that the Loomis and White's estimate of US\$42.85 per household represented an acceptable estimate of the average WTP for conservation of some whale species and suggested that Canadian households WTP for Bowhead whales be in the order of CDN\$495 million.

Although a few studies have estimated non-use values for different areas in Canada using direct stated preference methods (contingent valuation, discrete choice experiments), the non-use value for the proposed Tuvaijuittuq MPA has not been studied so far. Neither has there been any study that could serve as proxy values for the area. Despite the challenge to capture the benefits of non-use values, it may be noted that even if non-use values of the attributes within the proposed Tuvaijuittuq MPA might be insignificant at the individual level within the communities, aggregated values for an entire economy may likely be significant.

Section 6: Overview of Social and Cultural Values

NeoEskimo sites have been located on northeastern Ellesmere Island. The sites from the NeoEskimo period are characterized by semi-subterranean winter whale bone houses. These houses contained

¹⁶ Although in theory non-use values are divided into existence and bequest values, the empirical studies do not always make the distinction and calculate them together as non-use values (Hayder, 2014).

passage way entrances and rear sleeping areas, tent rings, hearths and artifact remains indicating use of ocean and land animals (Nunami Stantec, 2011).

There have been Norse (European) cultural remains identified across eastern Ellesmere Island. The remains consist of chain mail sections, boat rivets, iron knife blades, cooper, wood and wool cloth fragments (Nunami Stantec, 2011).

Historic sites are located the northern and northeastern coasts of Ellesmere Island. These sites generally represent the remains of Inuit use and Arctic expeditions. Fort Conger, located within Quttinirpaaq National Park, was established in 1881 and many of the original buildings have been designated as Federal Heritage Buildings. These buildings are managed by the Parks Canada Agency (Nunami Stantec, 2011).

While no Inuit Qaujimagatuqangit (IQ) has been collected for this particular area, DFO undertook a preliminary scan of existing IQ from nearby communities. This included information from a 2012 Nunavut Coastal Resource Inventory as well as IQ collected by the DFO in 2010 for the purposes of conservation planning. Given that there is little existing information for this area the parties involved in the designation process are committed to obtaining more IQ (Pers. comm. Brown, 2019).

Section 7: Baseline Scenario Management Measures

Key federal legislation and regulations with management authority over the waters of the proposed Tuvaijuittuq MPA include the *Oceans Act*, the *Fisheries Act*, Marine Mammal Regulations (enabled by the *Fisheries Act*), *Species at Risk Act*, *Canada Shipping Act, 2001*, *Arctic Waters Pollution Prevention Act*, and the *Migratory Birds Contraventions Act*.

Territorial legislation and regulations include the Nunavut Land Claims Agreement, the *Nunavut Act*, the *Nunavut Wildlife Act*, and Nunavut Hunting Regulations.

The Nunavut Planning Commission (NPC) currently implements the North Baffin Regional Land Use Plan (NBRLUP) that applies to the proposed Tuvaijuittuq MPA. The land use plan provide guidance and direction for the conservation, development and utilization of land within its respective planning region. The plan contains a policy framework that recognizes the importance of conserving natural and cultural resources, and establishing protected areas (http://www.nunavut.ca/en/approved_plans).

The most relevant conventions, codes and agreements (in an Arctic context) for the proposed Tuvaijuittuq MPA include: the United Nations Convention on the Law of the Sea (UNCLOS); Convention on Biological Diversity (CBD); the Convention on Persistent Organic Pollutants; the International Code for Ships Operating in Polar Waters (Polar Code); the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic; the Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic (MOSPA); and the Agreement on Enhancing International Arctic Scientific Cooperation.

Additionally, in December 2016, the federal government announced that the Canadian Arctic Ocean will be indefinitely off limits to new oil and gas exploration licencing. The federal government has committed to reviewing this freeze every five years through a science based, life-cycle approach, taking into account marine and climate change science. Consultations will inform the five year assessment (Prime Minister of Canada news, Dec. 20, 2016). This moratorium applies to the area in which the proposed Tuvaijuittuq MPA is located.

Section 8: Regulatory Management Scenario

The primary objectives of the designation of MPAs are the conservation of marine living organisms and their habitats as well as ecological systems and functions, through the regulatory prohibitions of potentially polluting commercial uses such as fishery harvests, waste disposal and mineral development (such as seabed mining) (Sumaila & Charles, 2002). MPAs can be effective in addressing multiple threats such as commercial fishing, oil and gas exploration and development, and shipping and vessel traffic, etc. through the creation of sanctuaries for marine ecosystems to recover and species to thrive (CPAWS, 2018).

The proposed Tuvaijuittuq MPA is expected to be one of the last areas in the world that multiyear pack ice will persist and will likely be critically important habitat for under-ice and ice-dependent species, such as Polar Bears and Seals (DFO, 2018). The designation of the proposed Tuvaijuittuq MPA as an MPA (by way of Ministerial Order) is considered necessary given the high potential importance of the area for species diversity and productivity, and the need for more scientific research.

Conservation Objectives

The Conservation Objective for the proposed Tuvaijuittuq MPA was identified by DFO Central and Arctic Region and is as follows:

“To contribute to the conservation, protection and understanding of the natural diversity, productivity and dynamism of the High Arctic sea ice ecosystem.”

The current Conservation Objective does not impact the regulatory intent of the proposed MPA, as it is being used in part to inform and identify the need for protection of the area.

Regulatory Intent

The regulatory scenario (i.e., MPA (by way of Ministerial Order)) engages “Freezing the Footprint” for up to five years and by not increasing the impact of human activities beyond ongoing activities in a marine area identified in the regulations for the proposed MPA (i.e., ongoing activities continue, prohibit new activities, etc.).¹⁷ The proposed MPA would provide a stop-gap measure by prohibiting new activities within the area for up to five years at which point a long term protection measure must be established or the Order be repealed.

The regulatory intent is based on knowledge of activities that have occurred in the area one year prior to designation, as well as any future activities that would be allowed to continue in the proposed MPA. As such, the following Regulatory Intent has been developed by DFO Central and Arctic Region.

The establishment of a conservation area triggers rights and obligations under the Nunavut Agreement to establish an Inuit Impact Benefit Agreement (IIBA). An IIBA is required under the Nunavut Agreement before any federal marine protection measures can be designated in the Nunavut Settlement Area including an interim MPA designation.

¹⁷ <http://www.dfo-mpo.gc.ca/oceans/conservation/act-loi-eng.html>

In the proposed MPA no new or additional human activities would be allowed in the area following this designation, except for specific activities listed below. Any activities that have occurred in the proposed MPA over the twelve months prior to designation (or that have been authorized to occur) would be allowed to continue in the proposed MPA. In addition, scientific research, safety, security and emergency activities, as well as certain activities carried out by a foreign national, entity, ship or state, would be allowed in the proposed MPA.

Exemptions: The proposed MPA Regulations contains a list of ongoing activities which are:

- Constitutionally protected Aboriginal rights to fish and Comprehensive Land Claims Agreements would continue to apply in the proposed MPA;
- Scientific activities carried out on the ice or from a ship to monitor and sample oceanographic, atmospheric, physical (i.e., ice) and biological features, and;
- Activities carried out by the Department of National Defence.

The time period considered for the regulations is five years from the base year of 2019, as per the proposed MPA time frame (five years).

When the proposed MPA is established, a five-year time limit will be placed on the establishment of an *Oceans Act* MPA through Governor in Council (GiC) regulation. The five-year time limit starts on the day the MPA enters into force. If a GiC regulation is not put in place within this time frame, the Order must be repealed.

Section 9: Analysis of Costs and Benefits of Establishing the proposed Tuvaijuittuq MPA

The purpose of this report is to estimate the incremental costs and benefits to Canadians that result from establishing the proposed Tuvaijuittuq MPA. The measures listed in the Regulatory Intent to achieve the stated Conservation Objectives may have impact on direct and indirect uses of the study area.

The following sections provide an assessment of the costs and benefits (i.e., impacts) of the regulatory scenario which establishes the proposed Tuvaijuittuq MPA, based on information available at relevant websites and in the existing literature as secondary sources of information.

Costs of Establishing the proposed Tuvaijuittuq MPA

Extractive Use

Commercial Fishing: Currently there are no active commercial fisheries in the proposed Tuvaijuittuq MPA, and interest in developing future fisheries within the proposed five-year period is unlikely. As a result, the establishment of the proposed MPA is unlikely to impose any costs to the commercial fishing sector within the area in the form of foregone revenue or higher costs of operation.

Subsistence Harvesting: Based on DFO harvest records, and conversations with communities (with the regional Oceans Program in 2019) for the proposed Tuvaijuittuq MPA no subsistence harvesting activities occurred in or directly adjacent to this area. Constitutionally protected rights under the Nunavut Agreement remain in the proposed MPA resulting in no additional costs to harvesting activities within the area such as forgone revenue or higher costs of operation, are expected. No change in peoples' way of life or livelihood is anticipated.

Recreational Fisheries: There are currently no active recreational fisheries within the proposed Tuvaijuittuq MPA, and interest in beginning such activities within the proposed five-year time period is unlikely. As a result, the establishment of the proposed MPA is unlikely to impose any costs to recreational fisheries sectors in the form of foregone revenue or higher costs of operation.

Aquaculture Activities: There are currently no active aquaculture activities within the proposed Tuvaijuittuq MPA, and interest in beginning such activities within the proposed five-year time period is unlikely. As a result, the establishment of the proposed MPA is unlikely to impose any costs to aquaculture sectors in the form of foregone revenue or higher costs of operation.

Resource Extraction

Mining Exploration and Production: There is no current mining activity, such as mineral exploration or mine production in the proposed Tuvaijuittuq MPA. There is no active mineral exploration or mine production in the area near the proposed Tuvaijuittuq MPA. It is unlikely there will be any mineral exploration or mine production in the proposed Tuvaijuittuq MPA within the proposed five-year time period. If mineral exploration within or adjacent to the proposed Tuvaijuittuq MPA was to be considered during the five-year time period, the proposed regulations may hinder these exploration activities, with a potential loss of future revenue to the mining industry. However, as mineral and exploration and

production is a remote possibility, the establishment of the proposed MPA is unlikely to impose any additional costs to the mining sector in terms of forgone revenue or higher costs of operation.

Oil and Gas Exploration and Production: There are currently no oil and gas licences within the proposed Tuvaijuittuq MPA and no offshore wells have been drilled within the boundaries of the proposed Tuvaijuittuq MPA (although there are wells adjacent to the area). The moratorium¹⁸ on new oil and gas exploration licencing also applies to the area.

There is potential for future oil and gas development in the proposed Tuvaijuittuq MPA. If the moratorium is not renewed after the five year period (December 2021), oil and gas exploration within the proposed Tuvaijuittuq MPA could be considered over the latter part of the five-year period, in which the proposed MPA regulations may hinder these exploration activities, with a potential loss of future revenue to the oil and gas industry. However, as oil and gas exploration and production is unlikely¹⁹ over the latter portion of the 5 year time period, the establishing of the proposed MPA is unlikely to impose any additional costs to the oil and gas sector in terms of forgone revenue or higher costs of operation.

Non-Extractive Use

Commercial Shipping and Other Vessel Activities: According to the analysis of satellite AIS data there was no indication of vessel traffic in the area during the time period of March 2017 to November 2018. Interest in beginning vessel activities within the proposed five-year time period is unlikely. As a result, the establishment of the proposed MPA is unlikely to impose any costs to the vessel sectors.

Recreational and Tourism Activities: There are no tourist or recreational activities taking place within in the proposed Tuvaijuittuq MPA and it is unlikely there will be interest in starting recreational and tourism activities within the five-year time period. This is likely due to the far distance to the area for tourists, along with the significant costs to travel to the area. As a result, the establishment of the proposed MPA is unlikely to impose any costs to recreational and tourism sectors within the area in the form of foregone revenue or higher costs of operation.

Other Sectors: There are scientific research and National Defence activities occurring within the proposed Tuvaijuittuq MPA area. These activities will continue to be allowed to occur within the proposed area.

Other uses and Non-use Values: Negative impacts on other uses and non-use values listed in Matrix 1 are anticipated to be unlikely due to the establishment of the proposed MPA as those uses and values align well with the Conservation Objectives.

Management Costs

Once established the management costs for the proposed Tuvaijuittuq MPA include monitoring, enforcement, administration and scientific research. The level of these costs is determined upon the size, location, restrictions of the proposed MPA, regulations and the available technology.

¹⁸ In December 2016, the federal government announced that the Canadian Arctic Ocean will be indefinitely off limits to new oil and gas exploration licencing. The federal government has committed to review this freeze every five years through a science based, life-cycle approach, taking into account marine and climate change science.

¹⁹ This is unlikely due to depressed oil prices, limited infrastructure and the remoteness of the area which would make oil and gas extraction operations difficult.

Based on the information provided by the regional Oceans Program, the total government costs (federal government) related to monitoring, enforcement, administration and scientific research is estimated to be \$2.56 million per year over the five year period.

Therefore, the total management costs comprising of monitoring, enforcement, administration and scientific research to be incurred by the government is estimated at \$12.8 million over five years. Assuming 2019 as the base year and using a discount rate of 7%, the study calculated that the present value of the total costs would be \$11.23 million (see annex 4 for details). This estimate does not include future feasibility assessment work planned to inform consideration of permanent marine protection measures. These costs are yet to be fully defined and are not considered as management costs specific to establishment of the interim MPA.

Additionally, if established, the required IIBA will result in additional costs. An IIBA for the proposed Tuvaijuittuq MPA has not been concluded which means that these costs are not unknown at this time.

Benefits of Establishing the proposed Tuvaijuittuq MPA

The establishment of the proposed Tuvaijuittuq MPA may help promote environmental preservation and conservation by preventing any potentially negative activities that are currently not occurring in the area such as oil and gas development, mineral exploration and commercial fishing. This will provide protection for the area while additional information is collected to inform the potential selection and creation of a long term marine protected area measure. If an Oceans Act GiC regulation is established it will explicitly identify the impacts of potential activities on the conservation objectives.

The establishment of the proposed Tuvaijuittuq MPA may provide benefits to the surrounding communities and Canadians at large as described below:

Non-Extractive Use

Monitoring/Research: Additional Inuit led research and other marine scientific research will be conducted within the proposed Tuvaijuittuq MPA. This research is anticipated to provide baseline data for use in characterizing existing marine populations and communities (e.g., stock assessments, trophic linkages, habitat utilization), as well as for use in regulation and monitoring. Establishing environmental baselines for marine research improves the cumulative understanding of ecosystem processes over time, and provides control areas for assessing human induced impacts (Angulo-Valdés and Hatcher, 2010). Lastly, research is often linked with education, and protected areas provide rich opportunities for study. Although, estimating the economic value of these uses is difficult, their contribution in this area cannot be overlooked.

Ecosystem Services: It is believed that the proposed Tuvaijuittuq MPA provides invaluable direct and indirect services to society by supporting Arctic marine and ice-associated ecosystems and biodiversity. Additional research is necessary to determine the nature of this area's ecological importance, how migratory and non-migratory species utilize the area, and determine the area's contribution to biodiversity on both local and regional scales.

The proposed Tuvaijuittuq MPA is the last area is expected to be one of the last areas in the world that multiyear pack ice is projected to persist and is considered a critically important habitat of under-ice and ice-dependent species such as seals and polar bears (DFO, 2018).

Measuring these ecosystem services is difficult, as thus far there has not been sufficient guidance on how to measure such intrinsic benefits. As preservation (i.e., maintaining at current levels) and increases in ecosystem services benefits occur over long-run protection, it is quite unlikely these values will change over the five year time period for the proposed MPA. However conducting more marine scientific research in the area may provide valuable information that could help the efforts to maintain and possibly improve ecosystem services benefits.

Non-Use Values: These values are the value people derive from a good or resource, independent of any use people might make from that good/resource, including the conservation of the ecosystem for future generations (e.g., future biodiversity) also known as bequest value and existence value arising from people intrinsically valuing the existence of the ecosystem regardless of its use.²⁰ Existence value includes the benefits from knowing that the resources are being used by others as well as cultural values for an economy.

The communities nearest the proposed MPA and people residing elsewhere in Canada are expected to derive non-use value from the services provided by the area.

Information on marine mammal use of the area is very limited, marine mammals are thought to exist in low numbers within the proposed Tuvaijuittuq MPA – including Bearded and Ringed Seals (Pers. comm. Ferguson, 2018). Other marine mammals such as Beluga, Narwhal and Bowhead whales, and Walrus may migrate through the proposed Tuvaijuittuq MPA (Pers. comm. Ferguson, 2018).

Preservation (i.e., maintaining at current levels) and increases in non-use values occur over long-run protection. However it is likely that non-use values may increase slightly once people are aware of the fact that steps are being taken through the proposed MPA to conserve fish and marine mammals and seabirds within the five year time period. Moreover, conducting more marine scientific research in the area may provide valuable information that could help in future efforts to improve non-use values.

Archaeological and Historical Values: The efforts taken to protect the proposed Tuvaijuittuq MPA may help to preserve the archaeological, historical and cultural heritage within the proposed area. Preserving natural and cultural resources would benefit Canadians as they learn about the cultural values that exist within the proposed Tuvaijuittuq MPA. In addition, future generations of Canadians can also enjoy the history and culture that are preserved within the proposed Tuvaijuittuq MPA.

Other: There will be benefits accrued from the IIBA, however these benefits are unknown at this time.

²⁰ Although in theory non-use values are divided into existence and bequest values, the empirical studies do not always make the distinction and calculate them together as non-use values (Hayder, 2014).

Section 10: Conclusion

This report analyzed the costs and benefits of the establishment of the proposed Tuvaijuittuq MPA and attempted to assess the net value generated by the proposed MPA either qualitatively or quantitatively. While secondary sources of information were used, the study was largely based on the Socio-Economic Overview and Assessment of the Area of Interest report which provided foundation to some degree for developing the baseline scenario and projections for the proposed five year period.

The proposed Tuvaijuittuq MPA was chosen because of the critically important role it is expected to play in the future as sea-ice continues to decline. This area is expected to retain multi-year sea ice past 2050 and is expected to play an important role for ice dependent species.

The report found that the study area provides indirect services to society through maintaining ecosystems services and non-use values, and biodiversity. The area is expected to provide some, albeit limited, economic, subsistence, social, and cultural benefits to the closest communities and Canadians as a whole. The area also provides opportunities for scientific research activities that can result in a better understanding of the ecology.

If the proposed Tuvaijuittuq MPA is established, the study estimated that the total cost related to administration, enforcement, scientific research and monitoring would be \$12.8 million over five years. Assuming 2019 as the base year and using a discount rate of 7%, the study calculated that the present value of the total costs would be \$11.23 million.

Due to lack of information, the potential limited benefits that may accrue from the establishment of the proposed MPA could not be assessed quantitatively. Nevertheless, the study made an attempt to qualitatively assess the potential limited benefits that may accrue due to the establishment of the proposed MPA for five years period starting 2019.

The proposed five year time period associated with the proposed MPA is too short to accrue any sizeable incremental costs and benefits. As potential costs are realized immediately (i.e., short run) and potential benefits take time to be accrued (i.e., long run), a more fulsome CBA (GiC MPA) would be undertaken for the long run. However the proposed MPA would provide a stop-gap measure by prohibiting new activities (i.e., freezing the footprint) within the area until an *Oceans Act* MPA providing long-term protection is established. Interim protection will ensure no additional unforeseen stressors impact the area. Additionally the proposed MPA affords the opportunity to conduct further science research, consultations, risk assessments, socio-economic and ecological overviews, and identify and establish appropriate conservation tools during the five years following establishment of the proposed MPA.

Despite the fact that the report could not quantify the potential benefits and compare the present values of costs and benefits quantitatively, it was concluded that any ecological, economic, social and cultural benefits of the proposed MPA would likely outweigh any perceived costs.

Limitations associated with this report include a lack of information. While obtaining and analyzing information for the purpose of this report, the most notable limitations identified are:

- iv. Lack of detailed and specific information for the area;

- v. Outdated information (lack of recent information);
- vi. Including detailed subsistence harvest figures (if any) from solely within the proposed MPA was not possible due to a lack of specific information available. This is also a data gap for all marine mammals and additional information is required. Correspondence with communities around the area would greatly help to aid in the development of a more precise report.

These limitations have been mitigated to some extent through qualitative discussions to illustrate the expected economic and social outcomes. However, the appropriate remedy for these limitations would be further research and community input. Despite data limitations and uncertainties associated to the report, it provides information which may be found useful for decision making processes, such as regulatory intent.

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Personal Communications

Leah Brown, Senior Oceans Biologist, Fisheries and Oceans Canada, Emails and in person conversations, 2018 and 2019.

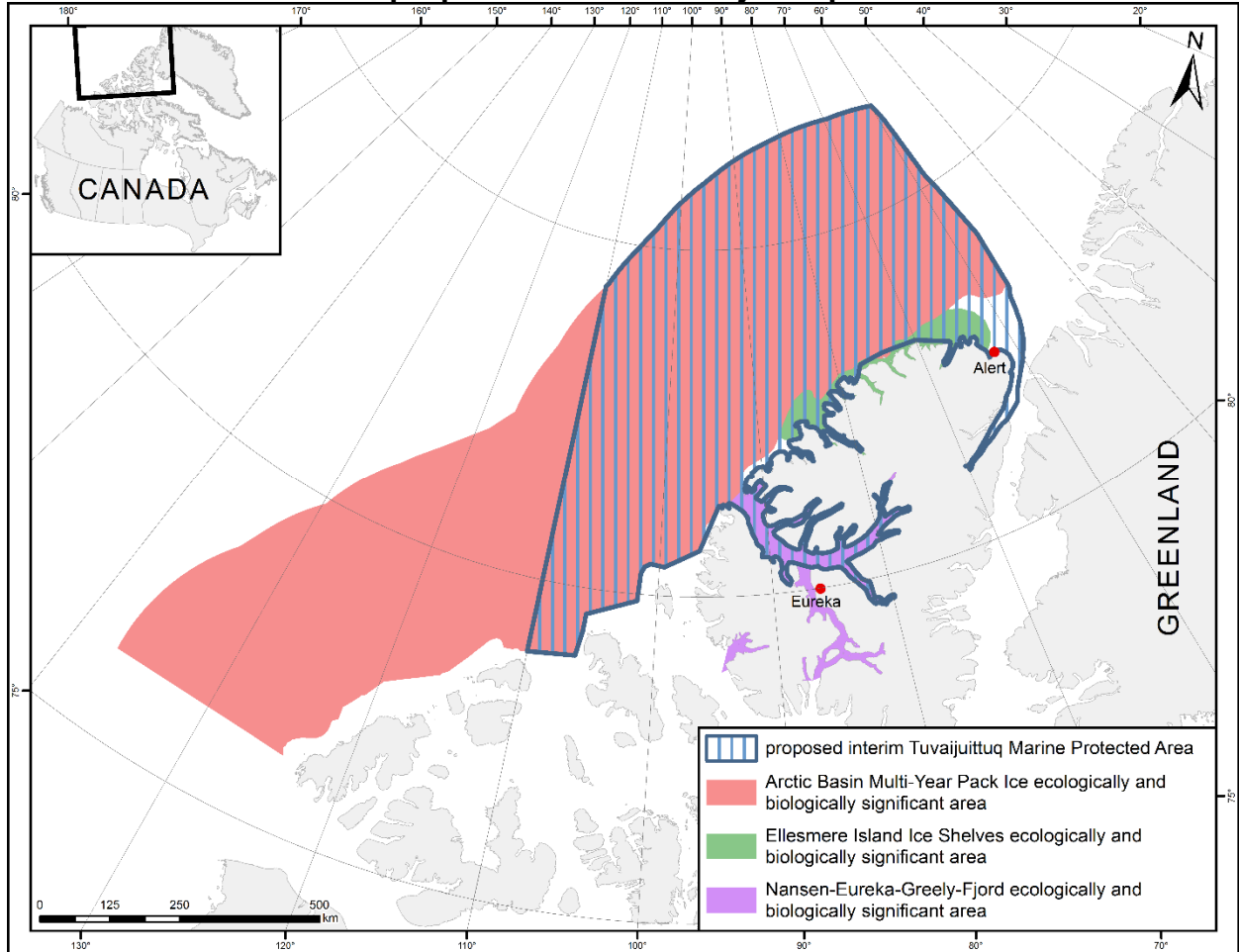
Steve Ferguson, Research Scientist, Fisheries and Oceans Canada, Emails and in person conversations, 2018.

Kevin Hedges, Research Scientist, Fisheries and Oceans Canada, Emails and in person conversations, 2018.

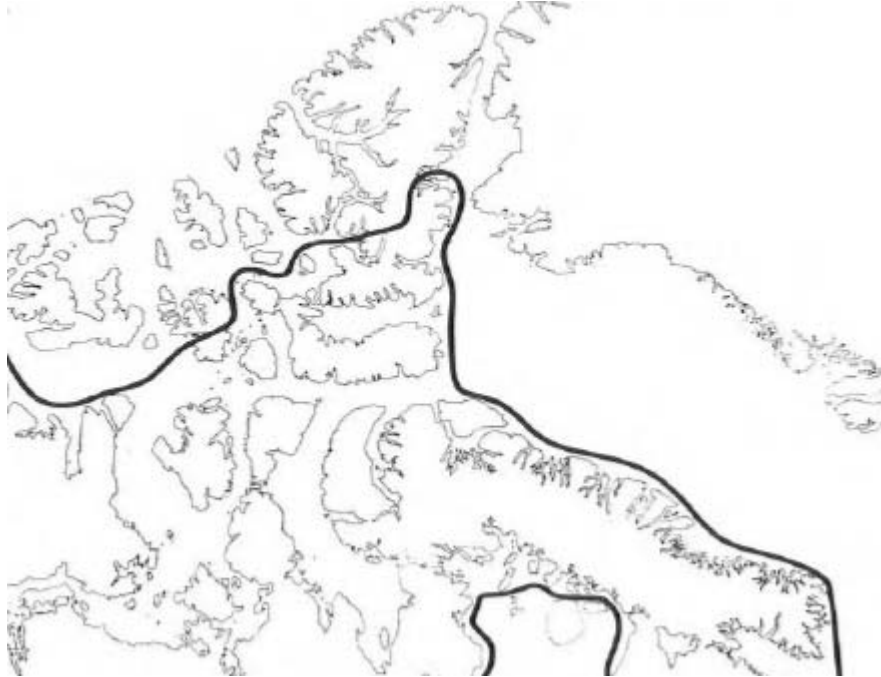
Holly McCullough, Marine Protected Area Biologist, Fisheries and Oceans Canada, Emails, 2018.

Steve Sharpe, Staff Geologist, Mineral Resources, Crown-Indigenous Relations and Northern Affairs Canada, Emails, 2019.

Annex 1: Map of Ecologically and Biologically Significant Areas (EBSAs) within the proposed interim Tuvaijuittuq MPA

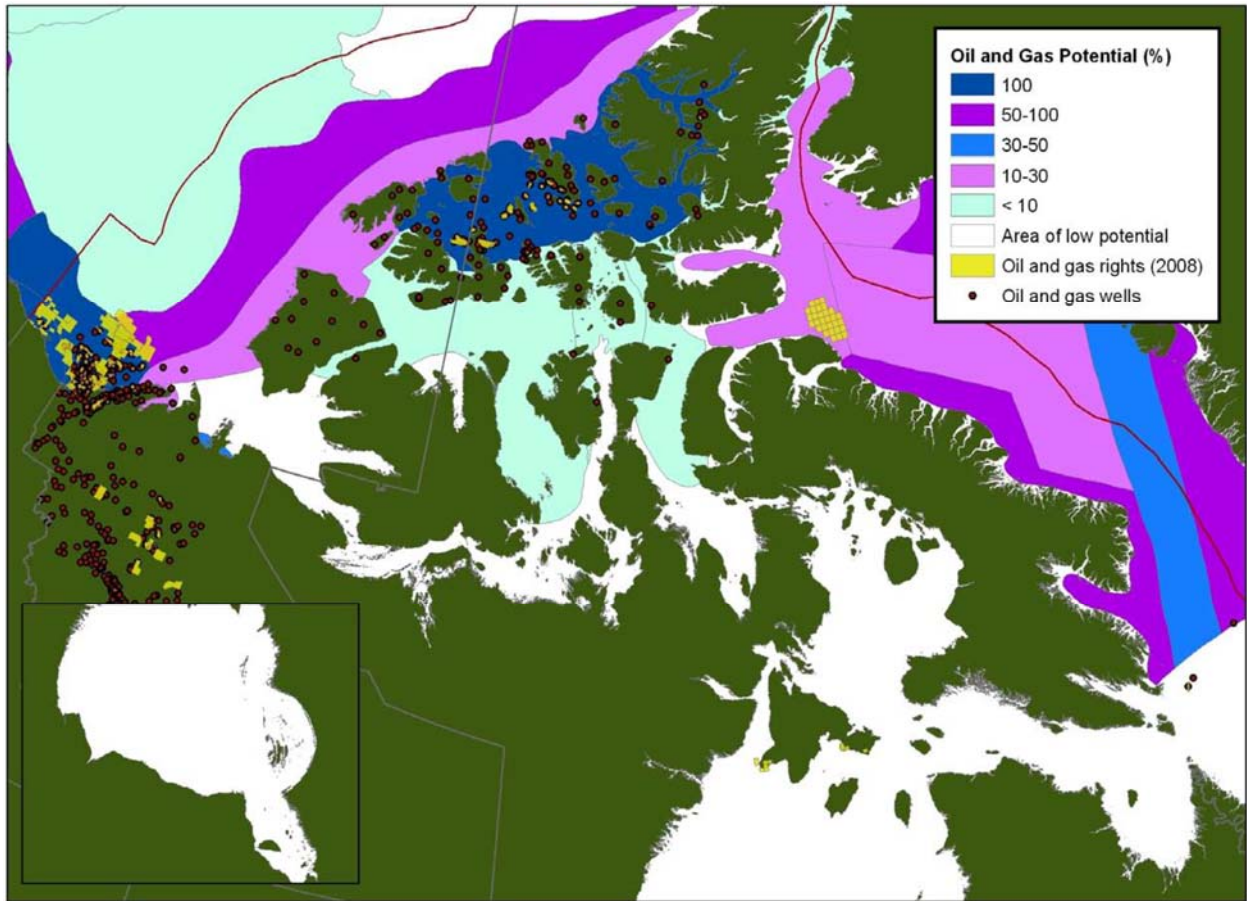


Annex 2: Map of the Outer Extent of Inuit Land Use in Living Memory



Map taken from Aarluk Consulting, 2009.

Annex 3: Arctic Oil & Gas Potential

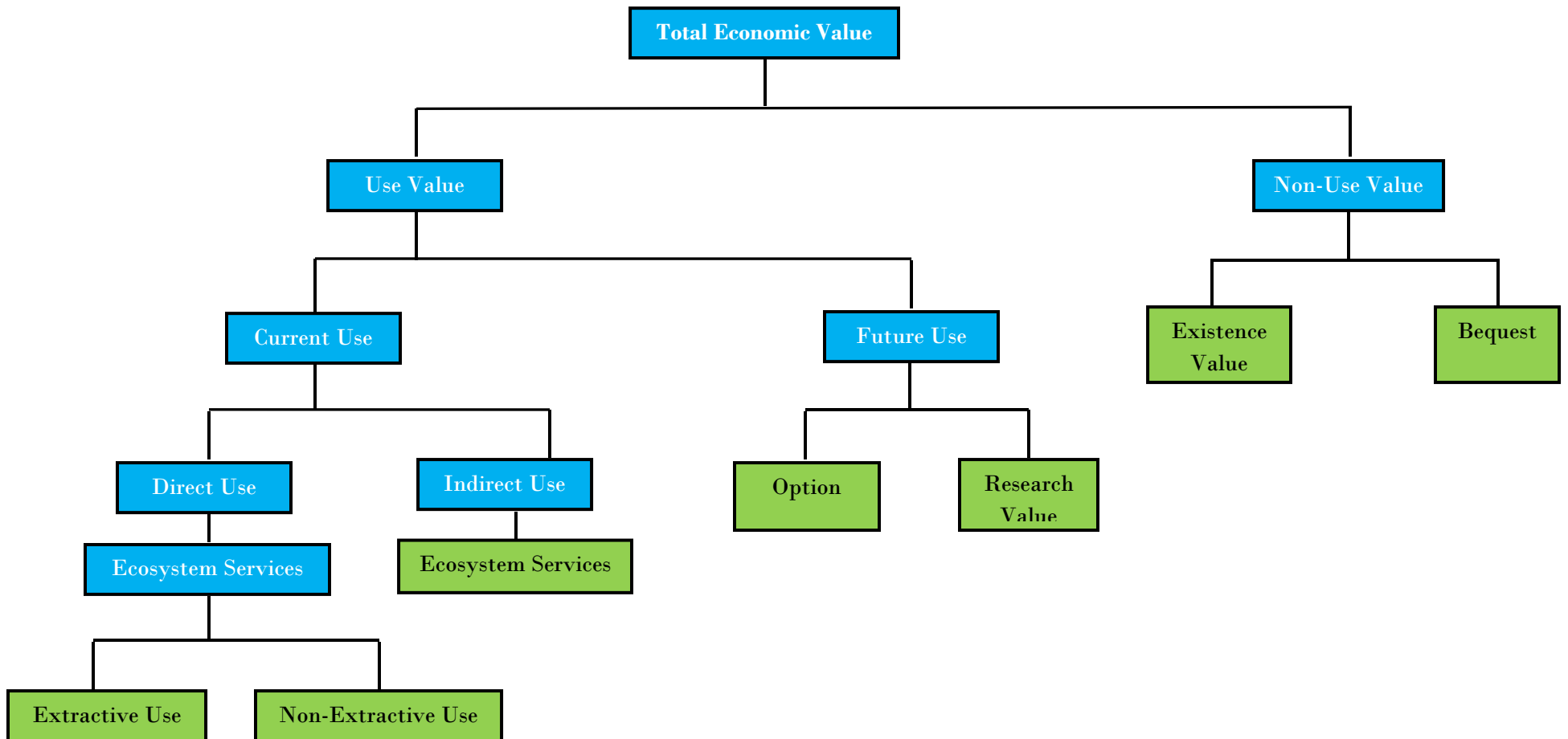


Map taken from Stephenson and Hartwig, 2010 (referenced from United States Geographical Survey (USGS) Fact Sheet 2008-3049 (2008)).

Annex 4: Management Costs

Government Management Costs	2019	2020	2021	2022	2023	Total
<i>Cost Category</i>	<i>Nominal Value \$</i>					
Salary	\$700,000	\$700,000	\$700,000	\$700,000	\$700,000	\$3,500,000
Operations and Maintenance	\$1,660,000	\$1,660,000	\$1,660,000	\$1,660,000	\$1,660,000	\$8,300,000
Capital	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$1,000,000
Total \$	\$2,560,000	\$2,560,000	\$2,560,000	\$2,560,000	\$2,560,000	\$12,800,000
	<i>Present Value \$ (Base Year 2019)</i>					
Salary	\$700,000	\$654,206	\$611,407	\$571,409	\$534,027	\$3,071,048
Operations and Maintenance	\$1,660,000	\$1,551,402	\$1,449,908	\$1,355,054	\$1,266,406	\$7,282,771
Capital	\$200,000	\$186,916	\$174,688	\$163,260	\$152,579	\$877,442
Total \$	\$2,560,000	\$2,392,523	\$2,236,003	\$2,089,723	\$1,953,012	\$11,231,261

Matrix 1: Total Economic Valuation Flowchart (Source: Hayder (2014))



Definitions²¹

Use Value: The value people derive from using a good.

Current Use Value:

Direct use: Directly consumable goods and services through ecosystem services.

Ecosystem services: Include provisioning services such as food, water (Millennium Ecosystem Services Assessment, 2005).

Extractives use: Extractive uses result in water level and/or commodities provided by the area (e.g. commercial fishing).

Non-extractives use: Non-extractives uses do not cause water level and/or commodities provided by the area (e.g. wildlife watching).

Indirect use: Indirectly consumable goods and services through ecosystem services.

Ecosystem services: Include provisioning services such as include regulating services (e.g. climate, floods, disease, water quality) and supporting services (e.g. soil formation, nutrient cycling) (Millennium Ecosystem Services Assessment, 2005).

Future Use Value:

Option value: The amount someone is willing to pay to keep open the option of future use of the resources (e.g. possibility of commercial/recreational fishing in the future).

Research Value: Scientific research potential that may result in new discoveries/knowledge and/or new developments that have broader application in future. Some of the potential beneficial effects include new understanding of the biology and ecology of the area, new understanding of inter-specific interactions and competition, new chemicals/medicines with broader applicability.

Non-Use Value: The value people derive from a good/resource independent of any use people might make of that good/resource.

Bequest value: Conservation for future generations (e.g. future biodiversity). Bequest value takes into account people's WTP for future total use by their children and future generations.

Existence value: Existence value arises because people intrinsically value the existence of the area regardless of its use. Existence value includes the benefits from knowing that the area is being used by others as well as cultural values for an economy.

²¹ The development of this section has largely been based on Hayder (2014).

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