Mackenzie Valley All-Weather Road Economic Analysis

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Northwest Territories Transportation

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Government of the Northwest Territories, Department of Transportation, Planning Division

Executive Summary

The Government of the Northwest Territories, Department of Transportation (DOT) retained Terra-Firma Consultants and Pacific Analytics Inc. to undertake an analysis of the economic effects of building a Mackenzie Valley All-Weather Road (AWR) from Wrigley to Tuktoyaktuk.

Four overall economic effects of building an AWR through the Mackenzie Valley to Inuvik in the Mackenzie Delta were assessed: 1) building and maintaining the AWR, 2) reduction in the cost of living, 3) increase in tourism activity, and 4) impacts on the Mackenzie Gas Pipeline (MGP) including natural-gas field exploration and development in the Mackenzie Valley.

The study uses two models: the NWT Input-Output Tables developed by Statistics Canada and a financial/economic model of the MGP developed by Pacific Analytics and used in earlier studies of the MGP that were submitted to the Joint Review Panel (JRP) and the National Energy Board (NEB). The Input-Output Tables analyze how the broader NWT and Canadian economies are affected by the AWR by calculating the spin-off (indirect and induced) impacts on the NWT and the rest of Canada (ROC). The financial/economic model is based on the detailed financial structure of the proposed MGP provided by Imperial Oil and analyzes how the AWR changes the MGP's internal finances (Cash Flows, Royalties, Income Taxes, Internal Rates of Return, etc.) and investment requirements based on various operating assumptions.

Assumptions for the MGP model were refined through interviews with oil and gas executives; business managers and owners in communities affected by the AWR; and air and ground transport companies servicing communities affected by the AWR. In addition, PROLOG Canada prepared a logistics analysis to determine if the MGP will derive any economic benefits from the existence of the AWR.

The results of the study strongly suggest that building the AWR is good for the residents of the Mackenzie Valley, the Canadian energy sector, and all governments in Canada. Specifically, the study concludes the following:

14,082 One-Time and 93 Long-Term Jobs Will Be Created

Building the AWR will create 7,785 one-time jobs in the NWT and 6,297 one-time jobs in the rest of Canada.

Building the AWR will create 7,785 one-time jobs in the NWT and 6,297 one-time jobs in the ROC. The AWR will create 78 long-term jobs in the NWT and another 15 in the ROC. Building the AWR will earn all governments over $200 million from activities in the NWT and an additional $70 million accruing to governments in the ROC.

AWR Maintenance Creates 161 Long-Term Jobs

Maintaining the AWR will create 161 long-term jobs: 128 in the NWT and 33 in the rest of Canada

Maintaining the AWR at $13 million a year results in total yearly benefits (direct plus indirect plus induced) of an additional $10 million in GDP, the creation of 128 permanent jobs, and an increase in GNWT revenues of $0.8 million. The (ROC) will also benefit with an additional $2.4 million in GDP, 33 additional permanent jobs, and just over $300,000 in additional tax revenues.

$1.3 Million a Year for Government to Reinvest

The AWR frees up about $1.3M a year for Government to spend elsewhere.

The economic downside of building the AWR is that it will replace the annual winter-road construction. This saves the GNWT money, but it also reduces the annual purchase of goods and services, as well as the number of jobs, thereby reducing economic activity in the NWT and the ROC. This study assumes that government savings resulting from not having to build annual winter-roads will be reinvested elsewhere into the NWT economy, but it does not identify exactly where this spending will be.

Improved Quality of Life

The NWT's quality of life indicators are significantly below national standards. Economic activity in the NWT is unevenly distributed: unemployment rates range from 5 percent in Yellowknife to almost 40 percent in smaller communities. In addition to these alarming employment statistics, population statistics show a declining population. Limited opportunities for employment and the high cost of living are factors contributing to this decline.

The AWR will increase community accessibility, quality of life, and resident populations.

The AWR will reduce transport costs in the Sahtu, Gwich'in and Beaufort-Delta regions and enable people to purchase more for the same amount of money, which will increase economic well-being. The decline in the population of smaller communities is often attributed to isolation, cost of housing, and availability of public and private service conveniences. The AWR will increase accessibility to the smaller communities, increase the standard of living in the Mackenzie Valley, and facilitate the transformation of the NWT's economy.

Transportation Cost Structures in the Mackenzie Valley Will Be Reduced

The results of the study confirm that transportation cost structures in the NWT will be reduced and that residents will enjoy higher standards of living based on their increased purchasing power.

It will cost less to ship goods overland to Inuvik, Tuktoyaktuk, and communities along the Mackenzie Valley.

The AWR will reduce the cost of shipping goods to Inuvik, Tuktoyaktuk, and communities along the Mackenzie Valley served by the AWR. Lower prices for goods will mean that people will have money left over after buying the same basket of goods they bought before the AWR. That is, they will be able to buy more goods and services without having to make more money. The "additional disposable income", by definition, will equal the savings in freight rates.

$15.7 Million More Dollars in Peoples' Pockets Each Year

. The AWR will put about $15.7 million more dollars in peoples' pockets each year. Lower freight rates in NWT will make each dollar go further

Lowering freight rates in the NWT will make each dollar go further. The AWR will put about $15.7 million more dollars in peoples' pockets each year, and that will have positive spin-off benefits for the rest of the NWT economy. People will be able to purchase more goods with the same amount of money as before the AWR, which will generate $5.5 million in GDP, create 41 permanent jobs, and increase government revenues by $1.1 million, of which $0.6 million will accrue to the GNWT.

Tourist Visitation Will Increase by 20 Percent Each Year

$2 million increase in tourist expenditures, 10 new permanent jobs, and almost $100,000 in GNWT revenue.

Tourist visitation is expected to increase by 20 percent, or by about 2,500 □ 2,700 new tourists each year. Based on historical average spending, a conservative increase in tourist expenditures of $2 million a year is expected. This translates into $550,000 more buying and selling in the NWT each year, 10 new permanent jobs each year, and almost $100,000 more in government revenues each year. The ROC will see a $200,000 increase in GDP, three more permanent jobs, and $25,000 in additional government revenues.

AWR Is a Significant Benefit to the Energy Sector's Financial Viability in the NWT

The AWR will be of significant benefit to the energy sector's corporate financial viability (possibly increasing after-tax cash flows by $1 – $2 billion), despite our assumption that the building of the AWR will NOT affect in any material way the initial cost of building the Mackenzie Gas Project. There is also a substantial increase in GDP for the NWT, although because of the reduced investment costs of exploration and development, the GDP in the ROC actually falls. Similarly, the NWT will enjoy a clear increase in overall employment (person-years of employment), but the ROC will experience a decline in employment because the total demand for goods and services is lower.

Based on a 1.2 bcf/day capacity pipeline, the AWR will save the MGP about $1.2 billion in exploration and well-development costs.

The MGP Will Save $1.215 Billion over the 45 Years

Based on a 1.2 bcf/day capacity pipeline, the construction of the AWR affects the proposed MGP by reducing future exploration and well-development costs by an estimated $1.215 billion ($2009 dollars, discount rate of 5 percent) over the 45-year operating period of the pipeline. While the reduced exploration and well-development costs will result in less money being spent in the NWT and in the ROC, the increased financial returns for companies will increase the economic viability of many exploration projects and will therefore help promote economic development throughout the region.

Corporate after-tax returns to increase by almost $2 billion

MGP Project Economics Will improve by Between $1.1 and $2 Billion, and Government Revenues Will Decrease

The net or total effect of building the AWR on the base 1.2 bcf/day pipeline over the 45-year period will both improve private sector after-tax cash flows by almost $1.1 billion and the viability (Internal Rate of Return) of the MGP by almost 2 percent, as well as decrease total government revenues by an estimated $125 million, although the net fall in GNWT revenues will be only $30.9 million over the entire 45-year period.

The conclusion that the building of the AWR will actually reduce overall government revenues from the MGP project may at first appear counter-intuitive; however, the interpretation is that the AWR is serving to "support" the viability of the MGP by increasing after-tax cash flows and the Internal Rates of Return (IRR). Accordingly, while the AWR is not considered a benefit to the initial construction of the MGP, it does have a significant positive impact on its long-term success.

Improve private sector cash flows by $1.1 billion, the viability of the MGP by about 2 percent, and reduce government revenues by about $125 million

Rig Savings Will Reach $357 Million over the Life of the MGP

The AWR reduces costs on a 1.2 bcf/day pipeline by $1.084 billion, not including rig savings of $357 million.

While the AWR will result in reduced corporate investment costs by an estimated $1.215 billion ($2009 dollars, discount rate of 5 percent) over the 45-year operating period of the pipeline, the AWR could also result in exploration companies reducing their rig rental costs by being able to rent rigs over a shorter period. These factors are estimated to save companies $357 million ($2009 dollars, discount rate of 5 percent) over the 45-year operating period of the pipeline.

The Structure of the NWT Economy Will Change

Building the AWR will cause a structural change in the economy of the NWT as established patterns of economic activity change. Concurrently, however, new economic patterns and structures will emerge to take advantage of the lower costs and lower risks provided by the AWR.

For example, as Rod Maier of Chevron Canada (personal communication, June 16, 2009) states, an AWR can help spread the work over a longer period of time where spur roads off an AWR or a marine access from the AWR are feasible, thus reducing the cyclical intensity of activity and the associated inflationary pressures. Additionally, an AWR will allow for the mobilization of more equipment from southern contractors, increase competition between contractors, increase the potential for NWT resident companies to provide goods and services to the oil and gas industry, and reduce costs for industry. New hydrocarbon fields can be developed sooner and more efficiently, and can have a lower overall cost structure.

The AWR will improve the economics of working in the Mackenzie Valley and alter the economic structure of the NWT.

As the number of barriers to spending money in the NWT by businesses such as Chevron declines, more money will be spent in the NWT, and this will create more employment and increase the NWT's GDP. Ultimately, the AWR should lower cost structures, which will in turn both open up the NWT to a greater number of smaller oil and gas companies, as well as increase oil and gas activity in the NWT.

Positive Economic Returns for the Economy of the NWT

The AWR generates positive economic returns to the economy of the NWT.

Building the AWR will generate positive economic returns for the economy of the NWT. However, these estimates do not include other important economic effects that could not be quantified — the most important of these being the potential for NWT-based businesses to provide additional supplies and services to the oil and gas sector via the AWR.

Assertion of Canadian Sovereignty

The AWR is a comparatively low-cost assertion of Canadian sovereignty in Canada's Arctic without significant on-going expenses.

The Beaufort-Delta region is a territorial and national asset of strategic importance. It provides the only NWT and Canadian deep-sea port in the Western Arctic, and the development of oil and gas resources in Alaska may create additional and as yet unrealized opportunities, particularly if all-weather road access is available. The region is strategically located to assist shipping to/from Alaska, Asia, and the continental U.S. It could receive goods from Asia for trans-shipment south to the ROC. Arctic sovereignty concerns over the Northwest Passage could lead to the establishment and investment of an amplified Canadian presence. Potential partnerships exist with the U.S. and

Canada in the transport of oil and gas, and between the private and public sectors in the NWT in the development of infrastructure.

For comparison purposes, the cost of “[f]lying the flag in the Arctic could cost the Canadian military as much as $843 million annually, says a series of internal Defence Department cost estimates. The bill for operation and maintenance would be on top of the estimated $4.5-billion capital outlay for new light icebreakers, a deepwater port and a support base” (Brewster, 2009: and that is for the Eastern Arctic only). “From a cost perspective, it cannot be over-emphasized that the vastness, isolation and lack of existing infrastructure will lead to increased costs in all aspects of implementation and operations in the Arctic” (Brewster, 2009). With experts predicting that Arctic channels could be open to unimpeded summer navigation by 2015 (Brewster, 2009), Canada’s ability to exercise its sovereignty in the Western Arctic becomes more urgent.

AWR delivers a viable and economic assertion of Canadian sovereignty.

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1.1. Approach

The purpose of this study, commissioned by the Department of Transportation (DOT), Government of the Northwest Territories (GNWT), is to estimate the economic effects of building the Mackenzie Valley All-Weather Road (AWR) from Wrigley to Tuktoyaktuk.

The outcome of the study flows from an analysis of the following:

1. the effects of building and maintaining the AWR, including the reduction in economic activity resulting from not having to build a winter-road each year;
2. the reduction in freight costs due to the year-round AWR resulting in lower consumer prices and increased standards of living in northern communities served by the AWR;
3. the effects on tourism stemming from the improved access provided by the AWR;
4. the impacts of the AWR on exploration and new gas-well development linked to the Mackenzie Gas Project (MGP); and finally
5. a qualitative assessment of the intangible impacts that the AWR may bring to the NWT.

The first three components are assessed in Section 2.2. In Section 2.3 the MGP impacts are examined. In that analysis a comparison between trucking and barging logistics of the MGP was prepared, and interviews with petroleum industry executives and retailers in Fort Good Hope, Norman Wells, Tulita, and Inuvik were held. The information derived from that analysis was included in a full financial model of the MGP that was developed and submitted to the MGP Joint Review Panel in 2007. The output of the financial model included:

1. financial information (e.g., cash flows, internal rates of return, royalties, and income taxes payable); and
2. economic outcomes (i.e., direct, indirect, and induced impacts) of the AWR on the MGP.

For the purposes of all the analyses, a 45-year life of the AWR was assumed, corresponding to the 45-year life of the MGP used by the Joint Review Panel assessment. The annual impacts of the AWR are discounted (at 5 percent) and summed over that 45-year period in order to calculate total impacts. It should be noted that because of the large effect that discounting has after 30 or so years, selecting an AWR life of 40 or 50 years would have no material effect on the outcome of the analysis.

An analysis was completed and interviews were coded and analysed for key themes regarding the strengths, weaknesses, opportunities, and threats (SWOT) of each NWT region affected by the AWR,

1.2. Context

The Federal Government has considered the vision of an all-weather highway through the Mackenzie Valley to the Arctic Coast to be a strategic priority for Canada since as far back as 1958. This vision has been restated in a number of GNWT strategic documents, including the *Department of Transportation's 2000 Highway Strategy*, *Investing in Roads for People and the Economy: A Highway Strategy for the Northwest Territories*, and two funding proposals in pursuit of this vision.

In the 1960's and 1970's, there were a number of studies that the Federal Government undertook in support of constructing an all-weather highway through the valley. In 1977, however, with the increasing uncertainty regarding oil and gas development potential along with political, economic, and legal issues of the time, construction was halted. The Federal Government abandoned the route 18 kilometres south of Wrigley.

In the early 2000's, work on this highway was revived by the GNWT through a funding partnership with the Federal Government to construct permanent bridges at all stream crossings. These bridges, which will extend the winter-road window of operation and reduce environmental concerns at stream crossings, will ultimately serve the future all-weather highway.

Canada is on the brink of significant opportunities with the development of oil and gas discoveries in the Mackenzie Valley and Beaufort Delta. The potential for Arctic shipping is a reality for the near future. The significant natural gas and oil reserves in the Mackenzie Delta and Basin are key to the economic future and prosperity of Canada. Connecting Canada to the Arctic Coast would both facilitate Canada's development of these resources and safeguard against the associated challenges. While northern development offers significant opportunities for Canadians, it also poses significant risks. Canada's sovereignty, security, and environmental integrity are threatened by the economic, political, and environmental shifts ahead. These challenges, however, can be mitigated through the construction of an all-weather transportation corridor through the Mackenzie Valley to the Arctic Coast. It is crucial that this major corridor be connected to Canada through an all-weather surface transportation link.

Connecting Canada to the Arctic Coast is also crucial to the socioeconomic future of Canada. The completion of the Mackenzie Valley Highway to the Arctic Coast will provide residents of the Northwest Territories and all Canadians with enormous opportunities. Its completion is a cornerstone of the GNWT's plan for present and future economic development in the NWT. However, the benefits of completing the Mackenzie Valley Highway extend much further than the northern regions it would be connecting.
The benefits would extend coast to coast to coast. The highway is the final step in connecting Canada's three coasts and is critical for the future protection and prosperity of Canadians.

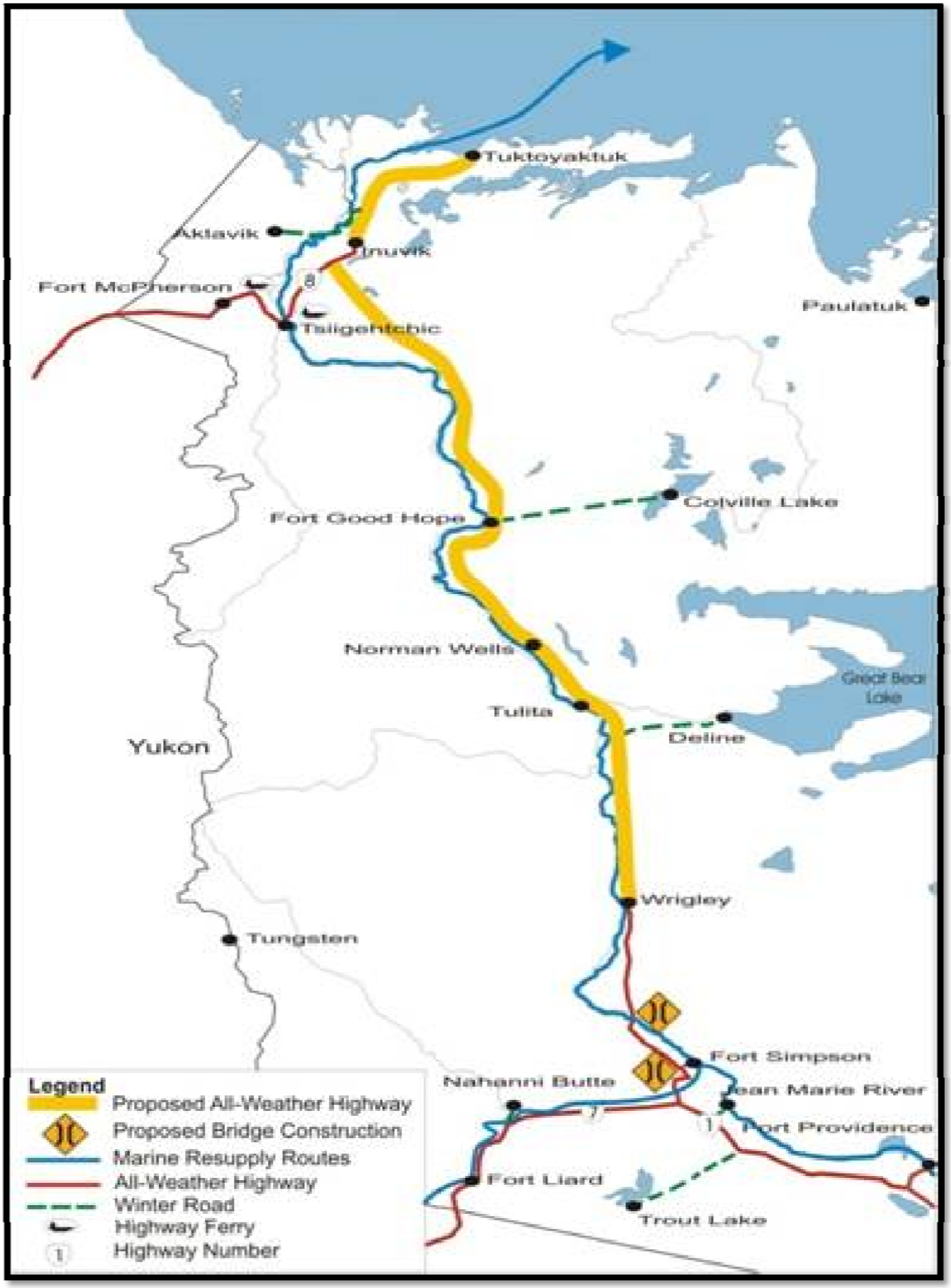

FIGURE 1 CURRENT NWT HIGHWAY SYSTEM

1.2.1. Strategic Regional Considerations

Each NWT region's strategic positioning with respect to the construction and operation of the AWR was assessed using a SWOT. Results indicate that the AWR will be a positive catalyst for renewable and non-renewable resource access; tourism; enhanced socioeconomic well-being; assertion of sovereignty; and climate change mitigation.

All regions have significant renewable and non-renewable resources. The AWR will reduce the time, cost, and attractiveness of investing in the NWT's renewable and non-renewable resource sectors.

All regions possess outstanding untapped tourism offerings. The AWR will improve tourism opportunities in the Northwest Territories, the Yukon Territory, and British Columbia. General touring is expected to increase about 20 percent within five years of the construction of the AWR, based on the current inventory of tourist offerings. The AWR will expand the NWT's tourism offering and likely increase tourist visitations.

The NWT continues to exhibit quality of life indicators that are significantly below national standards. Economic activity in the NWT is unevenly distributed with unemployment rates ranging from 5 percent in Yellowknife to almost 40 percent in smaller communities. In addition to these sobering employment facts, statistics show a population decline in smaller northern communities. Limited opportunities for employment and the high cost of living are factors contributing to this decline. The AWR will reduce transport costs in the Sahtu, Gwich'in and Beaufort-Delta regions and will enable people to purchase more for the same amount of money, hence increasing economic well-being. In addition, the alarming decline in the population of smaller communities is often attributable to isolation, cost of housing, and availability of public and private service conveniences. The AWR will reduce the isolation of smaller communities, reduce what it costs to live in the communities, and facilitate the creation of new jobs in the economy.

The Beaufort-Delta region is a territorial and national asset of strategic importance. It provides the only NWT and Canadian port in the Western Arctic, and the development of oil and gas resources in Alaska may create additional and as yet unrealized opportunities, particularly if all-weather road access is available. The region is also strategically located to assist shipping to/from Alaska, Asia, and the continental U.S. It could receive goods from Asia for transhipment south to the ROC. Arctic sovereignty concerns related to the Northwest Passage could lead to increased investment in Canadian presence. Potential partnerships exist between the U.S. and Canada in the transportation of oil and gas, and between the private and public sectors in the NWT in the development of infrastructure.

The cost of "[f]lying the flag in the Arctic could cost the Canadian military as much as $843 million annually, says a series of internal Defence Department cost estimates. The bill for operation and maintenance will be on top of the estimated $4.5-billion capital outlay for new light icebreakers, a deepwater port and a support base" (Brewster, 2009): and that is for the Eastern Arctic only. "From a cost perspective it cannot be over-emphasized that the vastness, isolation and lack of existing infrastructure will lead to increased costs in all aspects of implementation and operations in the Arctic," (Brewster, 2009). Moreover, with experts predicting that Arctic channels could be open to unimpeded summer navigation by 2015 (Brewster, 2009), Canada's ability to exercise its sovereignty in the Western Arctic becomes more urgent.

There is a critical need for a port connected to an AWR road link because if BP goes into development and production it will need a vastly improved harbour than currently *exists at Tuktoyaktuk to support the level of activity that will occur and the type of vessels that will be frequenting the Beaufort Sea.*

Bob Ball, BP Operations Manager, North American Arctic Exploration, (personal communication, June 16, 2009).

Extreme weather events; record temperatures and precipitation levels; thawing permafrost; and rising sea levels indicate that climate change is happening now and at a much faster rate than expected. Climate change will seriously affect northern regions, including transportation systems. The trend to warmer than normal temperatures has delayed the opening dates of ice bridges on the all-weather highways and reduced the operating window of the winter-road system (GNWT, 2007).

These impacts will require additional equipment, labour, and materials to maintain the integrity of the all-season transportation infrastructure (i.e., all-season roads and airports) resulting in maintenance costs over and above those currently being incurred. Based on the information collected from DOT staff, these effects currently cost DOT a minimum of $1,200,000 annually. Estimates of financial costs are difficult to provide given the current status of permafrost degradation modeling and available information. However, this cost is expected to rise in excess of $3,000,000 annually by 2055 assuming that permafrost degradation advances as indicated by the modeling (Dillon Consulting Limited, 2007).

2. The Economic Impacts of the All-Weather Road

2.1. Introduction

Four overall economic effects of building the AWR through the Mackenzie Valley to Inuvik in the Mackenzie Delta were assessed.[1] They are:

1. The construction and maintenance of the AWR: The actual building of the AWR will have three major impacts on the economy of the NWT.
   1.1. *Construction of the AWR:* Construction of the AWR will have a temporary (limited to the building period) impact on demand for supplies (e.g., gravel and fuel) and employment (and therefore wages), both of which will create additional spin-off activity in the economy. Once the AWR is built, there will be no additional economic stimulus from construction.
   1.2. *Annual maintenance of the AWR:* This component will generate much less activity in the economy than the construction activity; however, maintenance will need to be done every year, and therefore demand for supplies and maintenance jobs will be permanent fixtures in the economy.
   1.3. *Loss of annual winter-road construction:* This represents an annual cost savings to the government, but it also represents a reduction in economic activity since the supplies and employment associated with the winter-road building will no longer be required.
2. Reduction in the cost of living: With the AWR, it will cost less to transport goods to northern communities. With lower freight rates, people and businesses in communities will pay less for what they buy and will therefore have money left over (equal to the savings in freight rates) with which to buy more goods and services. Since people will be able to buy more with the same amount of money after the AWR is built, all things the same, this will lead to a higher standard of living and likely create additional local employment, too. This increase in consumer purchases and standard of living will have spin-off impacts on other parts of the economy throughout the NWT.

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[1] The economic impacts that will result from the building of the AWR have been calculated using the NWT Input-Output Tables developed by Statistics Canada. Three measures of economic impacts are calculated. The first are the ***direct impacts***. Direct impacts refer to the contribution to the economy made from specific economic activities related to the AWR ─ for example, actual AWR construction activities or the specific increase in tourism spending resulting from the existence of the AWR. Over and above these impacts are the ***indirect impacts***, which refer to the additional economic activity generated as the result of the purchases of material inputs. That is, when (say) the construction company building the AWR purchases goods and services (such as gravel, asphalt, or trucking services), those industries themselves generate activity in the economy through their own production process and through their own purchase of additional goods and services (e.g., the trucking industry would have to purchase greater quantities of diesel fuel, which would increase economic activity in the petroleum refining industry). On top of that, there are the ***induced impacts*** on the economy generated when the wages and salaries paid by the (say) construction company and (say) the trucking company are re-spent in the economy, generating economic activity in the retail sector, the recreation sector, the restaurant sector, and the like. Companies affected by this increase in local disposable income will themselves demand greater inputs and will hire additional staff, all of which serves to increase economic activity even further.

Direct, indirect, and induced impacts are determined separately for GDP (Gross Domestic Product – a standard measure of economic activity in the economy), for Labour Incomes, for Employment, and for Government Revenues. In order to calculate the direct, indirect, and induced impacts of an investment or an increase in spending, the investment or spending estimates (broken down by commodity type) are first entered into the NWT Input-Output Model. Then, since taxes do not add to economic activity, the appropriate taxes are removed. Third, the value of margins are reallocated (in a nutshell, the value of (say) gravel is made up of three price components: the value of the gravel at the mine site, the value of any wholesale and retail mark-ups, and the value of the transport or delivery costs to the construction site – see Appendix B for an in-depth explanation of IO modeling). Finally, the import content of each commodity is removed, since imported goods and services do not generate additional economic activity in the local economy. These impacts are calculated separately for impacts on the NWT economy and for impacts on the economies in the rest of Canada. Note that for ROC estimates, Statistics Canada does NOT calculate induced impacts and therefore the impacts highlighted in the Tables are "Direct + Indirect" only; as a consequence, the stated impacts are under-estimates.

It should be noted that the reduction in freight rates will likely have a negative impact on trucking and airline industry revenues, and transportation companies could earn less money due to this increase in freight-hauling productivity. This decline will be partially counterbalanced by an increase in purchases by northern residents and hence more trucking business. But more importantly, the increase in trucking productivity will have far-reaching positive impacts on a variety of economic activities in the NWT, impacts that are almost impossible to foresee and quantify, but that invariably occur with such investment in infrastructure.[2]

3 Increase in Tourism Activity: The creation of more economical access to northern areas will result in additional tourism activity. This increase will have a direct impact on local employment and incomes, and it will also have spin-off effects on the demand for supplies and other goods and services.

4. Impacts on the Mackenzie Gas Pipeline The AWR could have two potential impacts on the Mackenzie Pipeline Project. It could affect the initial cost of construction of the MGP; and it could affect future exploration and well-development costs.

4.1. *Construction of the MGP:* The cost structure of the MGP as proposed by the proponents (Imperial Oil et. al) was estimated based on the absence of an AWR. With an AWR, it is possible that the cost of building the MGP will decline. Reduced MGP construction costs would result in lower tolls for moving gas through the pipeline and would therefore increase gas field profitability. This increase in profitability would result in higher royalties and income taxes accruing to the GNWT. However, if investment costs are lower (due mainly to lower trucking costs), this would result in lower spin-off economic effects of the MGP and thus lower government revenues. While this reasoning is logical, an analysis by PROLOG (Section 4 beginning on page 33) suggests that the AWR will actually have no substantive effects on the construction costs of the MGP and that there will therefore be no spin-off effects.

4.2 *Impacts on natural gas field exploration and development in the Mackenzie Valley*: Apart from any effects on the construction phase of the MGP, the AWR could also reduce the cost of natural gas field drilling and well development in the Mackenzie Valley area. If this does happen, field profitability would increase, as would royalties and income taxes going to the GNWT. However, as with the MGP construction, a reduction in trucking costs for exploration and field development would result in less money spent in the NWT and therefore fewer spin-off dollars in the NWT economy. Whether the net effects are positive or negative for the economy of the NWT would depend on the exact nature of the exploration and well development costs, and this, in essence, will be the focus of this assessment.

> *An AWR would reasonably reduce logistics costs for a company in its development and production phase by 15 percent.*
>
> Gary Bunio, Vice President Operations & COO MGM Energy Corporation (personal communication, June 16, 2009).

[2] A number of examples can be cited, ranging from the economic spin-offs resulting from the building of the Trans-Canada Highway to the building of the Dempster Highway to the expansion of all-weather road capacity in the Peace River area of BC.

2.2. ECONOMIC IMPACTS OF THE AWR (EXCLUDING IMPACTS ON THE MGP)

2.2.1. AWR CONSTRUCTION AND MAINTENANCE

CONSTRUCTION IMPACTS OF THE AWR

The total estimated cost of building the AWR including costs for engineering design is approximately $1.67 billion, of which $1.3 billion is for road building, $223 million is for bridge construction, and $178 million is for engineering. The GNWT Department of Transportation (DOT) provided these updated costs as of October 2008.[3] Table 1 summarizes the construction estimates for the AWR and includes both road and bridge requirements.

NWT benefits (direct plus indirect plus induced benefits) of building the AWR at a cost of $1.67 billion were calculated using the NWT Input-Output Model (see footnote 1) and include $956 million in additional GDP, the creation of 7,718 person-years of employment, and a $78 million increase of GNWT revenues. Building the AWR will also benefit the ROC because goods and services are purchased from other regions of the country. Benefits for ROC include $531 million in GDP, 6,281 more person-years of employment, and $67 million in new tax revenues for other governments (federal and provincial). See Appendix A for detailed results of these calculations.

ANNUAL MAINTENANCE OF THE AWR

Once built, the AWR requires an annual budget for its maintenance, which the GNWT DOT estimates will be $13 million a year. As a result of spending this money, the total yearly benefits (direct plus indirect plus induced) are an additional $10 million in GDP, the creation of 128 permanent jobs, and an increase in GNWT revenues of $0.8 million. ROC will also benefit with an additional $2.4 million in GDP, 33 additional permanent jobs, and just over $300,000 in additional tax revenues. These economic benefits of maintaining the AWR will continue year after year in contrast to the economic benefits of building the AWR, which will be a one-time event. See Appendix A for detailed results.

LOSS OF ANNUAL WINTER-ROAD CONSTRUCTION

The economic downside of building the AWR is that it will replace the annual winter-road construction. This saves the GNWT money, but it will also reduce the annual purchases of goods and services and jobs, thereby reducing economic activity in the NWT and ROC.

It costs the DOT $1.3 million every year to build the winter-road from Wrigley to Fort Good Hope. Spending this money adds (direct plus indirect plus induced) $0.8 million to the NWT GDP, creates six permanent jobs, and adds $152,000 to government revenues, of which $63,000 goes to the GNWT. In addition, ROC benefits from the winter-road by an additional $400,000 in GDP, five permanent jobs, and $55,000 in tax revenues. All these economic benefits will be lost after the AWR is built. Also, because the building of the winter-road normally happens every year, these winter-road benefits will be lost annually when the AWR is built.

2.2.2. REDUCTION IN THE COST OF LIVING

The AWR will reduce cost of shipping goods to Inuvik, Tuktoyaktuk, and communities along the Mackenzie Valley served by the AWR. With lower prices on goods, people will have money left over after

[3] It should be noted that final engineering specifications for the AWR are still far in the future, and therefore the estimate used in this study must be treated as preliminary and may be subject to significant changes as the road design is finalised.

buying the same basket of goods they bought before the AWR. They will be able to buy more goods and services without having to make more money and thus standards of living will increase. This additional disposable income, by definition, will be equal to the savings in freight rates.[4]

Currently, about 5,110 commercial transport trucks travel up the Dempster Highway each year, bringing goods into the NWT. The AWR would save about $3,070 a year per transport load, or about $15.7 million a year in total. The reduced cost of shipping goods north would result in lower prices for consumers. In other words, the AWR will put about $15.7 million more dollars in peoples' pockets each year, and that will have positive spin-off benefits on the rest of the NWT economy. The spin-off of people being able to purchase more goods with the same amount of money as before the AWR would generate $5.5 million in GDP, create 41 permanent jobs, and increase government revenues by $1.1 million, of which $0.6 million would accrue to the GNWT. ROC will experience an increase of $0.8 million in GDP, 11 more permanent jobs, and $88,000 in additional government revenues. This increase in consumer spending would occur annually and therefore would boost the economy year after year. Detailed results are in Appendix A.

> *An AWR would save the community about a half-million dollars a year, lower food prices by 20 – 30 per cent and reduce inventory costs and wastage.*
>
> Greg Turnbull, Tulita, Northern Store Resident Manager (per. com. April 10, 2009).

Another effect of better trucking infrastructure is that the delivery of food via the Federal Government-sponsored Food Mail programme would likely cease as food would be cheaper to purchase right in the communities. Consequently, there would be less need for food delivery via air cargo, and more trucking activity with an AWR. The bottom line would be an increase in GDP of $0.5 million, four additional permanent jobs, and an increase in Government Revenues of $77,000, of which $23,000 would go to the GNWT.

2.2.3. Tourism Impacts

Discussions with NWT Tourism officials suggest that the AWR would increase visitations by 20 percent, or 2,500 – 2,700 new tourists each year. Based on an historical average spending per person of $644 (excluding airfares) and prepaid package costs of $284 (some of which do not accrue to businesses in the NWT), a conservative increase in tourist expenditures of $2 million a year is expected. This translates into $550,000 more buying and selling in the NWT each year, 10 new permanent jobs, and almost $100,000 more in government revenues each year. ROC would experience a $200,000 increase in GDP, three more permanent jobs, and $25,000 in additional government revenues. Appendix A provides details of the analysis.

The AWR will also increase tourism numbers and result in longer stays in the NWT and across the North by creating a stunning loop up through the NWT and back down the Dempster Highway into the Yukon.

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[4] The reduction in prices for consumer goods will flow partly to local individuals, resulting in additional disposable income. For local businesses that purchase (lower-priced) goods, the assumption is that lower input costs to businesses will lower business prices rather than raise profits. These lower business prices then flow to consumers, resulting in additional disposable income.

2.2.4. TOTAL ECONOMIC IMPACTS (EXCLUDING MGP EFFECTS)

Building the AWR will provide on-going benefits to the economy for many years in the future. Economists convert the flow of benefits (and costs) over time into a single value. This is done by adding up all the economic plusses and minuses over the years (in this case, over the 45-year life of the AWR) and coming up with a total. However, a dollar today buys more than a dollar in the future because of inflation, so money made in the future is worth less. This study uses a 5 percent discount rate. This "Net Present Value" (NPV) is a way of comparing the value of money now with the value of money in the future.

Table 1 presents the total economic impacts, in 2009 dollars, of building the AWR. It highlights the positives (e.g., from construction and maintenance, reductions in cost of living, and increases in tourism) and the negatives (e.g., from not building the winter-road each year).

TABLE 1: NPV OF TOTAL IMPACTS EXCLUDING MGP EFFECTS ($2009; DISCOUNT RATE = 5%)

NPV TOTAL IMPACTS	NWT				REST OF CANADA
	Direct	**Indirect**	**Induced**	**TOTAL**	**Dir. + Indir.**
Output	$2,142,000,861	$468,942,286	$443,966,589	**$3,054,908,736**	$1,242,402,573
Material Inputs	$1,133,778,175	$245,506,214	$290,044,702	**$1,669,328,091**	$650,782,592
GDP	$828,795,625	$220,147,073	$148,266,954	**$1,197,209,652**	$584,872,886
Employ (Initial Const.)	4,863	1,897	968	**7,785**	6,297
Employ (On-Going)	57	14	7	**78**	15
Wages & Salaries	$539,946,139	$127,541,706	$81,126,051	**$748,615,896**	$309,743,759
Benefits	$39,008,279	$9,672,477	$6,119,329	**$54,800,085**	$37,666,393
Total Gov't Revenues	$159,799,073	$33,638,569	$36,993,266	**$230,429,907**	$73,330,349
Federal	$97,197,692	$18,672,928	$15,518,653	**$131,390,273**	$40,846,174
Net Indirect Taxes	*$11,911,321*	*$2,429,966*	*$3,552,703*	***$17,894,990***	*$5,035,225*
Personal Income Taxes	*$85,332,364*	*$16,230,965*	*$11,934,954*	***$113,497,283***	*$35,818,448*
NWT	$62,600,363	$14,964,641	$21,476,630	**$99,041,634**	$32,489,619
Net Indirect Taxes	*$21,564,353*	*$8,191,358*	*$15,968,790*	***$45,724,501***	*$18,400,933*
Personal Income Taxes	*$41,051,358*	*$6,770,126*	*$5,493,648*	***$53,315,133***	*$14,095,968*

Source: NWT Input-Output Model

Note: Rest of Canada estimates are "Direct + Indirect" only; estimates exclude induced impacts and therefore are under-estimates.

Building the AWR will cost governments (Federal and Territorial) about $1.85 billion, and total government and non-government spending will reach $2.14 billion. The additional spending comes from increased tourism activity and increased trucking demand to accommodate additional spending by residents and businesses served by the AWR. When all economic spin-offs (direct, indirect, and induced impacts) are accounted for, this increase will create about $1.67 billion in net purchases of goods and services (material inputs) in the NWT and an additional $651 million (ROC). This results in a net increase in GDP in the NWT of $1.2 billion and an increase in GDP in the ROC of $585 million. Building the AWR will create 7,785 one-time jobs in the NWT and 6,297 one-time jobs in ROC. The AWR will create 78 long-term jobs in the NWT and another 15 in ROC. Building the AWR will earn all governments in Canada over $230 million from activities in the NWT and an additional $73 million accruing to governments in ROC. Therefore, the net cost to governments of building the AWR after accounting for these additional revenues could be as low as $1.55 billion ($1.85 billion - $230 million - $73 million). This excludes any benefits stemming from its effects on the MGP, which are examined next.

Limitations

In addition to increased tourism and trucking demand to accommodate additional spending by residents and businesses served by the AWR, the AWR will engender a number of catalytic effects for which no economic analysis has been undertaken. These effects are partially the result of increased economies of scale that the AWR will generate, particularly with regards to the MGP. In Newfoundland, for example, the development of Hibernia provided sufficient demand for a number of different types of supplies that prior to Hibernia had been sourced from outside the province.[5] At the same time, the reduced transport costs and improved transport links will act as a catalyst for import substitution and export potential beyond the MGP similar to what has occurred whenever transportation links improve (e.g., the Trans-Canada Highway). These catalytic effects can be summarised as follows:

1. Attracting new inward investment from outside the area (i.e., companies relocating to a given area).
2. Retaining existing companies in the area.
3. Promoting the import substitution and export success of companies located in the area by the provision of overland transport links to key markets.
4. Enhancing the competitiveness of the NWT economy and thereby reducing storage, warehousing, and medical travel costs.
5. Increasing opportunities for social and cultural interaction and development through reduced isolation, increased mobility, and expanded learning and training opportunities.

2.3. Impacts of the AWR on the Proposed Mackenzie Gas Pipeline

At the start of this study, there was a question as to whether constructing the AWR prior to the building of the MGP would reduce the overall investment costs of the MGP. The main argument for a reduction in investment costs was that the AWR would provide a more efficient trucking system and therefore reduce overall logistics costs. The argument against a substantive reduction in investment costs is that, much of the MGP construction will take place during the winter months when viable winter-roads are in place. Furthermore, there are potentially major advantages to using the existing barging operations to haul materials.

In order to answer the above question, the consulting firm PROLOG was commissioned to undertake a comparative analysis of the MGP with and without the AWR. The analysis by PROLOG (Section 4 beginning on page 33 of this study) found that having the AWR in place before building the MGP will have little or no impact on the costs of MGP construction since the MGP's bulk barging rates are about the same if not lower than trucking rates.

While the AWR may not change the initial construction costs of the MGP, the Gathering System, or the costs of development drilling and hook-ups of the three Anchor Fields[6], it will likely save the oil and gas

[5] One of the best examples coming out of Newfoundland is the supply of some specific office supplies, which has enabled several companies not only to provide these goods locally, but also, through the Internet, to develop a viable export product.

[6] The Mackenzie Gas Project (MGP) delivering natural gas from the NWT to Alberta is proposed by Imperial Oil, ConocoPhillips, Shell, ExxonMobil, and the Aboriginal Pipeline Group (APG). The three Anchor Fields (Niglintgak, Taglu, and Parsons Lake) are owned by Shell, Imperial Oil, and ConocoPhillips respectively.

The MGP will deliver dry natural gas from the Mackenzie Valley region (the Inuvik Gas Facility) down to Zama, located just south of the NWT/Alberta border, from where the gas will hook into the NOVA Gas Pipeline for delivery into the Alberta system.

industry 15 percent a year on all <u>future</u> field drilling and development. The savings result principally from reduced logistics costs.

> *Having access to an all-weather road provides Paramount Resources at least a 15 percent savings on its work in the Cameron Hills area. For example, the winter-road spur Paramount currently constructs into the Cameron Hills areas off the existing highway system costs Paramount $500 – $750K a year to build when needed. If there were no AWR, it would have to build a winter-road from possibly High Level at significantly greater cost.*
>
> Lloyd Doyle, COO, Northern Operating Unit, Paramount Resources Ltd. (personal communication, June 16, 2009).

2.3.1. Analysis of the Impacts of the AWR on the MGP

In its submission to the National Energy Board (NEB) and the Joint Review Panel (JRP), the proponents of the MGP proposed a pipeline with a daily capacity of 1.2 bcf/day, but included an alternative pipeline design with a daily capacity of 1.8 bcf/day (the design incorporated additional compressors along the pipeline, thereby increasing gas pressure). With an increase in capacity, additional gas would be needed to fill the pipeline (the 1.8 bcf/day scenario is estimated to require an increase in development wells from 435 wells under a 1.2 bcf/day scenario to 648 wells with a 1.8 bcf/day capacity pipeline).

The savings realized by the existence of the AWR (based on a reduction of 15 percent in exploration and development costs as suggested by discussions with exploration and production companies) were integrated into the MGP Financial Model[7], and two gas flow scenarios were examined to contrast against the Base Case gas flow of 1.2 bcf/day.

Associated condensates will be stripped at the Inuvik Gas Facility and moved to Norman Wells from where the condensateswill flow through the existing Enbridge Pipeline to Zama and from there into the Alberta system over the existing Rainbow Pipeline.

The main delivery Pipeline itself will function as a regulated utility earning a fixed rate of return on invested capital. The Gathering System consists of a number of pipeline laterals connecting the various fields to the Gas Plant, the Inuvik Gas Facility (comprising a Gas Plant/Compression Station and a Liquids Stabilisation Plant to separate the condensates), and a Liquids Line for delivering condensates to Norman Wells. Although not strictly regulated, according to the proponents, the Gathering System components will be operated as though they are regulated utilities, each earning a cost of service sufficient to earn a prescribed rate of return with unit tolls set at the cost of service divided by gas or condensate throughout. In contrast, the various natural gas fields will function as separate standard businesses, with their rates of return dependent on the following: their specific production profile; their unique capital investment and operating costs; Edmonton-based prices for natural gas and condensates; and the unit tolls charged by the Gathering System and main Pipeline.

[7] In 2005 a comprehensive financial model of the MGP was developed by Pacific Analytics Inc. with the objective to assess the financial implications (Cash Flows, Royalties, Income Taxes, Internal Rates of Return, etc.) of the project based on various assumptions regarding gas production over time; construction and development costs; gas prices; tax and royalty rates; and the like. A Base Case scenario was developed using information provided by Imperial Oil (updated in September 2007) and was presented to the Joint Review Panel. The present Financial Model maintains all the assumptions in that Base Case scenario, with the exception that an updated gas price forecast (from the same source used by Imperial Oil in the 2007 Base Case) is used; all other assumptions remain the same.

2. The first scenario assumes that the MGP gas flow remains as a 1.2 bcf/day pipeline over the 45-year production period, but that with the AWR, exploration and development costs for the appropriate wells within the total of 435[8] are reduced by the aforementioned 15 percent.

2. The second scenario assumes that additional compression is added to the MGP enabling a daily capacity to increase from 1.2 bcf/day to1.8 bcf/day (and, consequently, the number of development wells increases from a Base Case 435 wells to 648 wells. As above, the number of affected wells is lower than the total number of wells.[9]

3. A third scenario is one based on a 1.8 bcf/day capacity pipeline but that includes rig savings of approximately $1.22 million per well is also assessed.

Based on these scenarios, there are two effects that the AWR may have on the MGP. The first is the *financial impacts*: the reduction in exploration and well development costs will directly impact company returns, employment, and taxes.[10] The second impact is the *economic impacts,* which relate to the direct, indirect, and induced effects of the reduction in required corporate investment.

2.3.2. Financial Impacts

1.2 bcf/day capacity pipeline

Based on a 1.2 bcf/day capacity pipeline and a 15 percent reduction in overall logistics costs with the AWR, future exploration and well-development costs are reduced by an estimated $1.084 billion ($2009 dollars, discount rate of 5 percent) over the 45-year operating period of the pipeline. As displayed in Table 2, this reduction in investment by the oil and gas sector will result in the following financial impacts:

1. Reduced investment costs will lead directly to greater cash flows. It is estimated that after-tax cash flows going to corporations will increase by $1.08 billion over the 45-year period. This will have the effect of increasing the Internal Rate of Return (IRR) to corporations by roughly 2.0 percent.

2. Total revenues to governments will increase by some $80.5 million ($2009 dollars, discounted at 5 percent) due to the presence of the AWR, although, due to the vagaries of royalty legislation, the Federal Government will increase its revenues by $95.2 million, and the NWT will see its revenues drop by $14.7 million. It is expected that the Federal Government and GNWT will sign a royalty-

[8] Under the Base Case 1.2 bcf/day pipeline, 435 wells are forecast, but some of these, particularly those in the Beaufort Sea, will not be affected by the AWR. The total number of affected wells, then, is estimated at 325.

[9] Gilbert Lausten Jung Associates Ltd. (GLJ) developed the original 1.2 bcf/day production forecast submitted by the proponents of the NEB and Joint Review Panel. GLJ did not, however, provide a 1.8 bcf/day production scenario. For the purposes of this present analysis, we augmented GLJ's 1.2 bcf/day scenario with a 1.8 bcf/day production forecast produced by Sproule Associates. Table 20 includes two scenarios: a Base 1.8 bcf/day scenario, which excludes any AWR impacts, and a 1.8 bcf/day with the AWR. The difference between these two scenarios is the impact of the AWR, given that the AWR is not necessary for an expanded pipeline.

[10] The reduced exploration and well development costs factor into the financial results through a number of avenues. First, reduced costs directly lead to an increase in pre-tax cash flows and consequently the Internal Rate of Return (IRR) since expenses are now lower. Second, royalties increase because the "payout" date (the date at which the development company recovers the cost of field development and the date after which royalties kick in) is achieved earlier, and thus the royalties are larger and the discounted value of the stream of royalties over the 45-year period of production is higher. At the same time, royalties are a corporate tax write-off, and accordingly, despite the increase in cash flows, income taxes actually decline. Nevertheless, the aggregate level of taxes going to governments does increase.

sharing agreement, and therefore it is likely that the AWR will result in an increase in revenues flowing to the GNWT.

TABLE 2: FINANCIAL IMPACTS OF THE AWR ($2009 MILLIONS; DISCOUNT RATE = 5%)

	GLJ Base Case (1.2 Bcf/day)	With AWR (1.2 Bcf/day)	Base Case (1.8 Bcf/day)	With AWR (1.8 Bcf/day)	With AWR (1.8 Bcf/day) and Rig Savings
PRE-TAX CASH FLOWS	**$38,886.1**	**$40,043.1**	**$56,754.8**	**$58,648.6**	**$58,974.5**
Pre-Tax Tax IRR	**28.3%**	**30.2%**	**25.1%**	**27.3%**	**27.6%**
AFTER-TAX CASH FLOWS	**$24,124.3**	**$25,200.9**	**$31,649.8**	**$33,414.4**	**$33,618.5**
After-Tax IRR	**19.2%**	**20.8%**	**17.1%**	**19.0%**	**19.2%**
After-Tax IRR*	**20.6%**	**22.5%**	**17.8%**	**19.9%**	**20.2%**
TAXES	**$25,521.9**	**$25,602.4**	**$35,917.5**	**$36,046.6**	**$36,168.4**
Federal Royalties	$12,101.8	$12,216.9	$18,656.1	$18,838.0	$18,880.7
Field Income Taxes	$8,780.1	$8,745.5	$12,625.8	$12,573.1	$12,652.1
- to Canada	*$5,325.6*	*$5,304.6*	*$7,658.3*	*$7,626.3*	*$7,674.3*
- to NWT & Alb	*$3,454.5*	*$3,440.8*	*$4,967.5*	*$4,946.8*	*$4,977.9*
Pipeline Income Taxes	$4,640.0	$4,640.0	$4,635.6	$4,635.6	$4,635.6
- to Canada	*$2,622.3*	*$2,622.3*	*$2,619.6*	*$2,619.6*	*$2,619.6*
- to the NWT & Alb	*$2,017.7*	*$2,017.7*	*$2,015.9*	*$2,015.9*	*$2,015.9*

Source: MGP Financial Model

1.8 BCF/DAY CAPACITY PIPELINE

Based on a 1.8 bcf/day capacity pipeline and a 15 percent reduction in overall logistics costs with the AWR, future exploration and well development costs are reduced by an estimated $1.950 billion ($2009 dollars, discount rate of 5 percent) over the 45-year operating period of the pipeline, resulting in the following financial impacts:

1. Estimated after-tax cash flows going to corporations will increase by $1.765 billion over the 45-year period. This will have the effect of increasing the Internal Rate of Return (IRR) to corporations by roughly 2.1 percent.

2. Total revenues to governments will increase by $129.1 million over the 1.8 bcf/day pipeline without the AWR, of which $108.4 million will go to the Federal Government and another $20.7 million will accrue to the Government of the NWT. A royalty agreement with the Federal Government would result in even greater revenues flowing to the GNWT.

1.8 BCF/DAY CAPACITY PIPELINE WITH RIG SAVINGS

There is another consequence of building the AWR: without the AWR, drilling equipment (e.g., rigs and material) in the Colville Hills area will be stranded and will have to be stored over the summer period when the land is not suitable for the transport equipment and drill rig. With the AWR, however, drilling equipment could be dismantled and shipped southward where the rigs could be used for summer drilling in Alberta, as noted in the interviews. Accordingly, companies drilling in the Colville Hills area could reduce their MGP costs by using or renting out their equipment in Alberta.

Based on information provided by PROLOG, the rental value of a rig in Alberta is approximately $40,000 per drilling day. Using an average of 15 drilling days a month for a seven-month drilling season in Alberta, the gross rental value of a rig in Alberta would be approximately $4.2 million. The transport costs for moving the rig to/from Alberta are subtracted from this value.

Based on PROLOG's truck cost analysis, the cost for a flatbed truck is estimated at $2.50 per kilometre. Using a rough measure of 2,500 kilometres one-way from the Colville Hills area to northern Alberta, a two-way cost per truck load is $12,500. Adding a loading/off-loading cost of another $1,000 gives an estimated total cost per truckload of $13,500. Using an average of 40 loads per rig, the cost to transport a rig to/from Alberta is approximately $540,000. Consequently, the net rental value that a company drilling in the Colville Hills area could expect for its rig will be $4.2 million - $540,000 = $3.66 million per rig.

Finally, assuming a rig in the Colville Hills area could drill three wells over the (short) winter drilling season, the AWR will reduce average well development costs by $1.22 million. This reduction in the average cost of drilling and developing a well was integrated into the MGP Financial Model.

Comparing a 1.8 bcf/day capacity pipeline using the AWR with a 1.8 bcf/day capacity pipeline using the AWR plus rig savings shows that industry could save $357 million ($2009 dollars, discount rate of 5 percent) over the 45-year operating period of the pipeline by backhauling its rigs Being able to backhaul rigs into Alberta has the following financial effects on savings to industry:

1. Estimated after-tax cash flows going to industry will increase by $204 million over the 45-year period. This will have the effect of increasing the Internal Rate of Return (IRR) to corporations by roughly 0.3 percent.

2. Total revenues to governments will increase by $121.8 million over the 1.8 bcf/day pipeline with the AWR, of which $90.7 million will go to the Federal Government and another $31.1 million will accrue to the Government of NWT. A royalty agreement with the Federal Government would mean even greater revenues flowing to the GNWT.

2.3.3. Economic Impacts

The preceding financial analysis of the MGP provides details of the effects on the royalties and corporate income taxes due to the AWR. However, the economic activity related to the MGP (construction of the pipeline, expenditures on exploration and development, etc.) have their own direct, indirect, and induced effects on the NWT economy just as does activity related to the building of the AWR. However, in this case, because the AWR will reduce the cost of the required MGP infrastructure, the result will be a reduction in overall economic activity, in employment, and in government revenues.

The same three scenarios are examined:

1. the 1.2 bcf/day pipeline with the AWR in place contrasted against the original Base Case 1.2 bcf/day pipeline;

2. the 1.8 bcf/day pipeline with the AWR in place contrasted against an alternative 1.8 bcf/day pipeline; and

3. the 1.8 bcf/day pipeline with the AWR in place including rig savings contrasted against an alternative 1.8 bcf/day pipeline.

1.2 BCF/DAY CAPACITY PIPELINE

Based on a 1.2 bcf/day capacity pipeline, the construction of the AWR affects the MGP by reducing exploration and well development costs by an estimated $1.215 billion (2009 dollars, discount rate of 5 percent) over the 45-year operating period of the pipeline. In economic terms (as opposed to the financial effects on companies discussed earlier), the reduced exploration and well development costs result in less money being spent in the NWT and in the ROC. As displayed in Table 3, this reduction in spending by the oil and gas sector will result in the following:

1. <u>Less buying and selling</u>: A total reduction of $816 million ($18,651.3 – $19,467.3) in GDP over the 45-year period, with the ROC experiencing most of the decline ($518.3 million), and the NWT seeing a $297.7 million decline.[11]

2. <u>Fewer person-years of employment</u>: With less buying and selling it is estimated that over 45 years, there will be 16,589 fewer person-years of employment in NWT with the ROC having 12,702 fewer person-years of employment.

3. <u>Lower government revenues</u>: Governments will forgo $206 million in revenue; but since much of governments' revenues stemming from activity in the NWT actually accrue to the Federal Government, the NWT's portion of the decrease is about $16.2 million over 45 years.

1.8 BCF/DAY CAPACITY PIPELINE

Based on a 1.8 bcf/day pipeline, the reduced exploration and well development costs result in less money being spent in the NWT and in ROC. This reduction in spending by the oil and gas sector will result in the following:

1. <u>Less buying and selling</u>: Less buying and selling in the amount of $1.336 billion ($22,903.5 – $24,239.0) over the 45-year period will result in the NWT accumulating $487.1 million less in GDP.

2. <u>Fewer person-years of employment</u>: With less buying and selling, it is estimated that over 45 years, there will be 24,716 (5,790 in the NWT) fewer person-years of employment.

3. <u>Lower government revenues</u>: With less buying and selling and fewer person-years of employment, government revenues will decline by $337.3 million ($26.5 million in NWT revenues).

[11] Note: Unlike the non-MGP economic impact estimates, the estimates of economic impacts for the rest of Canada <u>do</u> include induced impacts and there is therefore no under-estimation.

Table 3: Economic Impacts of the AWR ($2009 Millions; Discount Rate = 5%)

	GLJ Base Case (1.2 Bcf/day)	With AWR (1.2 Bcf/day)	Base Case (1.8 Bcf/day)	With AWR (1.8 Bcf/day)	With AWR (1.8 Bcf/day) and Rig Savings
TOTAL INVESTMENT	**$27,093.3**	**$25,878.4**	**$34,109.7**	**$32,121.2**	**$31,779.0**
GROSS DOMESTIC PRODUCT (GDP)	**$19,467.3**	**$18,651.3**	**$24,239.0**	**$22,903.5**	**$22,673.6**
Rest of Canada	**$9,911.4**	**$9,393.1**	**$12,818.5**	**$11,970.1**	**$11,824.1**
NWT	**$9,555.9**	**$9,258.2**	**$11,420.5**	**$10,933.4**	**$10,849.5**
LABOUR INCOME	**$9,597.5**	**$9,121.5**	**$12,318.8**	**$11,539.8**	**$11,405.7**
Rest of Canada	**$6,428.0**	**$6,088.2**	**$8,331.4**	**$7,775.4**	**$7,679.7**
NWT	**$3,169.5**	**$3,033.3**	**$3,987.4**	**$3,764.4**	**$3,726.0**
EMPLOYMENT (jobs)	**312,446**	**295,857**	**391,284**	**366,568**	**361,684**
Rest of Canada	**234,030**	**221,328**	**293,969**	**275,045**	**271,305**
NWT	**78,416**	**74,529**	**97,314**	**91,524**	**90,380**
GOVERNMENT REVENUES	**$3,917.0**	**$3,710.9**	**$5,072.7**	**$4,735.4**	**$4,677.3**
Rest of Canada	**$2,694.6**	**$2,556.0**	**$3,476.4**	**$3,249.5**	**$3,210.4**
- Federal	*$1,743.7*	*$1,652.9*	*$2,254.1*	*$2,105.4*	*$2,079.9*
- Provincial	*$950.9*	*$903.1*	*$1,222.3*	*$1,144.0*	*$1,130.5*
NWT	**$1,222.3**	**$1,154.9**	**$1,596.3**	**$1,485.9**	**$1,466.9**
- Federal	*$908.8*	*$857.5*	*$1,191.1*	*$1,107.2*	*$1,092.7*
- Provincial/Territorial	*$313.5*	*$297.3*	*$405.2*	*$378.7*	*$374.2*

1.8 BCF/DAY CAPACITY PIPELINE WITH RIG SAVINGS

Savings on well drilling and development occur because rigs that were previously stranded in the North due to there not being an AWR will now be rentable in Alberta during the summer. These savings result in reduced investment costs (spending) in well exploration and development. Compared with the 1.8 bcf/day scenario that does not include backhauling rigs into Alberta, the result is:

1. Less buying and selling: Less buying and selling to the tune of $229.9 million ($22,673.6 – $22,903.5) over the 45-year period.

2. Fewer person-years of employment: With less buying and selling, it is estimated that over 45 years, there will be 4,884 (1,114 in the NWT) fewer person-years of employment.

3. Lower government revenues: With less buying and selling and fewer person-years of employment, government revenues will decline by $58.1 million, $4.5 million of which will be lost to the GNWT over the 45-year period.

2.3.4. TOTAL ECONOMIC IMPACTS ON THE MGP

Summing the financial impacts and the economic impacts on the MGP of building the AWR, the net or total effect on the Base 1.2 bcf/day pipeline over the 45-year period will improve private sector after-tax cash flows by almost $1.1 billion and the viability (Internal Rate of Return) of the MGP by almost 2 percent, and will decrease total government revenues by an estimated $125 million; however, the net fall in GNWT revenues will be only $30.9 million over the entire 45-year period.

For the Base 1.8 bcf/day pipeline, the net effect of building the AWR will improve private sector cash flows by almost $1.8 billion over the 45-year period and the viability (Internal Rate of Return) of the MGP by 2.1 percent, and will decrease total government revenues by an estimated $208 million. The net fall in GNWT revenues will be $47.2 million.

When rig savings are included, after-tax cash flows are $2.0 billion higher than under the Base 1.8 bcf/day scenario, the corporate IRR is 2.4 percent higher, and net government revenues decrease by $144.5 million ($20.6 million for GNWT revenues).

The conclusion that building the AWR will actually reduce overall government revenues from the MGP project may appear counter-intuitive at first; however, the interpretation is that the AWR is serving to "support" the viability of the MGP by increasing after-tax cash flows and the IRR. Accordingly, while the AWR is not considered a benefit to the initial <u>construction</u> of the MGP, it does have a significant positive impact on its long-term success.

3. Total Economic Impacts

Based on the preceding analysis, it is possible to calculate the total effects of the AWR on the economy of the NWT and ROC. Table 4 highlights the overall summation of the AWR construction and maintenance, the elimination of the winter-road, the effects of a lower cost of living, the additional tourism activity, the financial corporate tax effects on the MGP, and the economic impacts stemming from the MGP with the AWR in place.

Table 4: Total Economic Impact of Building the AWR ($Millions of $2009, discount Rate 5%)

NPV TOTAL IMPACTS Including MGP	MGP 1.2 Bcf/day	MGP 1.8 Bcf/day	MGP 1.8 Bcf /day and Rig Savings
Investment	$1,844.9		
After Tax Cash Flow	$1,076.5	$1,764.6	$1,968.7
Internal Rate of Return (IRR)	1.9%	2.1%	2.3%
Gross Domestic Product (GDP)	$966.1	$446.6	$216.7
Rest of Canada	*$66.6*	*-$263.5*	*-$409.5*
NWT	*$899.5*	*$710.1*	*$626.2*
Labour Income	$674.8	$371.8	$237.7
Rest of Canada	*$7.6*	*-$208.6*	*-$304.3*
NWT	*$667.2*	*$580.4*	*$542.0*
Employment (Person-Years)	1,684	-6,443	-11,327
Rest of Canada	*-5,721*	*-11,943*	*-15,683*
NWT	*7,405*	*5,502*	*4,358*
Government Revenues	$97.7	-$33.5	-$91.6
Rest of Canada Gov'ts	*$33.6*	*-$95.5*	*-$134.6*
NWT Gov't	*$64.0*	*$62.0*	*$43.0*

Depending on which version of the MGP is being considered, the AWR will be of significant benefit to corporate financial viability (possibly increasing after-tax cash flows by $1 – $2 billion) despite the fact we have assumed that the building of the AWR will NOT affect in any material way the initial cost of building the MGP. There is also a substantive increase in GDP for the NWT, although because of the reduced investment costs of exploration and development, GDP in ROC could actually fall. Similarly, the NWT will enjoy a substantive increase in overall employment (person-years of employment), but ROC could experience a decline in employment because the total demand for goods and services is lower with increased trucking productivity.

Depending on the final configuration of the MGP, overall government revenues could increase, but more likely, the building of the AWR will result in a small decrease in government revenues. Nevertheless, the GNWT will experience an increase in its revenues, and this may be expected to be even greater if there is an agreement with the Federal Government for sharing royalties.

The financial and economic effects outlined in this section of the study provide evidence that building the AWR will generate positive economic returns to the economy of the NWT. However, these estimates do not include other important economic effects that could not be quantified, the most important of these being the potential for NWT-based businesses to provide additional supplies and services to the oil and gas sector as a result of the AWR.

Building the AWR will cause a structural change in the economy of the NWT as established patterns of economic activity change. Concurrently, new economic patterns and structures will emerge to take advantage of the lower costs and lower risks provided by the AWR. For example, the AWR could help spread work over a longer period of time where spur roads off the AWR or marine access from the AWR are feasible, thus reducing the cyclical intensity of activity and the associated inflationary pressures (Rod Maier, Chevron Canada, personal communication, June 16, 2009). Additionally, the AWR will allow for the mobilization of more equipment from southern contractors; increase competition among contractors; increase the potential for NWT resident companies to provide goods and services to the oil and gas industry; and reduce costs for industry. In short, new hydrocarbon fields could be developed sooner and more efficiently, with a lower overall cost structure.

The AWR will also provide an alternative to using NTCL, and that will increase logistics competition and likely result in lower logistics costs – particularly if Chevron Canada did not have to front-load the cost of its equipment (rigs, etc.) and could simply truck it into place. Having an AWR will also do away with some of the redundancies in resources and equipment currently barged up because it could be trucked in if needed. Furthermore, having the AWR should allow for certain resources and equipment to be continuously available for use in various parts of the NWT (e.g., staged out of Inuvik), resulting in significant mobilization savings (i.e., not having to move it from Alberta to Inuvik every year). Currently, equipment standby charges are fairly high because rigs and equipment have to be barged into the NWT in the summer and are immobile until after freeze-up when overland access by winter-road is possible. Year-round access will also enable more efficient use of rigs and equipment. Chevron Canada could avoid having to pay stand-by costs for rigs and equipment when they are not in use, as the equipment could be de-mobilized to other projects in the North or western Canada.

As the number of barriers to spending money in the NWT by businesses declines, more money will be spent in the NWT, and this will create employment and increase the NWT's GDP. Ultimately, the AWR should, as Rod Maier explains, lower cost structures and in turn open up the NWT to a greater number of smaller oil and gas companies, and increase oil and gas activity in the NWT.

> *Having an AWR will provide a competitive alternative to NTCL and do away with some of the redundancies in resources and equipment currently barged up because it could be trucked in if needed. Furthermore, having an AWR should allow for certain resources and equipment to be permanently available in the region, e.g., Inuvik resulting in significant mobilization savings, i.e., not having to move it from Alberta to Inuvik every year. Currently, equipment standby charges are fairly high because of having to barge rigs and equipment into the NWT in the summer and not being able to use them until after freeze-up when overland access by winter-road is possible.*
>
> *Year-round access will also provide for more efficient use of rigs and equipment. That is, Chevron Canada could avoid having to pay stand-by costs for the rigs and*

equipment when they are not being used, as the equipment could be de-mobilized to other projects in the north or western Canada.

The top three areas where savings will result from having an AWR are: i) logistics, ii) construction, and iii) drilling and well-servicing. An AWR will provide industry with greater control of its logistics and planning functions and not be limited by third parties such as NTCL, local supplier/contractor availability, and standby costs will be dramatically reduced.

Rod Maier, Manager, Frontier Development, and Doug Connon, Mackenzie Delta Coordinator Chevron Canada Ltd. (personal communication, June 16, 2009).

While a complete analysis of the structural changes to the NWT economy resulting from the AWR is beyond the scope of this study, the results confirm that transportation cost structures in the NWT will be reduced and that residents will enjoy higher standards of living based on their increased purchasing power.

4. TRUCKING VS. BARGING THE MACKENZIE GAS PROJECT

PROLOG completed a series of studies on the impact of the MGP on the northern transportation system and local communities. Much of the data generated in this work form the basis of the economic analysis of trucking vs. barging the MGP. PROLOG worked closely with MGP planners, and its findings were generally verified as consistent with MGP logistics planning.

It is noted that MGP planners in their submissions to the National Energy Board's Joint Review Panel (JRP) assumed that main-line pipeline construction materials for the project route from (and including) Camsell Bend to the Mackenzie Delta anchor fields would be transported by barge to the various spread stockpile sites, all within a mile or two of the river. The MGP plan provides for trucks to service the pipeline south of Camsell Bend.

Appendix C describes the assumptions and limitations of the trucking vs. barging analysis; Appendix D provides the analysis; Appendix E shows what a typical MGP pipe trailer looks like; and Appendix F is a summary of the oil and gas industry interviews.

4.1. METHODOLOGY

The MGP logistics plan, as submitted to the JRP, assumes all commodities will arrive from the South by rail or truck to Hay River or directly to stockpile sites south of Camsell Bend by truck. PROLOG therefore assumes that this plan is common to both the truck and barge options as far north as Hay River/Enterprise for the purposes of this study and that the presence of the AWR down the Mackenzie River will not alter the cost of logistics south of these two points. Included are the volumes of freight required for construction of the three anchor fields, their gathering systems, and initial drilling operations.

4.2. CONCLUSIONS

It is clear from the analysis that oil and gas companies and other industries currently being serviced by barge under tariff rates could benefit directly from the presence of an AWR. On freight rate savings alone, almost $30 million could be accounted as a derived direct economic benefit from the presence of the AWR.

It is highly probable, however, that the MGP will negotiate a time charter arrangement for the fleet it requires over a three-year supply period.

Coopers Barging brings a measure of competition to the Mackenzie watershed. Coopers is a much smaller marine company than NTCL, backed by supply contracts it could lease equipment and manpower – a procedure common in the industry.

Even though NTCL is in the process of changing its business model due to declining traffic on the Mackenzie River, it will clearly not welcome the AWR and will likely be a willing party to the negotiation of charter contracts given that it has substantial barge capacity available at the time of writing.

GRAVEL

The eight or nine million tons of gravel to be mined and transported for pipeline access roads; camp areas; facility construction pads at gas plants and compressor stations; materials stockpile sites; etc. could provide an economic benefit to the MGP if the AWR could be used instead of specially constructed access roads otherwise required by the project.

A study is necessary to provide the associated economic benefits generated by the AWR. This should commence with a geotechnical survey (if one does not exist already) to identify the size and nature of all borrow pit locations adjacent to the AWR, and then distances from the granular sources to the required use points. The type and nature of the terrain that the access roads are constructed on have to be documented in order to produce a meaningful haul road construction estimate.

The MGP has validated or will be validating all known and existing borrow source sites adjacent to the river, and will be investigating new sites. Approximately 140 locations have been proven to date, with 60 or 70 expected to be used. Five or six will be major quarry operations with crushing equipment. Three of these are near Inuvik and others are near Norman Wells, Tulita (Fort Norman), and Little Chicago.

The Mackenzie Valley and adjacent area is a combination of permafrost, discontinuous permafrost, and muskeg. Large amounts of gravel will be required to construct roads through muskeg areas (assuming year-round operations) with sufficient strength to support the 12-cubic-metre (24-ton) capacity gravel trucks required.

If the average haul distance is 15 km and 60 pits are to be used by the MGP, and *if* it is assumed that one half of these could be facilitated by the AWR rather than new single-purpose haul roads planned by the MGP, a (very approximate) benefit of $200 million could be available using a (very rough) $500,000 per km capital cost estimate for the haul road.

Estimates for Seasonal Overland Roads (SOR) in the NWT– which are wider than haul roads and designed to handle higher operating speeds –are estimated to cost $800,000 – $1.2 million per km to construct. Haul roads are typically narrow, follow terrain contours, and feature relatively low-speed trucking operations, yet must support the very heavy gravel truck axle weights.

5. Core Glossary

Direct Impacts: equivalent to the level of direct value-added (or GDP) generated by an industry.

Gross Domestic Product (GDP or Value-Added): a measure of the total flow of goods and services produced by the economy and used for final domestic consumption, investment, and export (e.g., excluding immediate consumption). GDP can be calculated in three different ways, all of which yield the same results. The first method, applied in this report, estimates the value of net output of all industries minus the value of net material inputs used for immediate production (excluding indirect taxes). The second method sums the values of Wages and Salaries, Supplementary Labour Income (Benefits), Operating Surplus (Profits plus Depreciation plus Interest on Long-Term Debt), and Indirect Taxes for all industries. The third method sums the values for personal consumption, government expenditures, investment (including changes to inventories), and net exports. In addition to total GDP for the economy, GDP is also estimated for individual industrial sectors.

Indirect Impacts: the impacts resulting from the expenses (goods and services) of a firm or industry used in the production process. The purchase of goods or services increases the economic activity of the supplying firms and, in turn, the supplying firms themselves must purchase their own goods and services, which generates further economic activity in those supplying firms.

Induced Impacts: the impacts resulting from the wages and salaries paid by a firm or industry. When the wages and salaries are spent (minus taxes and savings) on goods and services, the economic activity of the firms supplying those goods and services increases. As well, the supplying firms themselves will pay additional wages and salaries to their own employees, which, when spent, generate more economic activity.

Input-Output Model: comprised of three tables or matrices: a **Make** matrix, a **Use** matrix, and a **Final Demand** matrix. The Make matrix lists all the different outputs produced by each industry. The Use matrix lists all the different purchases (material inputs) by each industry used in the production process as well as itemizing all taxes (explicit and implicit) paid by the industry (GST is not a company-level tax; rather, it is a tax paid by final consumers but channelled through the company). The Final Demand matrix lists all the various purchases by persons (including GST), by government, by industries for investment purposes, plus all net exports (exports minus imports) of each commodity (good or service). Mathematically re-arranging the tables enables one to determine how much additional production will be generated in the economy from an increase in demand for a commodity or series of commodities.

Intermediate Demand (or Material Inputs): a measure of all material inputs (goods and services) used in the production process excluding wages and benefits.

Internal Rate of Return (IRR): discount rate at which the present value of the future cash flows of an investment equals the cost of the investment. When the IRR is greater than the required return – called hurdle rate in capital budgeting – the investment is acceptable. The internal rate of return is the average rate earned by each and every dollar invested during the period. This rate is influenced by the timing and size of the cash inflows and outflows and the beginning and ending depreciated book or market value of the investment.

Payout Date: the date at which gas project revenues exceed project costs (capital investment and operating costs) and after which standard royalties apply.

Person-Year (PY) Employment: the total level of employment in a firm or industry when part-time positions are counted as a fraction of full-time positions. For example, four half-time positions equal two person-years of work.

Producer Prices: the value of a commodity (good or service) at the factory gate. It excludes all indirect taxes as well as wholesale, retail, and transportation costs (called "margins") associated with the final selling (purchaser) price.

Purchaser Prices: the price of a commodity (good or service) actually invoiced to the purchaser. It includes the factory-gate cost of the commodity plus any additional costs associated with indirect taxes, wholesale and retail margins, and costs associated with transporting the commodity from the factory gate to the final purchaser.

Royalty: a percentage interest in the value of production from a lease that is retained and paid to the mineral rights owner, in this case the Federal Government.

SWOT: abbreviation for Strengths, Weaknesses, Opportunities, and Threats.

Sunk Costs: costs incurred in the past and unaffected by any future action and thus irrelevant to decision-making. In economics and in business decision-making, sunk costs are costs that have already been incurred and that cannot be recovered to any significant degree. Sunk costs are sometimes contrasted with incremental costs, which are the costs that will change due to the proposed course of action. In microeconomic theory, only incremental costs are relevant to a decision. If sunk costs were to influence a decision, a proposal would not be assessed exclusively on its own merits. Note that sunk costs are still relevant for determining income taxes as they remain available for write-offs.

Value-Added: a term that is identical to GDP in concept, but that refers to a particular business or occasionally an industry sub-sector.

APPENDIX A-ECONOMIC IMPACT DETAILS

ECONOMIC IMPACTS OF AWR CONSTRUCTION

The estimate of total construction costs for the Mackenzie Valley All-Weather Road was supplied by the NWT Department of Transportation (DOT) based on updated costs as of October 2008.

TABLE A1: ALL-WEATHER ROAD CONSTRUCTION COSTS

	DOT Estimate (October 2008, $CDN)		
Mobilization 12 sites @ 6 years	84.0	$1,000,000	$84,000,000
Site clearing	5,920.0	$9,500	$56,240,000
Excavation - common	15,060,000.0	$16	$233,430,000
Excavation - rock	862,500.0	$36	$31,395,000
Excavate - fill	11,580,000.0	$8	$94,956,000
Excavate - waste	3,712,450.0	$7	$24,502,170
Channel excavation	9,960.0	$35	$348,600
Embankment construction	11,580,000.0	$29	$331,188,000
Sub-grade preparation	9,648,000.0	$4	$33,768,000
Load/haul and compact 50mm minus crushed granular	3,180,000.0	$23	$71,550,000
Excavate - gravel (100% crush, 60% blast)	3,180,000.0	$28	$89,835,000
Rip-rap	39,970.0	$20	$799,400
Ditch lining load, haul and place	21,010.0	$45	$945,450
Snow/ice removal	13,565.0	$0	$0
Supply and install CSP culverts	56,770.0	$1,875	$106,443,750
Supply and install CSPP culverts	9,396.0	$11,120	$104,483,520
Road sub-total			**$1,263,884,890**
Per km	**965.0**		**$1,309,725**
Install temporary bridges	13.0	$500,000	$6,500,000
Install short-span bridges	12.0	$2,000,000	$24,000,000
Large bridge - Great Bear			$57,500,000
Large bridge – Blackwater			$23,000,000
Large bridge - Hare River			$23,000,000
Bridge at Tieda Creek			$12,000,000
Bridge at Loon River			$12,000,000
Bridge at Shae Creek			$10,000,000
Bridge at Thunder River			$16,000,000
Bridge at Travailant River			$16,000,000
Bridge at Rengleng River			$23,000,000
Bridge sub-total			**$223,000,000**
Per km	**965.0**		**$231,088**
		Engineering @12%	**$178,426,187**
		TOTAL	**$1,665,311,077**

Source: NWT Department of Transportation

Table A1 highlights the construction estimates for the AWR including both road and bridge requirements. The total cost, with the additional costs for engineering design, comes to approximately $1.67 billion, of which $1.3 billion is for road building, $223 million is for bridge construction, and $178 million is for engineering. It should be noted, however, that final engineering specifications for the AWR are still way in the future; therefore, the estimate used in this study must be treated as preliminary and may be subject to significant changes as the road design is finalised.

The total length of the road is 965 kms, of which 820 kms is for the Wrigley to Dempster Highway portion and 145 kms is for the Inuvik to Tuktoyaktuk portion of the road. According to the NWT DOT, the road construction costs per kilometre are roughly the same over the two portions: accordingly, the Wrigley to Dempster road-construction costs are estimated at $1.1 billion vs. $190 million for the Inuvik to Tuktoyaktuk portion. Bridge costs apply only to the Wrigley to Dempster portion, while the engineering costs are allocated by the number of kilometres.

The final allocation of costs across the two road portions are highlighted in Table A2 below.

TABLE A 2: AWR TOTAL CONSTRUCTION COSTS BY ROAD PORTION

	Kms	Road Cost	Bridge Cost	Engineering Cost	Total Cost
TOTAL AWR COST	965	$1,263,884,890	$223,000,000	$178,426,187	**$1,665,311,077**
Wrigley to Dempster	820	$1,073,974,725	$223,000,000	$151,616,034	**$1,448,590,760**
Inuvik to Tuktoyaktuk	145	$189,910,165	$0	$26,810,152	**$216,720,317**

Source: NWT Department of Transportation

The economic effects flowing from this construction investment have been calculated using the NWT Input-Output Tables developed by Statistics Canada. Three measures of economic effects are calculated. The first is the ***direct impacts***, which refer to the contribution to the economy made from the actual AWR construction activities. Over-and-above these effects are the ***indirect impacts***, which refer to the additional economic activity generated as the result of the purchase of material inputs. That is, when the construction industry purchases goods and services (such as gravel, diesel, or trucking services), those industries themselves generate activity in the economy through their own purchase of goods and services (e.g., the trucking industry will have to purchase greater quantities of diesel fuel). On top of that, there are the ***induced impacts*** that are created when the wages and salaries paid by the construction industry and (say) the trucking industry are re-spent in the economy, generating economic activity in the retail sector, perhaps the restaurant sector, and the like.

The estimation of the economic effects of the construction of the AWR has been undertaken separately for each portion of the highway. The Wrigley to Dempster Highway portion of the AWR has an investment definitionally equal to 'Output') of $1.449 billion.

As displayed in Table A3, this investment results in an increase in NWT GDP of $525 and will generate direct employment of 4,230 person-years of employment over the entire construction period. The estimated wages stemming from this investment will be approximately $408 million. The revenues accruing to governments will reach roughly $113 million, of which $71 million will go to the Federal Government and of which $41 million will go to the GNWT. These government revenues are the result of increases in indirect taxes (e.g., fuel taxes) and personal income taxes.

TABLE A 3: ECONOMIC IMPACTS OF WRIGLEY TO DEMPSTER HIGHWAY AWR CONSTRUCTION[12]

AWR: Wrigley to Dempster Highway	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$1,448,590,760	$334,365,810	$305,058,795	**$2,088,015,365**	$988,361,167
Material Inputs	$876,654,152	$179,993,350	$202,253,980	**$1,258,901,482**	$525,656,327
GDP	$571,936,608	$154,372,460	$102,804,816	**$829,113,884**	$462,704,840
Employment (FTE)	4,230.1	1,615.7	832.8	**6,678.6**	5,474.1
Wages & Salaries	$380,078,220	$88,780,347	$56,222,046	**$525,080,613**	$243,945,854
Benefits	$27,790,924	$6,600,005	$4,179,597	**$38,570,526**	$29,841,424
Total Gov't Revenues	$112,899,865	$23,483,438	$25,818,680	**$162,201,983**	$58,065,970
Federal	$71,486,264	$13,276,481	$10,804,310	**$95,567,055**	$32,403,980
Net Indirect Taxes	*$8,766,600*	*$1,726,713*	*$2,549,743*	***$13,043,056***	*$4,105,380*
Personal Income Taxes	*$62,719,664*	*$11,549,768*	*$8,254,567*	***$82,523,999***	*$28,298,600*
NWT/Provincial	$41,413,601	$10,206,957	$15,014,370	**$66,634,928**	$25,661,990
Net Indirect Taxes	*$10,604,849*	*$5,319,267*	*$11,218,870*	***$27,142,986***	*$14,531,210*
Personal Income Taxes	*$30,808,752*	*$4,887,690*	*$3,795,500*	***$39,491,942***	*$11,130,780*

Source: NWT Input-Output Model

The $877 million in purchases of material input (ranging from gravel to diesel fuel to trucking services, but excluding any direct wage payments) have an ***indirect impact*** on the NWT economy. Once all imports are removed (since imports have almost no impact on local economies), the additional spending in the NWT economy is estimated at $334 million (Output), which results in an indirect increase in GDP of $154 million, additional employment of 1,616 jobs, and $23 million in government revenues ($13 million to the Federal Government and $11 million accruing to the GNWT).

As mentioned earlier, the additional wages and salaries paid to workers less taxes and savings result in additional spending on consumer goods and services. These ***induced impacts*** generate $103 million in GDP, 833 additional jobs, and total government revenues of $26 million ($11 million to the Federal Government and $15 million to the GNWT). The total impacts on the NWT economy stemming from the original investment of $1.449 billion for the Wrigley to Dempster Highway portion of the AWR is an increase in GDP of $829 million, an addition of 6,679 full-time equivalent jobs, and an increase in government revenues of $162 million (of which the GNWT will receive $67 million).

Impacts on ROC have also been calculated using Statistic Canada's Inter-Provincial I/O Impact tables (excluding any induced impacts, as Statistics Canada does not measure induced impacts). ROC GDP will increase by some $526 million as a result on the Wrigley to Dempster AWR construction, generating 5,474 direct and indirect jobs, and resulting in over $58 million in government revenues.

The economic effects stemming from the Inuvik to Tuktoyaktuk portion of the AWR construction are smaller, based on an estimated investment of $217 million for that portion of the AWR. As displayed in Table A4, the direct impact on GDP is estimated at $86 million, the number of jobs at 633, and government

[12] Definitions are as follows. Output: investment and/or construction costs; Material Inputs: the cost of all material expenses excluding wages and benefits; GDP (or Gross Domestic Product): equal to Output minus Material Inputs, alternatively, equal to the sum of wages and benefits, depreciation, interest costs, and profits; Employment: equals jobs but may differ slightly from full-time depending on industry; Wages and Salaries: wages excluding benefits (e.g. holiday pay, extended health, pension); Benefits: includes holiday pay, extended health, pension, etc.; Indirect Taxes: includes gasoline taxes, federal excise taxes and duties, air transport taxes, lottery and liquor taxes, etc.; Personal Income Taxes: taxes assessed on wages and benefits.

revenues at $18 million. Indirect impacts reach $25 million in GDP, generating 268 jobs and $4 million in government revenues. Induced impacts are estimated at $16 million, 128 jobs, and $4 million in additional government revenues. Overall, therefore, the total contribution to NWT GDP from the Inuvik to Tuktoyaktuk construction is estimated at $127 million with 1,029 jobs being created, and governments receiving $25 million in additional revenues (of which the GNWT will receive $11 million). The direct and indirect impacts on ROC are $69 million in GDP, 807 jobs, and $8.5 million in government revenues.

TABLE A 4: ECONOMIC IMPACTS OF INUVIK TO TUKTOYAKTUK AWR CONSTRUCTION

AWR: Inuvik to Tuktoyaktuk	NWT				REST OF CANADA
	Direct	**Indirect**	**Induced**	**TOTAL**	**Dir. + Indir.**
Output	$216,720,320	$52,958,145	$46,964,906	**$316,643,371**	$148,005,474
Material Inputs	$130,295,520	$27,961,349	$31,137,740	**$189,394,609**	$79,462,567
GDP	$86,424,797	$24,996,796	$15,827,175	**$127,248,768**	$68,542,907
Employment (FTE)	632.7	267.7	128.2	**1,028.6**	807.5
Wages & Salaries	$57,929,157	$14,247,555	$8,668,571	**$80,845,283**	$35,543,190
Benefits	$4,077,825	$1,036,253	$630,481	**$5,744,559**	$4,381,687
Total Gov't Revenues	$17,648,080	$3,790,336	$3,979,508	**$25,417,924**	$8,536,550
Federal	$11,137,439	$2,112,526	$1,666,253	**$14,916,218**	$4,729,440
Net Indirect Taxes	*$1,518,915*	*$300,442*	*$392,577*	***$2,211,934***	*$621,300*
Personal Income Taxes	*$9,618,524*	*$1,812,084*	*$1,273,676*	***$12,704,284***	*$4,108,140*
NWT/Provincial	$6,510,641	$1,677,810	$2,313,255	**$10,501,706**	$3,807,110
Net Indirect Taxes	*$1,770,894*	*$924,281*	*$1,727,340*	***$4,422,515***	*$2,191,240*
Personal Income Taxes	*$4,739,747*	*$753,529*	*$585,915*	***$6,079,191***	*$1,615,870*

Source: NWT Input-Output Model

ANNUAL MAINTENANCE COSTS OF THE AWR

Once the AWR is completed, it will be necessary to provide an annual budget for its maintenance. Again, the NWT DOT provided estimates of these maintenance costs, apportioned for the Wrigley to Dempster Highway portion and the Inuvik to Tuktoyaktuk portion of the AWR by the number of kilometres.

Table A5 and Table A6 highlight the estimated annual economic effects associated with the maintenance budget for each portion of the AWR. Total economic impacts are estimated at $8 million and $1.5 million in GDP, for a total maintenance impact on GDP of $10 million. The employment effects are estimated at 109 and 19 jobs for a total of 128 total jobs associated with maintenance, and $1.3 million and $230,000 in government revenues for a total of $1.5 million from all maintenance activities. ROC impacts are respectively $2 million and $366,000 in GDP, 28 and five direct and indirect jobs, and $260,000 and $47,000 in government revenues.

TABLE A 5: ANNUAL ECONOMIC IMPACTS OF WRIGLEY TO DEMPSTER HIGHWAY AWR MAINTENANCE

AWR Maint. Wrigley to Dempster Hwy.	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$11,070,000	$3,218,983	$3,226,481	**$17,515,464**	$4,030,340
Material Inputs	$5,373,518	$1,562,535	$2,139,160	**$9,075,213**	$1,955,489
GDP	$5,696,482	$1,656,448	$1,087,324	**$8,440,254**	$2,074,852
Employment (FTE)	77.2	22.4	8.8	**108.4**	28.0
Wages & Salaries	$3,511,764	$1,021,166	$588,349	**$5,121,279**	$1,138,057
Benefits	$301,392	$87,640	$50,494	**$439,526**	$138,187
Total Gov't Revenues	$893,558	$259,834	$259,587	**$1,412,979**	$263,210
Federal	$466,425	$135,630	$110,790	**$712,845**	$145,170
Net Indirect Taxes	*$56,599*	*$16,458*	*$24,868*	***$97,925***	*$16,820*
Personal Income Taxes	*$409,826*	*$119,172*	*$85,922*	***$614,920***	*$128,350*
NWT/Provincial	$427,133	$124,204	$148,797	**$700,134**	$118,040
Net Indirect Taxes	*$265,935*	*$77,330*	*$109,421*	***$452,686***	*$67,550*
Personal Income Taxes	*$161,198*	*$46,874*	*$39,376*	***$247,448***	*$50,490*

Source: NWT Input-Output Model

TABLE A 6: ANNUAL ECONOMIC IMPACTS OF INUVIK TO TUKTOYAKTUK AWR MAINTENANCE

AWR Maint. Inuvik to Tuktoyaktuk	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$1,957,500	$569,210	$570,537	**$3,097,247**	$712,682
Material Inputs	$950,195	$276,302	$378,270	**$1,604,767**	$345,788
GDP	$1,007,305	$292,908	$192,272	**$1,492,485**	$366,895
Employment (FTE)	13.6	4.0	1.6	**19.2**	4.9
Wages & Salaries	$620,983	$180,572	$104,037	**$905,592**	$201,242
Benefits	$53,295	$15,497	$8,930	**$77,722**	$24,435
Total Gov't Revenues	$158,006	$45,946	$45,903	**$249,855**	$46,550
Federal	$82,477	$23,983	$19,591	**$126,051**	$25,680
Net Indirect Taxes	*$10,008*	*$2,910*	*$4,397*	***$17,315***	*$2,980*
Personal Income Taxes	*$72,469*	*$21,073*	*$15,194*	***$108,736***	*$22,700*
NWT/Provincial	$75,529	$21,963	$26,312	**$123,804**	$20,870
Net Indirect Taxes	*$47,025*	*$13,674*	*$19,349*	***$80,048***	*$11,940*
Personal Income Taxes	*$28,504*	*$8,289*	*$6,963*	***$43,756***	*$8,930*

Source: NWT Input-Output Model

Unlike the economic effects of the AWR construction phase, which are one-time impacts, these maintenance effects are annual impacts and will therefore continue to impact the economy year after year. In order to convert these annual impacts into a single impact value, the standard treatment is to convert the profile of annual impacts (in this case, over the 45-year life of the AWR) into a discounted value (discounted at a 5 percent discount rate).

Table A7 and Table A8 each displays the same information as Table A5 and Table A6, except the data are in the form of a Net Present Value (NPV) over a 45-year period (discounted at 5 percent). Over this period, the (discounted) increase in GDP due to maintenance activities are estimated at $150 million (Wrigley to Dempster) and $27 million (for the Inuvik to Tuktoyaktuk portion) for a total of $177 million in GDP. The NPVs of government revenues are estimated at $25 million and $4 million for a total maintenance NPV impact in government revenues of $29 million. Note: the concept of NPV employment is not valid and therefore no estimate is provided.

Table A 7: NPV of Maintenance Impacts for Wrigley to Dempster Highway Portion

NVP Wrigley to Dempster Maint.	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$196,759,000	$57,214,000	$57,348,000	**$311,321,000**	**$71,635,533**
Material Inputs	$95,509,000	$27,773,000	$38,021,000	**$161,303,000**	**$34,756,890**
GDP	$101,250,000	$29,442,000	$19,326,000	**$150,018,000**	**$36,878,643**
Employment (FTE)	0	0	0		**0**
Wages & Salaries	$62,418,000	$18,150,000	$10,457,000	**$91,026,000**	**$20,227,917**
Benefits	$5,357,000	$1,558,000	$897,000	**$7,812,000**	**$2,456,090**
Total Gov't Revenues	$15,882,000	$4,618,000	$4,614,000	**$25,114,000**	**$4,678,241**
Federal	$8,290,000	$2,411,000	$1,969,000	**$12,670,000**	**$2,580,230**
Net Indirect Taxes	$1,006,000	$293,000	$442,000	***$1,741,000***	***$299,041***
Personal Income Taxes	*$7,285,000*	*$2,118,000*	*$1,527,000*	***$10,930,000***	***$2,281,379***
NWT	$7,592,000	$2,208,000	$2,645,000	**$12,444,000**	**$2,098,012**
Net Indirect Taxes	*$4,727,000*	*$1,374,000*	*$1,945,000*	***$8,046,000***	***$1,200,628***
Personal Income Taxes	*$2,865,000*	*$833,000*	*$700,000*	***$4,398,000***	***$897,381***

Source: NWT Input-Output Model

Table A 8: NPV Maintenance Impacts for Inuvik to Tuktoyaktuk Portion

NVP Inuvik to Tuktoyaktuk Maint.	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$34,793,000	$10,117,000	$10,141,000	**$55,051,000**	$12,667,335
Material Inputs	$16,889,000	$4,911,000	$6,723,000	**$28,523,000**	$6,146,001
GDP	$17,904,000	$5,206,000	$3,418,000	**$26,528,000**	$6,521,324
Employment (FTE)	0	0	0		0
Wages & Salaries	$11,037,000	$3,209,000	$1,849,000	**$16,096,000**	$3,576,874
Benefits	$947,000	$275,000	$159,000	**$1,381,000**	$434,181
Total Gov't Revenues	$2,808,000	$817,000	$816,000	**$4,441,000**	$827,394
Federal	$1,466,000	$426,000	$348,000	**$2,240,000**	$456,349
Net Indirect Taxes	*$178,000*	*$52,000*	*$78,000*	***$308,000***	$53,008
Personal Income Taxes	*$1,288,000*	*$375,000*	*$270,000*	***$1,933,000***	*$403,538*
NWT	$1,343,000	$390,000	$468,000	**$2,201,000**	$371,029
Net Indirect Taxes	*$836,000*	*$243,000*	*$344,000*	***$1,423,000***	*$212,255*
Personal Income Taxes	*$507,000*	*$147,000*	*$124,000*	***$778,000***	*$158,779*

Source: NWT Input-Output Model

Elimination of Temporary Winter-Road Requirements

The building of the AWR will have an additional impact on the economy. Once the AWR is in place, there will be no need for the temporary winter-road to be built. This will result in annual savings to the GNWT, but it also means that the associated annual purchases of goods and services and hiring of labour will be eliminated, thereby reducing economic activity in the NWT.

Table A9 below highlight this reduction in economic activity for the Wrigley to Fort Good Hope portion of the Winter Road. With a direct reduction in investment of approximately $1.3 million for the Wrigley to Fort Good Hope portion of the winter-road, the total associated negative annual economic impact on GDP is estimated at $763,000, six jobs, and $152,000 in government revenues, of which the Federal Government will experience a reduction of $89,000 in revenues and the GNWT will incur a reduction of $63,000 in tax revenues. Again, in order to convert these annual effects into a representative total value, an NPV value of impacts needs to be calculated using a discount rate of 5 percent over the 45-year life of the AWR. These NPV data are displayed in Table A11..

TABLE A 9: REDUCTION IN ECONOMIC IMPACTS FROM WRIGLEY TO FORT GOOD HOPE WINTER-ROAD

Winter: Wrigley to Fort Good Hope	NWT				REST OF CANADA
	Direct	**Indirect**	**Induced**	**TOTAL**	**Dir. + Indir.**
Output	$1,285,000	$318,358	$281,826	**$1,885,184**	$866,274
Material Inputs	$768,224	$167,843	$186,850	**$1,122,917**	$464,681
GDP	$516,776	$150,515	$94,977	**$762,268**	$401,593
Employment (FTE)	3.8	1.6	0.8	**6.2**	4.7
Wages & Salaries	$346,670	$86,196	$51,996	**$484,862**	$208,586
Benefits	$25,589	$6,311	$3,806	**$35,706**	$25,703
Total Gov't Revenues	$105,084	$22,873	$23,867	**$151,824**	$50,040
Federal	$66,329	$12,765	$9,993	**$89,087**	$27,730
Net Indirect Taxes	*$8,847*	*$1,805*	*$2,354*	***$13,006***	*$3,630*
Personal Income Taxes	*$57,482*	*$10,960*	*$7,639*	***$76,081***	*$24,100*
NWT/Provincial	$38,755	$10,108	$13,874	**$62,737**	$22,310
Net Indirect Taxes	*$10,449*	*$5,552*	*$10,360*	***$26,361***	*$12,830*
Personal Income Taxes	*$28,306*	*$4,556*	*$3,514*	***$36,376***	*$9,480*

Source: NWT Input-Output Model

The equivalent economic effects stemming from the Inuvik to Tuktoyaktuk portion of the winter-road are displayed in Table A10. With savings to government of $129,000 each year (equal to Output – what the cost of the winter-road will be without the AWR), this results in a reduction in economic activity of $73,000 in GDP, the loss of 0.6 full-time equivalent jobs, and a reduction in government revenues of approximately $15,000. The equivalent NPV values for this portion of the winter-road are displayed in Table A12.

Table A 10: Reduction in Economic Impacts from Inuvik to Tuktoyaktuk Winter-Road

Winter: Inuvik to Tuktoyaktuk	NWT				REST OF CANADA
	Direct	**Indirect**	**Induced**	**TOTAL**	**Dir. + Indir.**
Output	$128,650	$29,988	$26,758	**$185,396**	$91,619
Material Inputs	$78,790	$15,916	$17,740	**$112,446**	$49,326
GDP	$49,860	$14,073	$9,018	**$72,951**	$42,293
Employment (FTE)	0.4	0.1	0.1	**0.6**	0.5
Wages & Salaries	$33,326	$7,886	$4,947	**$46,159**	$21,818
Benefits	$1,951	$560	$351	**$2,862**	$2,693
Total Gov't Revenues	$10,329	$2,119	$2,273	**$14,721**	$5,260
Federal	$6,514	$1,175	$952	**$8,641**	$2,920
Net Indirect Taxes	*$954*	*$170*	*$224*	***$1,348***	*$390*
Personal Income Taxes	*$5,560*	*$1,005*	*$728*	***$7,293***	*$2,530*
NWT/Provincial	$3,815	$944	$1,321	**$6,080**	$2,340
Net Indirect Taxes	*$1,068*	*$525*	*$986*	***$2,579***	*$1,350*
Personal Income Taxes	*$2,747*	*$419*	*$335*	***$3,501***	*$990*

Source: NWT Input-Output Model

Note: The value of $0 in some cells does NOT indicate there is no impact; rather, impact is less than $500 and therefore is rounded downward to $0.

Table A 11 NPV Impacts for the Wrigley to Fort Good Hope Portion of the Winter-Road

NVP Winter: Wrigley to Fort Good Hope	NWT				REST OF CANADA
	Direct	**Indirect**	**Induced**	**TOTAL**	**Dir. + Indir.**
Output	$22,839,000	$5,658,000	$5,009,000	**$33,507,000**	$15,397,030
Material Inputs	$13,655,000	$2,983,000	$3,321,000	**$19,959,000**	$8,259,357
GDP	$9,185,000	$2,675,000	$1,688,000	**$13,549,000**	$7,138,142
Employment (FTE)					
Wages & Salaries	$6,162,000	$1,532,000	$924,000	**$8,618,000**	$3,707,431
Benefits	$455,000	$112,000	$68,000	**$635,000**	$457,107
Total Gov't Revenues	$1,868,000	$407,000	$424,000	**$2,699,000**	$889,569
Federal	$1,179,000	$227,000	$178,000	**$1,583,000**	$492,738
Net Indirect Taxes	$157,000	$32,000	$42,000	***$231,000***	$64,473
Personal Income Taxes	*$1,021,000*	*$195,000*	*$136,000*	***$1,352,000***	*$428,270*
NWT	$689,000	$180,000	$247,000	**$1,115,000**	$396,507
Net Indirect Taxes	*$186,000*	*$99,000*	*$184,000*	***$469,000***	*$228,264*
Personal Income Taxes	*$503,000*	*$81,000*	*$63,000*	***$647,000***	*$168,616*

Source: NWT Input-Output Model

TABLE A 12: NPV IMPACTS FOR THE INUVIK TO TUKTOYAKTUK PORTION OF THE WINTER-ROAD

NPV Winter: Inuvik to Tuktoyaktuk	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$2,207,000	$515,000	$459,000	**$3,181,000**	$1,571,982
Material Inputs	$1,352,000	$273,000	$304,000	**$1,929,000**	$846,187
GDP	$856,000	$242,000	$155,000	**$1,252,000**	$725,833
Employment (FTE)					
Wages & Salaries	$572,000	$135,000	$85,000	**$792,000**	$374,360
Benefits	$33,000	$10,000	$6,000	**$49,000**	$46,113
Total Gov't Revenues	$178,000	$36,000	$39,000	**$253,000**	$90,400
Federal	$112,000	$20,000	$16,000	**$148,000**	$50,013
Net Indirect Taxes	*$16,000*	*$3,000*	*$4,000*	***$23,000***	$6,654
Personal Income Taxes	*$95,000*	*$17,000*	*$12,000*	***$125,000***	*$43,363*
NWT	$65,000	$16,000	$23,000	**$104,000**	$40,026
Net Indirect Taxes	*$18,000*	*$9,000*	*$17,000*	***$44,000***	*$23,032*
Personal Income Taxes	*$47,000*	*$7,000*	*$6,000*	***$60,000***	*$16,967*

Source: NWT Input-Output Model

CONSUMER SURPLUS IMPACTS

One of the major rationales behind the building of the AWR is the belief that with the construction of the AWR, freight costs northward to Inuvik and Tuktoyaktuk will decrease and will result in lower prices for goods trucked into the various northern communities. Lower prices will mean that consumers, after buying the same basket of goods and services, will enjoy a "surplus" that will be available to be spent on additional goods and services. The "surplus", by definition, will be equal to the savings in freight rates.[13]

TABLE A 13: ECONOMIC IMPACTS DUE TO INCREASE IN CONSUMER SURPLUS

Consumer Surplus	NWT				REST OF CANADA
	Direct	**Indirect**	**Induced**	**TOTAL**	**Dir. + Indir.**
Output	$15,687,700	$1,109,503	$1,748,382	**$18,545,585**	$1,597,562
Material Inputs	$1,930,207	$526,503	$1,159,180	**$3,615,890**	$829,360
GDP	$4,288,410	$583,000	$589,204	**$5,460,614**	$768,202
Employment (FTE)	30.0	6.3	4.8	**41.1**	11.2
Wages & Salaries	$2,352,988	$298,938	$323,447	**$2,975,373**	$434,380
Benefits	$82,266	$21,007	$22,732	**$126,005**	$49,377
Total Gov't Revenues	$874,983	$85,134	$147,502	**$1,107,619**	$87,880
Federal	$428,239	$43,854	$62,027	**$534,120**	$48,300
Net Indirect Taxes	*$58,933*	*$8,613*	*$14,448*	***$81,994***	*$190*
Personal Income Taxes	*$369,306*	*$35,241*	*$47,579*	***$452,126***	*$48,110*
NWT/Provincial	$446,744	$41,280	$85,475	**$573,499**	$39,580
Net Indirect Taxes	*$270,145*	*$27,419*	*$63,572*	***$361,136***	*$20,660*
Personal Income Taxes	*$176,599*	*$13,861*	*$21,903*	***$212,363***	*$18,920*

Source: NWT Input-Output Model

[13] The reduction in prices for consumer goods will flow both partly to local individuals resulting in a "surplus" available to be spent. For local businesses purchasing (lower-priced) goods, the assumption is that lower input costs to businesses will lower business prices rather than increase profits. These lower business prices then flow to consumers resulting in an additional "surplus".

While the reduction in freight rates will increase the purchasing power of individuals in northern communities and therefore improve standards of living, the purchase of these additional goods and services will also have spin-off (indirect and induced) effects on the rest of the NWT economy.

As described earlier in this study, the savings in freight rates (which will flow into reduced prices) have been estimated by taking the number of freight-carrying vehicles travelling to the northern parts of the NWT and multiplying the number of freight-carrying vehicles, the estimated savings per truck. With the number of commercial trucks travelling to the north of the NWT estimated at 5,110 and the savings per truckload due to the AWR estimated at $3,070, the annual saving in freight is estimated at roughly $16 million.

Table A13 highlights the direct, indirect, and induced effects that this $15.7 million in annual freight savings will generate. While the actual increase in spending is estimated at $15.7 million, many of these goods and services will be imported from outside the NWT, resulting in much lower impacts on the NWT economy. Overall, the savings in freight rates will increase GDP by $5.5 million, generate 41 jobs, and contribute roughly $1.1 million to government coffers (of which $577,000 will accrue to the GNWT).

In addition to changes in freight rates with the building of the AWR, it is expected that most of the Food Mail programme will not be required, and that necessary food will be transported by truck. As a result, there will be a decrease in air-cargo traffic and an increase in truck transport. The net impacts of these changes are highlighted in Table A14. Including direct, indirect, and induced impacts, GDP due to the elimination of the Food Mail programme will increase by $0.5 million; there will be an additional four jobs created; and government revenues will increase by $77,000 of which $23,000 will accrue to the GNWT.

TABLE A 14: ECONOMIC IMPACTS OF CHANGES TO FOOD MAIL DELIVERIES

Food Mail	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$0	-$72,000	$117,030	**$44,940**	-$457,174
Material Inputs	-$373,000	-$152,000	$77,590	**-$447,330**	-$198,984
GDP	$373,000	$80,000	$39,440	**$492,270**	-$258,190
Employment (FTE)	3	1	0	**4**	-4
Wages & Salaries	$140,000	$23,000	$25,330	**$188,620**	-$168,922
Benefits	-$2,000	-$2,000	-$2,150	**-$6,000**	-$21,997
Total Gov't Revenues	$56,000	$10,000	$10,850	**$76,580**	-$38,570
Federal	$40,000	$9,000	$4,910	**$53,090**	-$20,670
Net Indirect Taxes	*$24,000*	*$7,000*	*$920*	***$30,720***	*-$1,810*
Personal Income Taxes	*$16,000*	*$2,000*	*$3,990*	***$22,370***	*-$18,860*
NWT	$16,000	$1,000	$5,940	**$23,490**	-$17,900
Net Indirect Taxes	*$10,000*	*$0*	*$4,030*	***$14,350***	*-$10,480*
Personal Income Taxes	*$6,000*	*$1,000*	*$1,910*	***$9,140***	*-$7,420*

Table A15 describes the effects of the AWR on Net Consumer Surplus.

The effect is a positive impact on the economy as a whole: GDP increases by some $4.1 million in the NWT, and there is a net gain of 37 jobs and an increase in GNWT revenues of $550,000.

Table A 15: Economic Impacts due to Increase in Net Consumer Surplus

Net Consumer Surplus	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$15,687,700	$1,181,503	$1,631,352	**$18,500,645**	$2,054,735
Material Inputs	$2,303,207	$678,503	$1,081,590	**$4,063,220**	$1,028,344
GDP	$3,915,410	$503,000	$549,764	**$4,968,344**	$1,026,392
Employment (FTE)	27	6	4	**37**	16
Wages & Salaries	$2,212,988	$275,938	$298,117	**$2,786,753**	$603,302
Benefits	$84,266	$23,007	$24,882	**$132,005**	$71,374
Total Gov't Revenues	$818,983	$75,134	$136,652	**$1,031,039**	$126,450
Federal	$388,239	$34,854	$57,117	**$481,030**	$68,970
Net Indirect Taxes	*$34,933*	*$1,613*	*$13,528*	***$51,274***	*$2,000*
Personal Income Taxes	*$353,306*	*$33,241*	*$43,589*	***$429,756***	*$66,970*
NWT	$430,744	$40,280	$79,535	**$550,009**	$57,480
Net Indirect Taxes	*$260,145*	*$27,419*	*$59,542*	***$346,786***	*$31,140*
Personal Income Taxes	*$170,599*	*$12,861*	*$19,993*	***$203,223***	*$26,340*

Source: NWT Input-Output Model

Table A16 provides the equivalent impact values summed over 45 years (discounted at 5 percent).

Table A 16: NPV of Net Consumer Surplus

NPV Net Con. Surplus	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$235,866,000	$16,681,000	$26,287,000	$278,834,000	$30,761,220
Material Inputs	$21,853,000	$5,961,000	$13,124,000	$40,937,000	$9,592,602
GDP	$54,654,000	$7,430,000	$7,509,000	$69,593,000	$14,422,042
Employment (FTE)					
Wages & Salaries	$31,106,000	$3,952,000	$4,276,000	$39,334,000	$8,497,869
Benefits	$978,000	$250,000	$270,000	$1,498,000	$817,051
Total Gov't Revenues	$11,500,000	$1,119,000	$1,939,000	$14,557,000	$1,784,635
Federal	$5,533,000	$567,000	$801,000	$6,901,000	$994,384
Net Indirect Taxes	*$446,000*	*$65,000*	*$109,000*	$621,000	*$27,965*
Personal Income Taxes	*$5,130,000*	*$489,000*	*$661,000*	*$6,280,000*	*$973,502*
NWT	$5,964,000	$551,000	$1,141,000	$7,656,000	$795,038
Net Indirect Taxes	*$3,459,000*	*$351,000*	*$814,000*	*$4,624,000*	*$412,581*
Personal Income Taxes	*$2,521,000*	*$198,000*	*$313,000*	*$3,032,000*	*$390,376*

Source: NWT Input-Output Model

Tourism Impacts

It is difficult to determine in a cogent, analytical manner the number of additional tourists who will likely visit the NWT due to the building of the AWR and the opening up of better transport links to the northern areas of the territory. Nevertheless, discussions with NWT Tourism officials have suggested that the AWR could result in an increase of 20 percent in visitation, equal to roughly 2,500 – 2,700 new tourists each year. Based on historical average spending per person of $644 (excluding airfares) plus prepaid package costs of $284 (some of which will not accrue to businesses in the NWT), we have estimated a conservative total increase in tourist expenditures of $2 million.

Table A17 below highlights the effects stemming from this addition to tourism activity. Overall, GDP will increase by $555,000 generating 10 new jobs and resulting in almost $100,000 in additional government revenues.

TABLE A 17: ECONOMIC IMPACTS DUE TO INCREASE IN TOURISM

Tourism	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$2,000,000	$220,255	$211,837	**$2,432,092**	$462,784
Material Inputs	$442,013	$126,028	$140,450	**$708,491**	$249,067
GDP	$388,561	$94,227	$71,390	**$554,178**	$213,716
Employment (FTE)	8.1	1.2	0.6	**9.8**	3.1
Wages & Salaries	$239,642	$50,694	$38,608	**$328,944**	$118,537
Benefits	$20,134	$4,383	$3,336	**$27,853**	$13,937
Total Gov't Revenues	$64,514	$14,789	$16,845	**$96,148**	$24,330
Federal	$33,578	$7,399	$7,234	**$48,211**	$13,090
Net Indirect Taxes	*$9,845*	*$1,622*	*$1,597*	***$13,064***	*-$20*
Personal Income Taxes	*$23,733*	*$5,777*	*$5,637*	***$35,147***	*$13,110*
NWT/Provincial	$30,936	$7,390	$9,611	**$47,937**	$11,240
Net Indirect Taxes	*$21,601*	*$5,118*	*$7,028*	***$33,747***	*$6,080*
Personal Income Taxes	*$9,335*	*$2,272*	*$2,583*	***$14,190***	*$5,160*

Source: NWT Input-Output Model

Since this tourism spending will occur each year, it is necessary to determine the Net Present Value (NPV) of the impacts. Table A18 displays these results: an increase in GDP of $9.5 million and an increase in government revenues of $1.7 million, of which $823,000 will accrue to the NWT.

TABLE A 18: NPV OF ECONOMIC IMPACTS DUE TO INCREASE IN TOURISM

NVP Tourism	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$34,317,781	$3,779,331	$3,634,888	$41,732,000	$7,940,856
Material Inputs	$7,584,503	$2,162,515	$2,409,982	$12,157,000	$4,273,749
GDP	$6,667,220	$1,616,817	$1,224,963	$9,509,000	$3,667,105
Employment (FTE)					0
Wages & Salaries	$4,111,762	$869,804	$662,434	$5,644,000	$2,033,846
Benefits	$345,530	$75,219	$57,251	$478,000	$239,179
Total Gov't Revenues	$1,107,128	$253,795	$289,078	$1,650,000	$417,528
Federal	$575,989	$126,921	$124,090	$827,000	$224,543
Net Indirect Taxes	*$168,806*	*$27,811*	*$27,383*	$224,000	-$343
Personal Income Taxes	*$407,176*	*$99,113*	*$96,711*	*$603,000*	$224,922
NWT	$531,121	$126,874	$165,005	$823,000	$192,972
Net Indirect Taxes	*$370,610*	*$87,810*	*$120,580*	*$579,000*	*$104,315*
Personal Income Taxes	*$159,859*	*$38,907*	*$44,233*	*$243,000*	*$88,364*

Source: NWT Input-Output Model

APPENDIX B-AN INPUT-OUTPUT PRIMER

National Accounting (also termed Economic Accounting) assumes a company undertakes two steps in its production process. First, it purchases material inputs from other industries and second, it transforms those material inputs into finished goods (or services) ready for resale. Take as an example a construction company constructing a pipeline. The construction company may buy steel pipe from the steel manufacturing sector. Using other material inputs (e.g., electricity and fuel oil), it transforms the steel pipe into a completed pipeline, which, in turn, is "sold" to the owners of the pipeline at a selling price (equal to the investment cost) higher than the cost of its inputs. The difference between the selling price (investment cost) and the material input cost is the "mark-up" or "value-added". This value-added is used to pay for the labour, any taxes levied by governments, the depreciation of equipment, and any interest costs the construction company may have, and will also generate, the owner hopes, a profit.

National Accounting asserts that the value that the construction sector adds to the economy (hence, the term "value-added") is equal not to the total revenues of the construction sector (equivalently, the investment cost), but only to this "mark-up" value. That is, the value of an industry to an economy is the difference between the value of its output (effectively, total operating revenues) and the cost of its material inputs. In this way, the construction industry does not claim the value of the steel pipe inputs it uses, which should rightly be accounted for by the steel industry. As a result, there is no double counting when measuring the value of the entire economy.

The value-added of the construction industry building the pipeline will be equal to the revenue received (equal to the invested capital) minus all of its material costs for goods or services (material inputs), or:

Value-Added = Revenue (or Capital Invested) - Material Inputs

Another way of defining value-added is that it is the sum of an industry's payments for labour, for indirect taxes, for depreciation and interest costs, and for profit:

Value Added = Labour + Indirect Taxes + Depreciation + Interest Costs + Profit

The resulting value-added of any firm (or industry) is available to be shared among labour (wages, salaries, and benefits), indirect taxes, and "operating surplus." The operating surplus itself is shared between payments for the use of physical capital (depreciation), payments for the use of monetary capital (interest costs), and payments (profits) to the owner(s) of the enterprise. Value-added is an industry's contribution to, or ***direct impact*** on, the economy. The sum of value-added of all industries is termed the country's Gross Domestic Product (GDP).

An important distinction needs to be made between Financial Accounting and National Accounting. Under financial accounting, an industry that has a high value-added (i.e., contributes a lot to the economy) can be unprofitable if, for example, its payments to labour or for interest costs are too high. Alternatively, low value-adding industries can be very profitable to their owners, depending on their usage of labour and their capital structure.

Economists have standardised the measure of the flows of commodities between industries and the inter-relationships of inputs and outputs among industries through the concept of Input-Output (I/O) analysis. The **MAKE** matrix identifies the various types of output the sector produces (the construction industry produces "construction" services). The **USE** matrix highlights all the various types of inputs used to produce that output (the construction industry uses a variety of inputs including steel pipe, fuel oil, office supplies, etc.).[14] By mathematically manipulating these matrices, it is possible to determine by how much the supply of each commodity will increase when the output of an industry increases by one dollar.

The GDP-to-Output ratio is a measure of the direct contribution to the economy *per dollar of output*. Clearly, an industry that requires a lower dollar value of inputs to produce a given dollar of output is a higher value-adding industry. One must note, however, that a higher GDP-to-Output ratio does *not* imply that the industry is more important to the economy. It merely states that for every dollar of output, the impact on the economy is greater. Obviously, when examining an industry's importance to an economy, one must also take into account the total output of the industry. There is, however, another important characteristic of an industry that must be examined if one is to determine the importance of a sector to the local economy: its ***linkages*** to other industries.

When inputs such as steel pipe are purchased by the construction sector, the industries supplying those goods and services (in this case, the steel industry) increase their own economic activity. This increased activity itself creates demand for other products. The steel industry, for example, may need more iron ore. Iron ore producers themselves may need more chemicals and fuel oil. The demand for extra chemicals and fuel oil will, in turn, stimulate activity in the chemical and hydrocarbon industries. The increased activity in the chemical industry will create greater demand for its own inputs, perhaps some other primary chemicals. And so it continues down the chain of industries. The sum effects of all this additional economic activity are known as ***indirect impacts***.

Such indirect impacts (also known as "multiplier effects" or "spin-offs") on the economy clearly are important. They should not be ignored (as they usually are with financial accounting) if we are to measure the true benefits of an industry or an investment to an economy. An interesting observation is that while it is true that high value-adding industries have low indirect impacts, those industries with relatively lower direct impacts have relatively higher indirect impacts. This is because, by definition, low value-adding industries consume more inputs per dollar of output and thus have a greater impact on their supplying industries. It should be noted, however, that the level of indirect impacts is highly influenced by the type of goods and services demanded and by the propensity of the companies (or the economy) to import those particular goods and services. The higher the propensity to import the required goods and services, the lower will be the effects on the local economy. Indeed, an industry that imports all its inputs will have virtually no indirect impact on the economy, save the small level of distributive activity (wholesale, retail, and transportation margins) that the imports may generate.

Increased industrial activity or investment has a third effect on the economy. When additional wages and salaries are paid out, those dollars (appropriately adjusted for taxes and savings) are available to be re-spent on consumer goods and services. Take, for example, an additional $1 million in wages resulting in, say, an increase of $750,000 in disposable income. Depending on the spending patterns, this may result in extra consumer spending of, say, $500,000 in the retail sector (the remaining being spent in the entertainment sector, restaurant sector, etc.). This will increase the economic activity of the manufacturers and other suppliers of consumer goods to the retail sector who, in turn, will increase their own employment and their own wage payments. The sum effects of this additional activity due to increased wages are known as ***induced impacts***. Again, it should be clear that, like indirect impacts, induced impacts are highly influenced by the economy's propensity to import as well as by the economy's taxation and savings rates, the level of wages paid to employees, and the level of capacity at which the economy is operating.

The following question arises: given that there are many levels of indirect and induced spending that affect many different firms and industrial sectors, how can we estimate these impacts on the economy? Fortunately, economists have developed a method to estimate these impacts by using the same input-output tables to which we already have been introduced.[15] However, since the base information is coming from

[14] Output is closely associated with industry revenues, but there are important differences. Likewise, inputs are highly related to industry expenses. But, again, the differences are important. For a summary of these differences, see the next sub-section: *Technical Differences*.

[15] For a detailed discussion of the underlying mathematics of Input-Output analysis, see *Input-Output Analysis: Foundations and Extension*, Ronald E. Miller and Peter D. Blair, Prentice Hall, 1985

financial statement data directly provided by operators, it is critical to understand how financial statement data are re-structured to meet National Accounting standards. These differences are discussed below.

Technical Differences

Although the National Accounting (Input-Output) measurement of the value and impacts of an industry begins with the same set of data as the financial results of the industry, a number of adjustments are required in order to conform to strict National Accounting standards. To avoid possible confusion, these technical differences between Financial Accounting and National Accounting should be understood, although not all the differences relate to the construction industry or to other industries involved in the MGP. The intent here is not to provide a comprehensive or definitive discussion of these differences, however, but rather to provide a cursory overview. For a more in-depth discussion of the differences and of the methodology underlying National Accounting, the interested reader is referred to the National Accounting compendium published by the UN.[16]

The following outlines the major differences:

1. The first and perhaps most important difference is that National Accounting measures all non-tax related revenues and expenses related to production, even those not itemized on the corporate income statement. Hence, gratuities paid to staff are included as output. This increases output but not material inputs, and therefore it increases the estimate of GDP (Output – Input) by precisely the amount of gratuities. Using our other definition of GDP (GDP = indirect taxes + wages, salaries and benefits + operating surplus), we see that the increase in GDP is reflected in an increase in wages and salaries equal to the reported gratuities.

2. Another (usually) off-budget item is an estimate of the value of imputed room and board provided to employees. On the Output side there is an increase in lodging revenues and, since the provision of room and board is a value to the employee, it is considered equivalent to a wage, and thus contributes to overall GDP equal to the value of the imputed room and board. Statistics Canada has standard values that it uses to assess the value of this room and board.

3. At the same time, National Accounting omits revenues not directly related to the production process. Generally, these incomes are limited to interest and dividend earnings, but include non-operating revenues related to rental incomes, commissions, and the like.

4. A third difference is that under National Accounting, the value of each input in the USE matrix is stated in "producer" prices. That is, all wholesale, retail, and transportation costs included in the "purchaser" price of a commodity are removed, as are all commodity taxes, indirect taxes, and import duties. These "distributive and tax margins", as they are called, are explicitly recognized in the USE matrix as separate line items. For the construction industry, the purchase cost of steel pipe will be equal to the "producer" cost of steel pipe (the cost at the manufacturer's plant gate) plus the cost of transporting the pipe to the NWT (the "transportation" margin) plus any retail/wholesale mark-ups plus any indirect taxes. The reader should understand that this does not in any way reduce the total cost of inputs to the industry; it simply re-assigns the costs to different input categories.

5. A fourth difference lies in the treatment of merchandise sales. National Accounting treats the purchase of merchandise as partly a purchase from the manufacturer of the good (equal to the cost price of the good less distributive and tax margins) and partly a purchase from the retailer (equal to the mark-up for the good). Consequently, in an input-output table for a sector selling some retail goods, there is no recognition of the cost of the merchandise on the input (USE) side, and only the mark-up value is recognized on the output (MAKE) side. The cost of the merchandise is captured in the manufacturing sector as output.

[16] *System of National Accounts*, Statistical Papers Series F No 2 Rev. 4, New York, 1993

6. Related to this unusual approach to merchandise sales is the treatment of "service margins." When a firm purchases a product (such as liquor, beer, or wine) and re-sells it with a mark-up without any fundamental change to it, National Accounting recognizes only the mark-up or "service margin" as output. It then treats the purchase cost of the product (less distributive and tax margins) as an output to the original producer of the good. The main instance that affects most industries (besides retail sales) is alcohol sales. In this case, only the service margins are recognized as output, and the costs are assigned to the alcohol manufacturing sectors (beer, wine, and liquor distillers).

APPENDIX C-Assumptions of Trucking Vs. Barging the MGP

Trucking

Pipe hauls are carried out with self-steering dolly trailers (see Appendix E on page 72) and they are while legal under current permissible vehicle weight laws in NWT, they are longer than permitted. Therefore, PROLOG has assumed pilot cars will be required as is customary for over-length loads. Modules will weigh over the permissible vehicle weight limits but will likely be within overall length allowances and conducted during the winter months when the AWR is frozen.

It is assumed that **fuel** will be trucked in conventional Super B Train equipment, as is customary in the NWT.

It is assumed that **construction equipment** (yellow iron) **and drilling equipment and supplies** will be moved on low-boy trailers and/or flat-deck trailers. **Camp Buildings** will be moved on conventional flat-deck trailers and **modules** by specially constructed trailers designed to match module dimensions. Flat-deck trailers may also be used for compressor station components.

Table A 19: Trucking System Description

Commodity	Vehicle Type	Payload	Avg. Speed	Running Cost/Hr.	Materials Handling Costs
Pipe	Tractor & Pipe Dolly	25 tons	60 km/hr	$263	$10 per ton - each end
Fuel	Super B Train	40 tons	70 km/hr	$192	load/unload - 1.5 hrs @ $63/hr.
Equipment	Tractor/Low-Boy	28 tons	70 km/hr	$175	$10 per ton - each end
Camp Buildings	Tractor/Flat-Deck	24 tons	70 km/hr	$175	$10 per ton - each end
Modules	Tractor/Special Trailers	60 tons	45 km/hr	$175	$10 per ton - each end
Drill Rigs/Supplies	Tractor/Flat Deck	30 tons	70 km/hr	$346	$10 per ton - each end

For the truck case, pipe and fuel (the commodities entering the NWT from the South by rail) are considered shipments originating in Hay River. Equipment, camps, and modules are typically truck-mounted at their factories or southern distribution points and assumed to originate in Enterprise (the origin of Highway No.1). All logistics costs south of Hay River and Enterprise are common to both scenarios, whether or not the AWR exists.

The following table shows commodity origins and AWR distances to the planned MGP river stockpile sites. Included are the estimated distances from the stockpile site to the closest new AWR alignment:

Table A 20: Trucking O/D Distance Assumptions (kms)

Destination	Origin	
	Hay River	Enterprise
Camsell Bend	518	475
Trail River	543	500
Ochre River	674	631

Destination	Origin	
	Hay River	Enterprise
Blackwater	747	704
Fort Norman	43	
Norman Wells	988	945
Fort Good Hope	1,135	1,092
Little Chicago	1,261	1,218
Inuvik	1,497	1,454
Swimming Point	1,571	1,528
Camp Farewell	1,651	1,608
Lucas Point	1,576	1,533

Tug and barge operating cost data are provided by a PROLOG consultant with 36 years experience with Northern Transportation Company Ltd. (NTCL), much of it in marketing and implementing logistics programs for the oil and gas industry active in the North, and for Arctic communities. He maintains a close relationship with senior NTCL officials.

Trucking and materials handling operating cost data are derived from the hands-on experience of PROLOG consultants and discussions with such companies as Trimac Transportation, Ventures West, Matco, Tli Cho Landtran, and Atco Structures; from personnel at ports and stevedoring companies; from energy and mining companies; and from consulting engineering firms – all highly experienced in northern operations.

BARGING

Two forms of rates are generally available from marine transportation companies:

> **Tariff rates** are available for periodic shippers, usually for seasonal deliveries, to points along the river. Tariffs are established by commodity groups for regional destinations throughout the Arctic. Rates increase in proportion to the distance from bases at Hay River (NTCL) and/or Fort Simpson (Coopers Barging).
>
> **Time Charter rates** are available for customers willing to commit large volumes of freight over extended periods of time. It is highly probable that the two- or (more likely) three-year supply program for the MGP will involve the time-chartering of tugs and barges from both major operators on the river. Some freight required by contractors and service companies no doubt will move under tariff rates, but the amount should be minimal.

Both tariff and time charter freight rates were developed for this analysis as a basis for comparing each with a trucking option.

TRUCKING

Typically, trucking freight rates in the North are developed on an hourly basis for specific hauls based on round-trip times, with additional consideration for loading and unloading the products. Mileage-based rates are generally developed for movements over the high volume and extensive southern highway system where traffic disruptions are less frequent and weather conditions less onerous.

Rates provided here are consistent with known rates for current bulk and full-load contract hauls in the NWT and Yukon. Included are a 10 percent administration fee and a 10 percent margin.

The following table describes the comparative results obtained in the analysis.

TABLE A 21: COMPARATIVE IMPACTS - TRUCK VS. BARGE MGP ($CDN)

	Tonnage (Short Tons)	Cost Truck (Hourly Basis)	Cost Barge	
			Tariff	Time Charter
Camsell Bend	43,475	5,374,833	4,583,015	3,444,800
Ochre River	59,680	8,914,874	9,299,060	3,744,000
Trail River	9,621	937,581	1,189,024	960,420
Blackwater River	9,819	1,302,313	1,759,335	864,000
Little Smith Creek	78,089	13,895,565	16,797,011	6,582,360
Norman Wells	76,666	16,215,214	16,254,117	7,469,060
Fort Good Hope	92,604	22,494,244	23,501,294	10,277,800
Little Chicago	168,090	42,377,830	46,494,740	20,781,400
Inuvik	100,608	27,874,189	30,601,780	14,252,160
Swimming Point	33,830	10,997,232	9,437,870	5,284,600
Camp Farewell	40,678	10,111,435	13,654,230	6,306,760
Bar C	63,560	11,500,504	22,513,690	9,472,600
Lucas Point	50,590	12,813,428	18,862,840	8,644,000
Totals	**827,310**	**$184,809,242**	**$214,948,006**	**$98,083,960**

BARGING

PROLOG assumes all materials will be shipped to river stockpile sites from Hay River, as most high volume commodity movements are currently planned in the MGP logistics submission to the JRP. MGP has some shipments from Fort Simpson in its plan, but the volumes are small and involve construction equipment only.

PROLOG assumes that a standard barge train consists of a 4,500 hp tug, six barges – four 1500 Series units (1,500-ton capacity), and two 1000 Series barges (1,000-ton capacity). This configuration provides excellent performance on the river and reflects NTCL's fleet mix.

The commodity-based NTCL tariff rates are based on travel distances from Hay River to a series of "tariff regions" blanketing NTCL's overall market area in the Mackenzie watershed and Western Arctic. The time charter rate is based on a daily charge of $48,000, $30,000 of which covers the cost of maintaining a tug on the Mackenzie system, and a balance of $18,000 for the six barges.

An Alaskan stevedoring company recently quoted PROLOG a figure of $10 per ton for loading and off-loading barges (same as truck) in the "tariff" case, except for fuel. The cost to off-load fuel is included in the tariff because barge-mounted pumps and hoses are used to transfer fuel to shore manifolds.

The destinations in all cases are the pipeline spread stockpile site locations identified in the MGP Logistics Plan. Swimming Point, Camp Farewell, and Lucas Point are the three Mackenzie Delta sites serving the three anchor field locations. Barging trip times are based on the following "average" return trip intervals:

TABLE A 22: TRAVEL TIME FROM HAY RIVER TO MGP STOCKPILE SITE LOCATIONS

Barge Travel Time From Hay River, NWT to MGP Stockpile Site Locations	
Camsell Bend	8 days
Trail River	8 Days
Ochre River	9 Days
Blackwater	9 Days
Little Smith Creek	9 Days
Fort Norman	10 Days
orman Wells	10 Days
Little Chicago	14 Days
Inuvik	15 Days
Swimming Point	16 Days
Camp Farewell	17 Days
Lucas Point	16 Days

LIMITATIONS

PROLOG's analysis of the economics of barging vs. trucking with the MGP considers only the transportation costs of moving construction materials to stockpile sites. Other benefits not within the scope of the analysis include:

1. Certainty of access and the impact on contingency planning
2. Opportunity cost of stockpiling material and equipment
3. Gravel pit development
4. Gravel quantities
5. Crew changes
6. Camp resupply
7. Emergency procedures

While it was not possible to assign a value to any of these potential investment savings or even to determine whether there would be any savings, it is safe to conclude that the AWR can only be a positive factor in the overall cost structure of the MGP. Since the financial impacts identified in this report can only be larger if the AWR reduces the investment costs of the MGP, it is also safe to say that with the AWR in place, the economic viability of the MGP and the long-run economic returns of future exploration and development would themselves only improve with the construction of the AWR.

APPENDIX D-AWR BARGE AND TRUCK IMPACTS

TABLE A 23: DEH CHO REGION MACKENZIE RIVER MGP STOCKPILE SITES

Deh Cho Region Mackenzie River MGP Stockpile Sites				BARGE					NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER				
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
Pipe	Camsell Bend	31,890	1 to 5	6,400	8	5	40	100	3,189,000	48,000	1,920,000	637,800	2,557,800
Fuel	Camsell Bend	5,635	6	5,635	8	1	8	89	501,515	48,000	384,000		384,000
Camps	Camsell Bend	5,950	7	5,950	8	1	8	150	892,500	48,000	384,000	119,000	503,000
	Total	43,475				Total at Tariff Rates			$4,583,015				
										Total at Time Charter Rate			$3,444,800
Pipe	Ochre R.	36,000	1 to 6	6,000	9	6	54	161	5,796,000	48,000	2,592,000	720,000	3,312,000
Pipe	Ochre R.	5,300	7	5,300	9	1	9	161	853,300	48,000	432,000	106,000	538,000
Fuel	Ochre R.	12,540	8 & 9	6,270	9	2	18	98	1,228,920	48,000	864,000		864,000
Camp	Ochre R.	5,840	10	5,840	9	1	9	239	1,395,760	48,000	432,000	116,800	548,800
	Total	59,680				Total at Tariff Rates			$9,273,980				
										Total at Time Charter Rate			$3,744,000
Fuel	Trail River	4,166	1	4,166				89	370,774				
Camp	Trail River	771	1	771	8	1	8	150	115,650	48,000	384,000	15,420	399,420
Equip.	Trail River	1,984	2	1,984				150	297,600			39,680	39,680
Modules	Trail River	2,700	2	2,700	8	1	8	150	405,000	48,000	384,000	54,000	438,000
	Total	9,621				Total at Tariff Rates			$1,189,024				
										Total at Time Charter			$877,100

Deh Cho Region Mackenzie River MGP Stockpile Sites				BARGE					NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER				
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
											Rate		
Fuel	Blackwater	4,166	1	4,166				98	408,268				
Equip.	Blackwater	1,983	1	1,983	9	1	9	239	473,937	48,000	432,000	39,660	471,660
Camp	Blackwater	770	2	770				239	184,030			15,400	15,400
Modules	Blackwater	2,900	2	2,900	9	1	9	239	693,100	48,000	432,000	58,000	432,000
	Total	9,819				Total at Tariff Rates			$1,759,335				
											Total at Time Charter Rate		$919,060
	Total	122,595				Total Region at Tariff Rates			$16,805,354				
										Total Region at Time Charter Rate			$8,984,960

NOTES:

1. These two rate levels are for transportation of the primary construction materials for the MGP to the major stockpile sites – by barge from Hay River.
2. Equipment includes 4,500 hp tugs, and 1,500 and 1,000 Series barges. Up to seven barges can be included in a barge train.
3. A "typical" barge train is made up of a 4,500 hp tug ($30,000 per day); 4 x 1500 series barges ($3,500 per day each); and two 1000 series barges ($2,000 per day each).

Table A 24: Sahtu Region Mackenzie River MGP Stockpile Sites

Sahtu Region Mackenzie River MGP Stockpile Sites					BARGE					NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER			
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
Pipe	Little Smith Cr.	50,688	1 to 8	6,336	9	8	64	219	11,100,672	48,000	3,072,000	1,013,760	4,085,760
Fuel	Little Smith Cr.	10,571	9 and 10	5,286	9	2	18	109	1,152,239	48,000	864,000		864,000
Equipment	Little Smith Cr.	11,000	11 and 12	5,500	9	2	18	270	2,970,000	48,000	864,000	220,000	1,084,000
Camps	Little Smith Cr.	5,830	13	5,830	9	1	9	270	1,574,100	48,000	432,000	116,600	548,600
	Total	78,089					Total at Tariff Rates		$16,797,011		Total at Time Charter Rate		$6,582,360
Pipe	Norman Wells	44,800	1 to7	6,400	10	7	70	220	9,856,000	48,000	3,360,000	896,000	4,256,000
Pipe	Norman Wells	3,200	8	3,200	10			220	704,000			64,000	64,000
Fuel	Norman Wells	2,413	8	2,413	10	1	10	109	263,017	48,000	480,000		480,000
Fuel	Norman Wells	12,800	9 and 10	6,400	10	2	20	109	1,395,200	48,000	960,000		960,000
Equipment	Norman Wells	1,980	11	1,980	10			300	594,000			39,600	39,600
Camps		3,000	11	3,000	10	1	10	300	900,000	48,000	480,000	60,000	540,000
Camps	Norman Wells	4,020	12	4,020	10	1	10	300	1,206,000	48,000	480,000	80,400	560,400
Camps		2,000	13	2,000	10			300	600,000			40,000	40,000
Modules	Norman Wells	2,453	13	2,453	10	1	10	300	735,900	48,000	480,000	49,060	529,060
	Total	76,666					Total at Tariff Rates		$16,254,117		Total at Time Charter Rate		$7,469,060

Sahtu Region Mackenzie River MGP Stockpile Sites					BARGE					NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER			
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
Pipe	Fort Good Hope	57,600	1 to 9	6,400	12	9	108	237	13,651,200	48,000	5,184,000	1,152,000	6,336,000
Pipe	Fort Good Hope	1,300	10	1,300	12			237	308,100			26,000	26,000
Fuel	Fort Good Hope	5,100	10	5,100	12	1	12	131	668,100	48,000	576,000		576,000
Fuel	Fort Good Hope	5,614	11	5,614	12			131	735,434				
Equipment	Fort Good Hope	786	11	786	12	1	12	354	278,244	48,000	576,000	15,720	591,720
Equipment	Fort Good Hope	12,000	12 and 13	6,000	12	2	24	354	4,248,000	48,000	1,152,000	240,000	1,392,000
Equipment	Fort Good Hope	2,064	14	2,064	12			354	730,656			41,280	41,280
Camps	Fort Good Hope	4,140	14	4,140	12	1	12	354	1,465,560	48,000	576,000	82,800	658,800
Camps	Fort Good Hope	4,000	15	4,000	12	1	12	354	1,416,000	48,000	576,000	80,000	656,000
	Total	92,604					Total at Tariff Rates		$23,501,294		Total at Time Charter Rate		$10,277,800
Pipe	Little Chicago	44,800	1 to 7	6,400	14	7	98	272	12,185,600	48,000	4,704,000	896,000	5,600,000
Pipe	Little Chicago	1,550	8	1,550	14			272	421,600			31,000	31,000
Fuel	Little Chicago	4,850	8	4,850	14	1	14	175	848,750	48,000	672,000		672,000
Fuel	Little Chicago	6,400	9	6,400	14	1	14	175	1,120,000	48,000	672,000		672,000
Fuel	Little Chicago	3,180	10	3,180	14			175	556,500				
Equipment	Little	2,600	10	2,600	14	1	14	407	1,058,200	48,000	672,000	52,000	724,000

Sahtu Region Mackenzie River MGP Stockpile Sites					BARGE					NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER			
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
	Chicago												
Equipment	Little Chicago	1,360	11	1,360	14			407	553,520			27,200	27,200
Camps	Little Chicago	770	11	770	14			407	313,390			15,400	15,400
Modules	Little Chicago	3,450	11	3,450	14	1	14	407	1,404,150	48,000	672,000	69,000	741,000
	Total	68,960					Total at Tariff Rates		$18,461,710		Total at Time Charter Rate		$8,482,600
Total Region (Tons)		316,319				Total Region at Tariff Rates			$75,014,132	Total Region at Time Charter Rate			$32,811,820

TABLE A25: INUVIK/BEAUFORT REGION - MACKENZIE RIVER MGP STOCKPILE SITES

Inuvik/Beaufort Region - Mackenzie River MGP Stockpile Sites				BARGE						NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER			
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
Pipe (1)	Little Chicago	51,200	1 to 8	6,400	14	8	112	272	13,926,400	48,000	5,376,000	1,024,000	6,400,000
Pipe	Little Chicago	2,560	9	2,560	14			272	696,320			51,200	51,200
Fuel	Little Chicago	3,840	9	3,840	14	1	14	175	672,000	48,000	672,000		672,000
Fuel	Little Chicago	17,950	10 to 12	5,983	14	3	42	175	3,141,250	48,000	2,016,000		2,016,000
Equip.	Little Chicago	6,000	13	6,000	14	1	14	407	2,442,000	48,000	672,000	120,000	792,000
Equip.	Little Chicago	2,290	14	2,290	14			407	932,030			45,800	45,800
Camps	Little	4,000	14	4,000	14	1	14	407	1,628,000	48,000	672,000	80,000	752,000

Inuvik/Beaufort Region - Mackenzie River MGP Stockpile Sites				BARGE						NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER			
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
	Chicago												
Camps	Little Chicago	5,645	15	5,645	14	1	14	407	2,297,515	48,000	672,000	112,900	784,900
Camps	Little Chicago	5,645	16	5,645	14	1	14	407	2,297,515	48,000	672,000	112,900	784,900
	Total	99,130					Total at Tariff Rates		$28,033,030		Total at Time Charter Rate		$12,298,800
Pipe	Inuvik	43,780	1 to 7	6,254	15	7	105	272	11,908,160	48,000	5,040,000	875,600	5,915,600
Fuel	Inuvik	19,118	8 to 10	6,373	15	3	45	175	3,345,650	48,000	2,160,000		2,160,000
Equip.	Inuvik	17,270	11 to 13	5,756	15	3	45	407	7,028,890	48,000	2,160,000	345,400	2,505,400
Camps	Inuvik	6,000	14	6,000	15	1	15	407	2,442,000	48,000	720,000	120,000	840,000
Camps	Inuvik	3,470	15	3,470	15			407	1,412,290			69,400	69,400
Modules	Inuvik	2,530	15	2,530	15	1	15	407	1,029,710	48,000	720,000	50,600	770,600
Modules	Inuvik	4,220	16	4,220	15	1	15	407	1,717,540	48,000	720,000	84,400	804,400
Modules	Inuvik	4,220	17	4,220	15	1	15	407	1,717,540	48,000	720,000	84,400	804,400
	Total	100,608					Total at Tariff Rates		$30,601,780	Total at Time Charter Rate			$13,869,800
Pipe	Swimming Pt.	19,200	1 to 3	6,400	16	3	48	300	5,760,000	48,000	2,304,000	384,000	2,688,000
Pipe	Swimming Pt.	1,220	4	1,220	16			300	366,000			24,400	24,400
Fuel	Swimming Pt.	5,180	4	5,180	16	1	16	175	906,500	48,000	768,000		768,000
Fuel	Swimming Pt.	4,070	5	4,070	16	1	16	175	712,250	48,000	768,000		768,000

Inuvik/Beaufort Region - Mackenzie River MGP Stockpile Sites				BARGE						NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER			
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
Camps	Swimming Pt.	4,160	6	4,160	16	1	16	407	1,693,120	48,000	768,000	83,200	851,200
	Total	33,830					Total at Tariff Rates		$9,437,870		Total at Time Charter Rate		$5,099,600
						Total Region at Tariff Rates			$68,072,680	Total Region at Time Charter Rate			$31,268,200

Note:1. Little Chicago is the stockpile site for construction spreads in both the Sahtu and Beaufort regions.

TABLE A 26: MACKENZIE DELTA ANCHOR PRODUCTION PAD SITES (1) - MGP

Mackenzie Delta Anchor Production Pad Sites (1) – MGP				BARGE						NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER			
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
Pipe	Camp Farewell	1,980	1	1,980	17			335	663,300			39,600	39,600
Fuel	Camp Farewell	4,420	1	4,420	17	1	17	220	972,400	48,000	816,000		816,000
Fuel	Camp Farewell	6,520	2	6,520	17	1	17	220	1,434,400	48,000	816,000		816,000
Equip.	Camp Farewell	1,980	3	1,980	17			503	995,940			39,600	39,600
Camps	Camp Farewell	2,430	3	2,430	17			503	1,222,290			48,600	48,600
Modules	Camp Farewell	2,000	3	2,000	17	1	17	503	1,006,000	48,000	816,000	40,000	856,000
Modules	Camp Farewell	1,240	4	1,240	17			503	623,720			24,800	24,800
Rigs Supplies	Camp Farewell	3,608	4	3,608	17	1	17	335	1,208,680	48,000	816,000	72,160	888,160
Rigs Supplies	Camp Farewell	16,500	5 to 7	5,500	17	3	51	335	5,527,500	48,000	2,448,000	330,000	2,778,000
	Total	40,678					Total at Tariff Rates		$13,654,230		Total at Time Charter Rate		$6,306,760
Fuel	Bar C	19,200	1 to 3	6,400	18	3	54	220	4,224,000	48,000	2,592,000		2,592,000
Fuel	Bar C	2,730	4	2,730	18			220	600,600				
Equip.	Bar C	2,070	4	2,070	18			503	1,041,210			41,400	41,400
Camps	Bar C	1,300	4	1,300	18	1	18	503	653,900	48,000	864,000	26,000	890,000
	Bar C	1,130	5	1,130	18			503	568,390			22,600	22,600
Modules	Bar C	5,080	5	5,080	18	1	18	503	2,555,240	48,000	864,000	101,600	965,600
	Bar C	12,700	6 and	6,350	18	2	36	503	6,388,100	48,000	1,728,000	254,000	1,982,000

Mackenzie Delta Anchor Production Pad Sites (1) – MGP				BARGE						NOTE: ALL SHIPMENTS ORIGINATE IN HAY RIVER			
Product	Destination	Volume (Short Tons)	Trip No.	Tons Per Trip (2)	Sailing Time (Days)	No. of Sailings	Total Days	Tariff Rate ($/Ton)	Total Cost (Tariff - $)	Charter Rate/Day ($)	Charter Trip Cost ($)	Load Unload ($10/Ton)	Total Cost Charter - ($)
			7										
Rigs/ Supplies	Bar C	19,350	8 to 10	6,450	18	3	54	335	6,482,250	48,000	2,592,000	387,000	2,979,000
	Total	63,560					Total at Tariff Rates		$22,513,690		Total at Time Charter Rate		$9,472,600
Fuel	Lucas Point	6,400	1	6,400	18	1	18	220	1,408,000	48,000	864,000		864,000
Fuel		440	2	440	18			220	96,800				
Equip.	Lucas Point	2,920	2	2,920	18			503	1,468,760			58,400	58,400
Camps	Lucas Point	2,890	2	2,890	18	1	18	503	1,453,670	48,000	864,000	57,800	921,800
Modules	Lucas Point	10,970	3 and 4	5,485	18	2	36	503	5,517,910	48,000	1,728,000	219,400	1,947,400
Rigs Supplies	Lucas Point	26,620	5 to 9	5,324	18	5	90	335	8,917,700	48,000	4,320,000	532,400	4,852,400
							Total at Tariff Rates		$18,862,840		Total at Time Charter Rate		$8,644,000
						Total Region at Tariff Rates			$55,030,760	Total Region at Time Charter Rate			$24,423,360

Note: 1. Camp Farewell is the stockpile site for Shell's Niglintgak anchor field; Bac C serves IOL'as Taglu field; and Lucas Point serves ConocoPhillips Parsons Lake field.

TABLE A 27: MACKENZIE HIGHWAY AWR IMPACTS ON THE MGP – DEH CHO REGION

	Deh Cho Region				Mackenzie River MGP Stockpile Sites							
Product	Volume (Tons)	Origin	Destination	Vehicle Type	Payload (Tons)	Distance (Kms)	Trip Run Time Hrs (1)	Running Cost/Hr.	Total Run Cost ($)	Load Unload Cost/ Trip ($) (2)	Total Cost Per Trip ($)	Total For Year ($)
Year 1												
Pipe	28,990	Hay River	Camsell Bend	Pipe Dolly	35	518	17.3	263	4,541	700	5,241	4,341,156
Fuel	5,330	Hay River	Camsell Bend	Super B	40	518	14.8	192	2,842	95	2,937	391,302
Equipment				Flat/Lowboy	28							
Camps (5)	5,400	Enterprise	Camsell Bend	Flat Deck	24	475	13.6	175	2,375	480	2,855	642,375
Modules				Special	60 (3)							
									Total Deh Cho Region - Year 1 (4)			5,374,833
Year 2												
Pipe	37,480	Hay River	Ochre River	Pipe Dolly	35	670	22.3	263	5,874	700	6,574	7,039,458
Fuel	11,380	Hay River	Ochre River	Super B	40	670	19.1	192	3,675	95	3,770	1,072,687
Fuel	3,780	Hay River	Blackwater	Super B	40	747	21.3	192	4,098	95	4,193	396,222
Fuel	3,780	Hay River	Trail River	Super B	40	544	15.5	192	2,984	95	3,079	290,987
Equipment	1,800	Enterprise	Blackwater	Flat/Lowboy	28	704	20.1	175	3,520	560	4,080	262,286
Equipment	1,800	Enterprise	Trail River	Flat/Lowboy	28	500	14.3	175	2,500	560	3,060	196,714
Camps	5,300	Enterprise	Ochre River	Flat Deck	24	631	18.0	175	3,155	480	3,635	802,729
Camps	700	Enterprise	Blackwater	Flat Deck	24	704	20.1	175	3,520	480	4,000	116,667
Camps	700	Enterprise	Trail River	Flat Deck	24	500	14.3	175	2,500	480	2,980	86,917
Modules	2,630	Enterprise	Blackwater	Special	60	704	31.3	346	10,826	1200	12,026	527,138
Modules	2,450	Enterprise	Trail River	Special	60	500	22.2	346	7,689	1200	8,889	362,963
Total	111,520								Total Deh Cho Region - Year 2 (4)			11,154,767

	Deh Cho Region				Mackenzie River MGP Stockpile Sites							
Product	Volume (Tons)	Origin	Destination	Vehicle Type	Payload (Tons)	Distance (Kms)	Trip Run Time Hrs (1)	Running Cost/Hr.	Total Run Cost ($)	Load Unload Cost/ Trip ($) (2)	Total Cost Per Trip ($)	Total For Year ($)
									Total Deh Cho Region - Years 1&2			$16,529,600

Notes:

1. Pipe – Assume 60 km.hr; fuel 70 km/hr; equipment, camps, and drilling supplies 70 km/hr; modules 45 km/hr. Speeds impacted by ferries.
2. Allow $10/ton for pipe, equipment, camps, and modules – at each end. Fuel – allow 1.5 hrs @ $63/hr (fixed costs only).
3. 12-ton module load permitted from South to Hay River. Assume load split to 60 tons from Hay River to site.
4. Note this excludes the Deh Cho area stockpile sites that can only be serviced by truck, i.e., McGill Station, Trout River.
5. Camp volumes include miscellaneous supplies, spare parts, and some consumables.

TABLE A 28: MACKENZIE HIGHWAY AWR IMPACTS ON THE MGP – SAHTU SETTLEMENT REGION

	Sahtu Settlement Region				Mackenzie River MGP Stockpile Sites							
Product	Volume (Tons)	Origin	Destination	Vehicle Type	Payload (Tons)	Distance (Kms)	Trip Run Time Hrs (1)	Running Cost/Hr.	Total Run Cost ($)	Load/ Unload Cost/Trip ($) (2)	Total Cost Per Trip ($)	Total For Year ($)
Year 1												
Pipe	53,550	Hay River	Ft. Good Hope	Pipe Dolly	35	1,130	37.7	263	9,906	700	10,606	16,227,690
Pipe	46,080	Hay River	Little Smith R	Pipe Dolly	35	811	27.0	263	7,110	700	7,810	10,282,116
Fuel	9,740	Hay River	Ft. Good Hope	Super B	40	1,130	32.3	192	6,199	95	6,294	1,532,554
	9,610	Hay River	Little Smith R	Super B	40	811	23.2	192	4,449	95	4,544	1,091,675
Equipment	13,500	Enterprise	Ft. Good Hope	Flat/ Lowboy	28	1,092	31.2	175	5,460	560	6,020	2,902,500
Equipment	10,000	Enterprise	Little Smith R	Flat/ Lowboy	28	773	22.1	175	3,865	560	4,425	1,580,357
Camps	7,400	Enterprise	Ft. Good Hope	Flat Deck	24	1,092	31.2	175	5,460	480	5,940	1,831,500
Camps	5,200	Enterprise	Little Smith R	Flat Deck	24	773	22.1	175	3,865	480	4,345	941,417
									Total Sahtu Region - Year 1			$36,389,809
Year 2												
Pipe	43,630	Hay River	Norman Wells	Pipe Dolly	35	983	32.8	263	8,618	700	9,318	11,615,095
Pipe	42,140	Hay River	Little Chicago	Pipe Dolly	35	1,250	41.7	263	10,958	700	11,658	14,036,633
Fuel	13,830	Hay River	Norman Wells	Super B	40	983	28.1	192	5,392	95	5,487	1,897,288
Fuel	13,130	Hay River	Little Chicago	Super B	40	1,210	34.6	192	6,638	95	6,733	2,210,013
Equipment	1,800	Enterprise	Norman Wells	Flat/ Lowboy	28	945	27.0	175	4,725	560	5,285	339,750
Equipment	1,800	Enterprise	Little Chicago	Flat/ Lowboy	28	1,218	34.8	175	6,090	560	6,650	427,500
Camps	8,200	Enterprise	Norman Wells	Flat Deck	24	945	27.0	175	4,725	480	5,205	1,778,375
Camps	700	Enterprise	Little Chicago	Flat Deck	24	1,218	34.8	175	6,090	480	6,570	191,625

	Sahtu Settlement Region				Mackenzie River MGP Stockpile Sites							
Product	Volume (Tons)	Origin	Destination	Vehicle Type	Payload (Tons)	Distance (Kms)	Trip Run Time Hrs (1)	Running Cost/Hr.	Total Run Cost ($)	Load/ Unload Cost/Trip ($) (2)	Total Cost Per Trip ($)	Total For Year ($)
Modules	2,230	Enterprise	Norman Wells	Special	60	945	42.0	346	14,532	1200	15,732	584,706
Camps	3,140	Enterprise	Little Chicago	Special	60	1,218	54.1	346	18,730	1200	19,930	1,043,010
									Total Sahtu Region - Year 2			$34,123,997
									Total Sahtu Region - Years 1&2			$70,513,806

TABLE A 29: MACKENZIE HIGHWAY AWR IMPACTS ON THE MGP – BEAUFORT DELTA REGION

	Beaufort Delta Region				Mackenzie River MGP Stockpile Sites							
Product	Volume (Tons)	Origin	Destination	Vehicle Type	Payload (Tons)	Distance (Kms)	Trip Run Time Hrs (1)	Running Cost/Hr.	Total Run Cost ($)	Load Unload Cost/ Trip ($)(2)	Total Cost Per Trip ($)	Total For Year ($)
Year 1												
Pipe	39,800	Hay River	Inuvik	Pipe Dolly	35	1,494	49.8	263	13,097	700	13,797	15,689,615
Pipe	48,810	Hay River	Little Chicago	Pipe Dolly	35	1,210	40.3	263	10,608	700	11,308	15,769,349
Fuel	11,180	Hay River	Inuvik	Super B	40	1,494	42.7	192	8,196	95	8,291	2,317,239
Fuel	19,810	Hay River	Little Chicago	Super B	40	1,210	34.6	192	6,638	95	6,733	3,334,377
Equipment	13,900	Enterprise	Inuvik	Flat/Lowboy	28	1,454	41.5	175	7,270	560	7,830	3,887,036
Equipment	13,900	Enterprise	Little Chicago	Flat/Lowboy	28	1,218	34.8	175	6,090	560	6,650	3,301,250
Camps	6,940	Enterprise	Inuvik	Flat Deck	24	1,454	41.5	175	7,270	480	7,750	2,241,042
Camps	7,540	Enterprise	Little Chicago	Flat Deck	24	1,218	34.8	175	6,090	480	6,570	2,064,075
									Total Beaufort Delta Region - Year 1			$48,603,982
Year 2												
Pipe	18,560	Hay River	Swimming Pt.	Pipe Dolly	35	1,570	52.3	263	13,764	700	14,464	7,669,876
Pipe	1,800	Hay River	Camp Farewell	Pipe Dolly	35	1,650	55.0	263	14,465	700	15,165	779,914
Fuel	9,410	Hay River	Swimming Pt.	Super B	40	1,570	44.9	192	8,613	95	8,708	2,048,456
Fuel	9,950	Hay River	Camp Farewell	Super B	40	1,650	47.1	192	9,051	95	9,146	2,275,174
Fuel	19,940	Hay River	Bar C/Taglu	Super B	40	1,638	46.8	192	8,986	95	9,081	4,526,679
Fuel	16,170	Hay River	Lucas Pt./Tuk	Super B	40	1,575	45.0	192	8,640	95	8,735	3,531,124
Fuel	6,220	Hay River	Inuvik	Super B	40	1,494	42.7	192	8,196	95	8,291	1,289,197
Equipment	1,800	Enterprise	Camp Farewell	Flat/Lowboy	28	1,608	45.9	175	8,040	560	8,600	552,857
Equipment	1,800	Enterprise	Bar C/Taglu	Flat/Lowboy	28	1,596	45.6	175	7,980	560	8,540	549,000
Equipment	2,600	Enterprise	Lucas Pt./Tuk	Flat/Lowboy	28	1,533	43.8	175	7,665	560	8,225	763,750
Equipment	1,800	Enterprise	Inuvik	Flat/Lowboy	28	1,454	41.5	175	7,270	560	7,830	503,357
Camps	3,780	Enterprise	Swimming Pt.	Flat Deck	24	1,528	43.7	175	7,640	480	8,120	1,278,900

	Beaufort Delta Region				Mackenzie River MGP Stockpile Sites							
Product	Volume (Tons)	Origin	Destination	Vehicle Type	Payload (Tons)	Distance (Kms)	Trip Run Time Hrs (1)	Running Cost/Hr.	Total Run Cost ($)	Load Unload Cost/ Trip ($)(2)	Total Cost Per Trip ($)	Total For Year ($)
Camps	2,210	Enterprise	Camp Farewell	Flat Deck	24	1,608	45.9	175	8,040	480	8,520	784,550
Camps	2,210	Enterprise	Bar C/Taglu.	Flat Deck	24	1,596	45.6	175	7,980	480	8,460	779,025
Camps	2,630	Enterprise	Lucas Pt./Tuk.	Flat Deck	24	1,533	43.8	175	7,665	480	8,145	892,556
Camps	1,670	Enterprise	Inuvik	Flat Deck	24	1,454	41.5	175	7,270	480	7,750	539,271
Modules	2,950	Enterprise	Camp Farewell	Special	60	1,608	45.9	175	8,040	1200	9,240	454,300
Modules	4,020	Enterprise	Bar C/Taglu.	Special	60	1,596	45.6	175	7,980	1200	9,180	615,060
Modules	6,490	Enterprise	Lucas Pt./Tuk.	Special	60	1,533	43.8	175	7,665	1200	8,865	958,898
Modules	9,970	Enterprise	Inuvik	Special	60	1,454	41.5	175	7,270	1200	8,470	1,407,432
Drill Rigs	18,280	Enterprise	Camp Farewell	Flat Deck	30	1,608	45.9	175	8,040	600	8,640	5,264,640
Supplies	17,590	Enterprise	Bar C/Taglu.	Flat Deck	30	1,596	45.6	175	7,980	600	8,580	5,030,740
Supplies	24,200	Enterprise	Lucas Pt./Tuk.	Flat Deck	30	1,533	43.8	175	7,665	600	8,265	6,667,100
								Total Beaufort Delta Region - Year 1				$49,161,856
								Total Beaufort Delta Region - Years 1 & 2				$97,765,837

APPENDIX E-TYPICAL MGP PIPE TRAILER

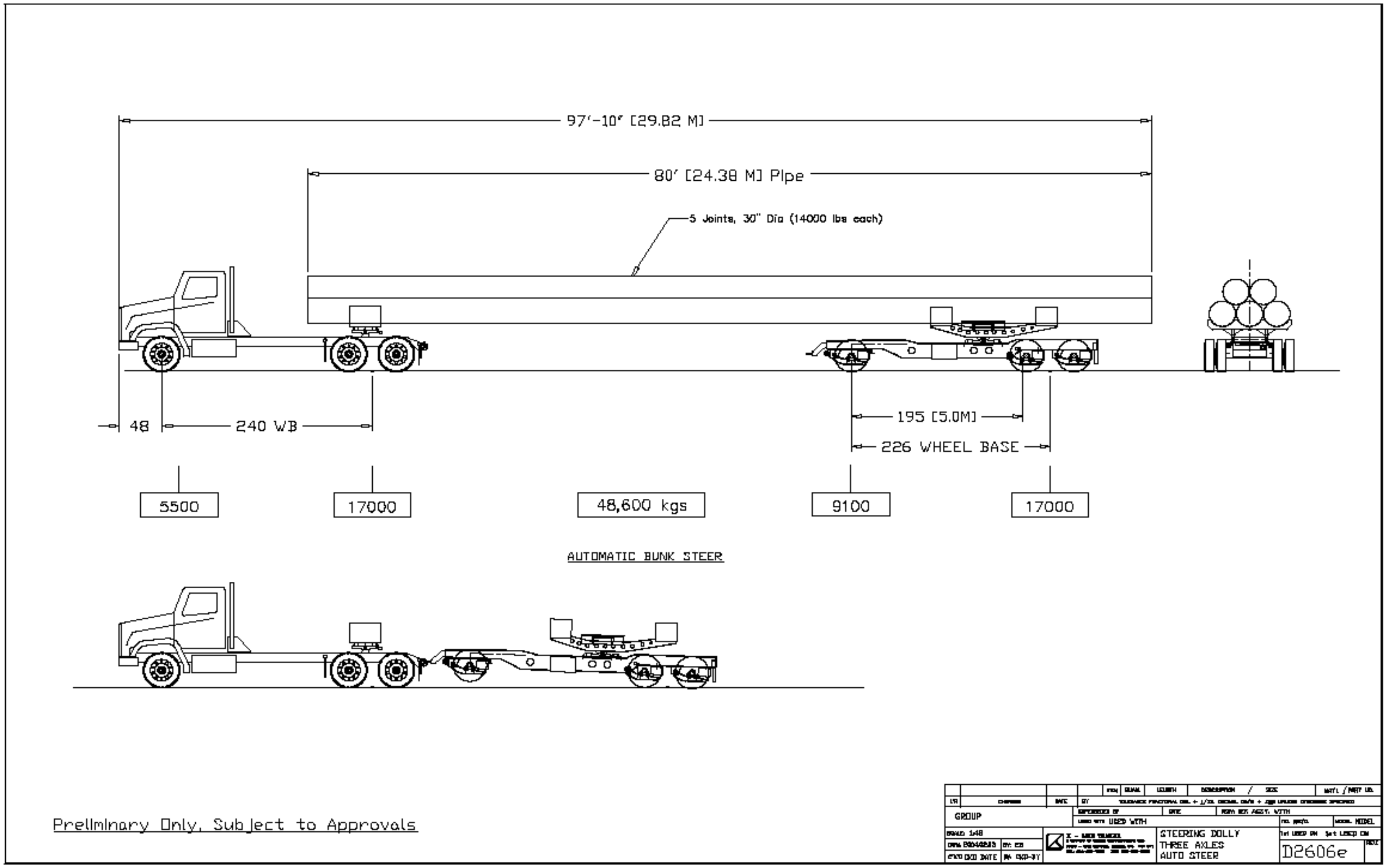

FIGURE 2 - MGP PIPE TRAILER

APPENDIX F-OIL AND GAS INDUSTRY INTERVIEWS

Bob Ball, BP Operations Manager, North American Arctic Exploration, (personal communication, June 16, 2009).

Intuitively, an AWR should reduce the cost of constructing the Mackenzie Gas Pipeline (MGP) and other oil and gas operations in the area. BP has a significant off-shore presence and a limited on-shore presence. The off-shore tracts are currently the focus of BP's exploration activities. The typical exploration cycle begins with seismic work followed by exploration drilling, and concludes with the development and then production of hydrocarbon resources, if found. Based on this cycle, BP would not not expect to undertake any drilling on its new lease until at least 2013, and if hydrocarbon resources of sufficient quantity are discovered, production would occur many years beyond that.

For BP's on-shore leases, an AWR would probably not make that big of an impact except for in logistics and its associated costs. Current constraints include the Fort McPherson and Tsiigehtchic crossings during the shoulder seasons (spring and fall) when neither ferry nor ice-road crossing is possible. The AWR from Inuvik to Tuktoyaktuk would not make much of a difference for our onshore activities, and could actually be a disadvantage depending on the location of the AWR and if the government ice roads were no longer supported.

BP's off-shore is a stand-alone operation in that it requires minimal on-land support other than the provision of consumables and fuel from supply bases. Off-shore work is similar throughout the world, and there is a true and tried method of doing the work that for the most part does not need to rely on AWR access. It would be nice to have a supply base nearby, and a port on the Arctic Ocean linked to a road connected to the North American road system during exploration, but it is not necessary and would not significantly affect the cost of off-shore seismic programs.

BP's seismic program in the Beaufort Sea includes two supply ships and a seismic vessel. The supply ships will obtain their supplies from Tuktoyaktuk, supplies that will have already mobilized to Tuktoyaktuk by barge. Helicopters transport crew changes between the ships and Tuktoyaktuk. A port harbour connected by an AWR would be advantageous, but may not make a big difference in cost to the seismic and exploration drilling work. BP's greatest constraint is the off-shore operational time in that it needs open water between June and September, and the movement of ships/barges through Point Barrow Alaska where the ice breaks up later than the Beaufort Sea area.

If sufficient hydrocarbon resources are discovered (Sic. economic), BP could enter into a field development phase. If oil is found, it could be loaded onto tankers and shipped for refinement. If gas is found, the AWR should reduce operating costs and provide efficiencies for the construction of gas transport infrastructure and eliminate the shoulder season (spring/fall) overland transportation constraint.

BP has not evaluated the impact of an AWR on their operations, but a 15 percent savings from having an AWR seems to be a reasonable estimate.

There is a need for a port connected to an AWR road link for a number of reasons including: i) if BP goes into development and production, it will need a vastly improved connected harbour than currently exists at Tuktoyaktuk to support the level of activity that will occur and the type of vessels that will be frequenting the Beaufort Sea and ii) national sovereignty and security.

Gary Bunio, Vice President Operations & COO MGM Energy Corporation (personal communication, June 16, 2009).

Scheduling is the key driver in an exploration/development program. With that in mind, the key question is how will the AWR affect scheduling (as it will probably not affect project scope)? The AWR will allow rig transfer inside the NWT and allow additional timing flexibility that will not otherwise exist. Currently, MGM's operating window begins on about December 1, and concludes early to mid-April, and requires equipment redundancy to accommodate unforeseen events that might require shipping in equipment at exorbitant cost. Therefore, an AWR will reduce scheduling risk and costs.

For development and production, MGM will undertake summer exploration/production work in the Mackenzie Delta using helicopter supported drill rigs that are built onto piles. This provides MGM at least an additional 2-month operating window keeping in mind this method applies to production wells, not exploration wells.

Currently, logistics costs comprise between 25 percent – 40 percent of exploration and production costs (in the Delta it is between 40 percent – 50 percent of exploration/production cost) with the key factor driving logistics costs being the distance from an exploration/production well and support infrastructure and services. That is why exploration around Norman Wells and Inuvik is less expensive. An AWR will not eliminate or reduce the need to carry redundant equipment during exploration and therefore will not affect exploration costs too much. However, if a company is in its development and production phase, the AWR will reasonably reduce logistics costs by 15 percent.

A constraint in the Mackenzie Delta is the April 10 – June 15 window when break-up makes winter-roads and ice bridges impassable. In the development phase of a gas field, having a shorter overland/winter-road route (spur roads) off an AWR can save a company a few days (shorter winter-roads/ice roads) and reduce redundancy costs. It is important to keep in mind that oil/gas companies will spend money to the point that scheduling risks are eliminated. If too much money is needed, the project won't proceed.

Not having an AWR results in freeze-up and break-up logistics constraints. That is, right after freeze-up, there is an influx of labour, materials, supplies, etc. into communities and drilling areas. Conversely, at the end of a season, there is a rush to relocate equipment, etc. This results in seasonal spikes in demand and associated cost increases for companies and communities. These cyclical spikes in demand not only draw away from needed community resources, but in some instances also increase the community costs for those resources by as much as 25 percent. An AWR will dampen the spikes in demand, reduce demand driven cost increases to communities and oil and gas companies, and allow for a more efficient use of all resources.

The NWT needs to build an AWR north of Wrigley as soon as possible because there is no means of economic transportation other than barging with its inherent limitations and seasonality. In the long-term, an AWR is vital to the social and economic evolution of the NWT.

Lloyd Doyle, COO, Northern Operating Unit, Paramount Resources Ltd. (personal communication, June 16, 2009).

Having access to an all-weather road provides Paramount Resources at least a 15 percent savings on its work in the Cameron Hills area. For example, the winter-road Paramount constructs into the Cameron Hills areas off the existing NWT highway system costs Paramount $500 – $750K to build. If there was no AWR Paramount would have to build a winter-road from possibly High Level at significantly greater cost. By way of another example, when Paramount was undertaking exploration work in the Colville

Lake area, its costs could have been significantly reduced if there had been an AWR. An AWR will also reduce Paramount's carrying charges for equipment it cannot use and enable the equipment to be redeployed elsewhere in the NWT or elsewhere. In short, having an AWR provides significant cost savings annually by i) avoiding lengthy winter-road construction and ii) avoiding the carrying charges for equipment and rigs stranded until freeze-up.

Rod Maier, Manager, Frontier Development, and Doug Connon, Mackenzie Delta Coordinator Chevron Canada Ltd. (personal communication, June 16, 2009).

Chevron Canada operates in the outer reaches of the Mackenzie Delta; and being a delta, there will still be the need for over-river winter-roads and barges to access specific areas for exploration and production purposes. Therefore, there will not be direct AWR access to each drill site/production facility, and year-round logistics via an AWR will still not be available; albeit the length of winter-roads necessary could be reduced. However, given the proposed routing of the AWR from Inuvik to Tuktoyaktuk, the AWR will not profoundly reduce Chevron's logistics costs in the Delta area.

Because of the seasonality of the work in the NWT (being dependent on winter-roads), there are significant seasonal fluctuations on the draw of human and local service resources, particularly during start of the season and end of the work season. The result is increased competition for scarce resources (particularly people and equipment) and inflationary pressures on budgets. An AWR could help spread the work out over a longer period of time where spur roads off an AWR or marine access from the AWR were feasible, thus reducing the cyclical intensity of activity and the associated inflationary pressures. Additionally, an AWR will allow for the mobilization of more equipment from southern contractors, increase competition among contractors, and reduce costs for industry. In short, new hydrocarbon fields could be developed sooner, more efficiently, and with a lower overall cost structure.

An AWR will provide an alternative to using NTCL, and that will increase logistics competition and likely result in lower logistics costs, particularly if Chevron Canada did not have to front-load the cost of its equipment (rigs, etc.) and could simply truck it into place. Having an AWR will also do away with some of the redundancies in resources and equipment currently barged up because it could be trucked in if needed. Furthermore, having the AWR should allow for certain resources and equipment to be permanently available in the region – e.g., Inuvik – resulting in significant mobilization savings, i.e., not having to move it from Alberta to Inuvik every year. Currently, equipment standby charges are fairly high because of having to barge rigs and equipment into the NWT in the summer and not being able to use them until after freeze-up when overland access by winter-road is possible.

Year-round access will also provide for more efficient use of rigs and equipment. That is, Chevron Canada could avoid having to pay stand-by costs for the rigs and equipment when they are not being used, as the equipment could be demobilized to other projects in the North or western Canada. There will still be some restrictions in the Delta, as logistics will still rely on seasonal transportation to/from the Delta to the AWR staging point in Inuvik. The benefit may be more profound farther down the Mackenzie Valley where the geography was more amenable to year-round access using spur roads off an AWR.

The top three areas where savings will result from having an AWR are: i) logistics, ii) construction, and iii) drilling and well-servicing. The AWR will provide industry with greater control of its logistics and planning functions and not be limited by third parties such as NTCL, and local supplier/contractor availability, and standby costs will be dramatically reduced.

From a broader socioeconomic perspective, having an AWR may provide residents of the Mackenzie Valley and the Delta more opportunities to interact and engage with others in the NWT and abroad. This will broaden their understanding and views regarding oil and gas development, and possibly increase their comfort with the oil and gas sector. From a global competitive standpoint, cost structure is overriding, and an AWR could reduce the cost structure of working in the Mackenzie Delta and the Mackenzie Valley. Lowering the cost structure will in turn open up the NWT to a greater number of smaller oil and gas companies, and increase oil and gas activity in the NWT. Fundamentally, it is not just about building a road. It is about supporting a vital sector of the NWT and Canadian economy that can probably run for the next 50 to 60 years. The hydrocarbon potential has been shown to exist; now AWR road access is needed to fulfill that long-term potential.

Confidential Interviewee and Company (personal communication, June 16, 2009).

Rigs: There are different types of rigs, and each type has its own unique logistics and operational requirements. The Arctic Class rigs are capable of handling 2 – 3 lengths of drill pipe at a time and can drill down 2,500 – 5,500m. The design of the Arctic Class rigs makes them optimal for the harsh northern climate and terrain.

The process that ultimately leads to the use of drilling rigs involves the following steps:

i. Obtain access to possible oil and gas through an open bidding process as per *Canada Oil and Gas Operations Act* (COGOA) based on work bid commitments. Highest work bid wins. Only lands that are put up for the bidding process are eligible (that is, not all lands in the NWT are open to hydrocarbon exploration at any one time), and these lands are pre-approved for hydrocarbon exploration and possibly production by the landowners.
ii. The successful firm undertakes seismic work to find/delineate a potential hydrocarbon resource. This takes at least one winter season, as land seismic work is not allowed in the summer in the Delta.
iii. The successful firm (upon finding a hydrocarbon resource) obtains authorizations and negotiates benefits agreements (Government, landowners) to undertake drilling. This can take upwards of one year.
iv. Concurrent to point iii above, the successful firm sources equipment to undertake exploration drilling. If authorizations do not come through in time, the successful firm could end up paying for equipment it cannot use in the field. That is, if the equipment has been barged northward and frozen into place in anticipation of winter drilling activity and authorizations do not come through in time, the successful company still has to pay for rental of the rig.
v. Once authorizations are secured, there is a 30 – 90 day operating window in which to drill and back-haul the rig on a winter-road to the nearest all-weather road.

For example, a typical drilling season will begin in September when a rig is barged and left to freeze in place. Then, as soon as winter-road travel is possible (ranges from mid-December to mid-January), crews are dispatched to set-up the camp and drill rig. This can happen anywhere from mid-December to mid-January depending on environmental conditions. Then, if the rig has to be moved to another drilling location, another winter-road has to be constructed, and the rig dismantled, moved, and reconstructed.

The AWR will make the overall rig deployment process somewhat less planning intensive, but the need for overland winter-road access remains a constraint. Currently in the Inuvialuit Settlement region, only minimal overland winter-road travel is allowed, and in the Sahtu Settlement area, only minimal frozen-water road travel is allowed (such as ice bridges). In places like Fort Liard where there is an AWR nearby and no community objections to constructing all-season access roads off the main highway system, drilling can happen year-round. If a general set of land-use guidelines were prepared that enabled permanent overland access, where possible, the full benefits of the AWR could be achieved. Furthermore, without such guidelines in place, it will not be economically possible to drill enough exploration and production wells to bring the MGP up to 1.8 bcf/day production.

The barging window of operations is from about June 15 to September 15, depending on climatic conditions. It takes between 6 – 8 days to set up a rig and its support infrastructure. Then, depending on the drilling depth (deep in the Inuvialuit Settlement region and certain places in the Sahtu Settlement area) a 3,500m well can take an entire drilling season. Shallower drilling such as in the Colville Lake area can result in up to three wells being drilled per winter operating season before the rig is transported by ice-road to the nearest AWR. In the Inuvialuit case, this is Inuvik.

A 15 percent costs savings associated with having an AWR in place is reasonable because presumably shorter winter-road spurs are necessary.

In summary, the true benefits of building an AWR can only be achieved if all-season spur roads can be built off the AWR, something not currently allowed in the NWT except in the Fort Liard area. And, while there will be logistics/planning cost savings in the order of 15 percent, these cost savings will not be linear because winter-road spurs will still need to be constructed under the current regulatory regime.

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