Inuvik to Tuktoyaktuk All-Weather Road Economic Analysis

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Tuktoyaktuk - Inuvik All-Weather Road Economic Analysis
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 an All-Weather Road (AWR) from Inuvik to Tuktoyaktuk.

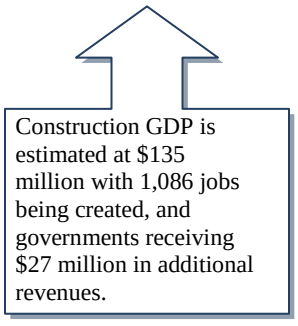
Four overall economic effects of building an AWR from Inuvik to Tuktoyaktuk were assessed: 1) building and maintaining the AWR, 2) reduction in the cost of living, 3) increase in tourism activity, and 4) impacts on the Mackenzie Gas Pipeline (MGP) including natural-gas field exploration and development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

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 those businesses most directly affected by the AWR, such as air and ground transport companies and tourism operators servicing Tuktoyaktuk.

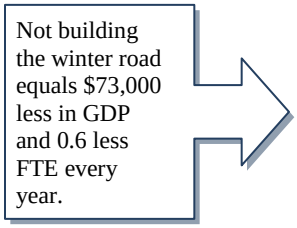
The results of the study indicate that the AWR will have a significant positive influence on local standards of living, tourism and general employment and importantly, will facilitated more efficient gas exploration and development in the Delta. Specifically, the study concludes the following:

AWR CONSTRUCTION AND MAINTENANCE CONTRIBUTION TO NWT GDP



The total contribution to NWT GDP from the Inuvik to Tuktoyaktuk construction is estimated at $135 million with 1,086 jobs being created, and governments receiving $27 million in additional revenues (of which the GNWT will receive $11 million). The direct and indirect impacts on ROC are $73 million in GDP, 860 jobs, and $9.5 million in government revenues. The increase in GDP due to AWR maintenance activities is estimated at $27 million with government revenues of $4 million.

GDP IMPACT OF DISCONTINUING THE ANNUAL TUKTOYAKTUK TO INUVIK WINTER ROAD

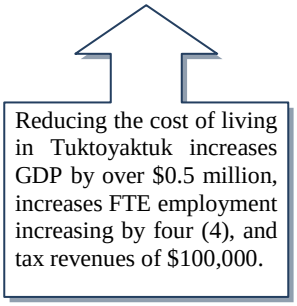


Discontinuing annual winter road construction will cause a reduction in economic activity of $73,000 in GDP, the loss of 0.6 full-time equivalent (FTE) jobs, and a reduction in government revenues of approximately $15,000.

Reduction in the Cost of Living

Assuming prices in Tuktoyaktuk approximately match those of Inuvik after the AWR is built (or Tuktoyaktuk residents purchase more of their goods and services in Inuvik); savings (excluding any extra vehicle costs and excluding the Food Mail savings examined previously) would reach roughly $1.0 million. Adding in the savings on Food Mail of $456,000 would mean that the AWR would result in approximately $1.5 million in savings, all of which would be available to be re-spent.

The elimination of the Food Mail program would have a negative impact on flights and a slight impact on the local trucking industry, the net impact being close to $0.5 million in reduced transport industry revenues.



Overall, reducing the cost of living in Tuktoyaktuk will result in a GDP increase of over $330,000, FTE employment increasing by 1.6 jobs and tax revenues of just over $60,000, of which almost half would go to the Government of the NWT.

Tourism Spending Projected to Increase by $2.7 Million Annually

The expect increase in tourism spending each year due to the building of the Inuvik-to-Tuktoyaktuk AWR is projected at $2,705,000. The direct tourism spending of $2.7 million each year will generate an increase of over $1.2 million in GDP, create 22 FTE jobs in the NWT, and result in government

revenues increasing by over $200,000, of which over $100,000 will accrue to the Government of NWT. The rest of Canada will also benefit, with GDP in other parts of the country increasing by almost $400,000, jobs increasing by six FTEs, and further government revenues rising by just over $50,000. The NPV increase in NWT GDP over this period is estimated at $21 million, and government revenues up by $3.5 million. In the rest of Canada, GDP increases by another $7 million and government revenues rise by almost $1 million.

Tourism spending of $2.7 million each year will generate an increase of over $1.2 million in GDP; create 22 FTE jobs in the NWT.

Total Economic Impact of Building the AWR (Not Including the MGP)

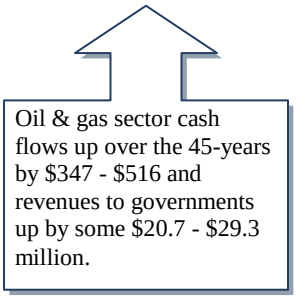
After taking into account all tax revenues stemming from the construction of the AWR, building the Inuvik-to-Tuktoyaktuk AWR will cost the Federal and Territorial government about $184 million. When all economic spin-offs (direct, indirect, and induced impacts) are accounted for over the 45 year existence of the AWR, this investment will create about $248 million in net purchases of goods and services (material inputs) in the NWT and an additional $97 million in ROC. This results in a net increase in GDP in the NWT of $186 million and an increase in GDP in the rest of Canada of $84 million. Building the Inuvik-to-Tuktoyaktuk AWR will create 1,086 one-time jobs in the NWT and another 860 one-time jobs in ROC. In addition, the building of the AWR will create 42 long-term jobs in the NWT and another 9 in ROC. Building the AWR will earn the Federal and Territorial governments almost $55 million from economic activities in the NWT and an additional $11 million accruing to governments in ROC.

Canada return on its investment is 2,000 one-time jobs, the addition of $270 million to Canada's GDP, about 55 new long-term jobs, and $66 million in revenues from new economic activity created.

Impacts of the AWR on the Proposed Mackenzie Gas Pipeline

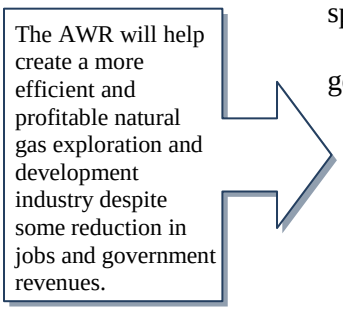
The AWR reduces oil and gas company investment costs which lead directly to greater company cash flows over the 45-year period of the MGP of $347 - $516 million depending on whether the eventual capacity of the pipeline is 1.2 bcf/day or 1.8 bcf/day.

Total revenues to governments will increase by some $20.7 - $29.3 million ($2009 dollars, discounted at 5 percent), although, due to the vagaries of royalty legislation, the Federal Government will increase its revenues by $29.6 - $41.5 million, and the NWT will see its revenues drop by $8.9 - $12.1 million. It is expected that the Federal and NWT Governments will sign a royalty-sharing agreement, and therefore it is likely that the AWR will result in an increase in revenues flowing to the GNWT.



Economic Impacts of the AWR Increasing Oil and Gas Sector Profitability

The AWR will enable the oil and gas sector to become more efficient and profitable through reduced exploration and well development expenditures. The increase in efficiency is a critical advantage for the industry, but the reduced spending by the oil and gas sector does result in reduced GDP, and diminished government revenue and jobs. That is, there will be:



1. Less buying and selling: Less buying and selling in the amount of $385 - $572 million over the 45-year period will result in the NWT accumulating $94.5 - $140.2 million less in GDP.

2. Fewer person-years of employment: With less buying and selling, it is estimated that over 45 years, there will be 1,127 -1,600 fewer person-years of employment in the NWT.
3. Lower government revenues: With less buying and selling and fewer person-years of employment, government revenues will decline by $65.4 - $97.1 million ($21.4 - ($31.8 million in NWT revenues).

Assertion of Canadian Sovereignty

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 rest of Canada. 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.

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

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.

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Third Party Disclaimer

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INTRODUCTION

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 an All-Weather Road (AWR) from Inuvik 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 Tuktoyaktuk;
3. the effects on tourism stemming from the improved access provided by the AWR to Tuktoyaktuk;
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 Beaufort-Delta region of the NWT.

The first three components are assessed in Section 2.2. Section 0 addresses the impacts of the AWR on the MGP. The latter including interviews with owners or senior executives of Aurora Expediting, E. Gruben Transport Ltd., Horizon North Logistics Inc., employees of the GNWT, Mid-Arctic Transportation Company (MATCO), Inuvialuit Regional Development Corporation, the North West Company, Northwest Transport, Stanton Distributing and Up North Tours. The information 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.

1.2. CONTEXT

Connecting Inuvik to Tuktoyaktuk is a transportation system comprised of a seasonal ice which is in operation about three months a year; year road air access; and, the twice yearly barge runs. All weather road access to Inuvik via the Dempster Highway #8 with ferry/ice bridge crossings on the Mackenzie River at Fort McPherson and on the Arctic Red River at Tsiigehtchic.

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 the Beaufort Sea may create additional and as yet unrealized opportunities, particularly if all-weather road

FIGURE 1 LOCATION MAP

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.

With the development of oil and gas discoveries in the Beaufort Delta and Arctic shipping becoming a reality, connecting Canada to the Arctic Coast facilitates Canada's development of these resources.

Connecting Canada to the Arctic Coast is also crucial to the socioeconomic future of Canada. The benefits would extend coast to coast to coast. The Inuvik to Tuktoyaktuk highway is a crucial step to connecting Canada's three coasts and is critical for the future protection and prosperity of Canadians.

A 140-kilometre all-weather highway could someday connect Inuvik and Tuktoyaktuk, N.W.T., which are currently linked by air or ice road. (CBC)

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).*

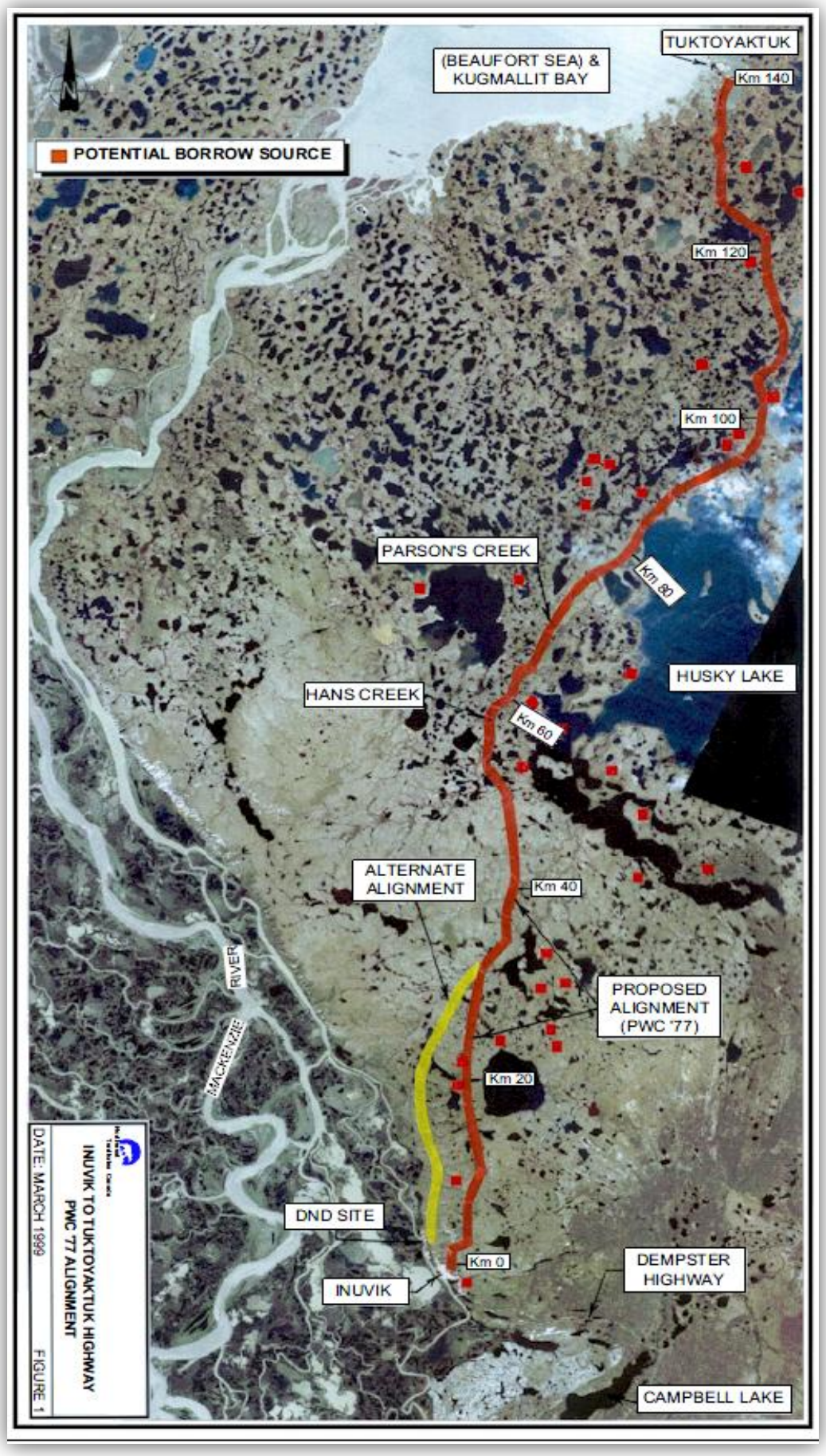

FIGURE 2 INUVIK – TUKTOYAKTUK ALL-WEATHER-ROAD PROPOSAL

2. THE ECONOMIC IMPACTS OF THE ALL-WEATHER ROAD

2.1. INTRODUCTION

Four overall economic effects of building the AWR from Inuvik to Tuktoyaktuk 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 Tuktoyaktuk. With lower freight rates, people and businesses 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. At the same time, easier access to Inuvik will enable people in Tuktoyaktuk to travel to Inuvik where goods and services are generally less expensive. This also will provide cost savings which can be spent on other 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

[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; consequently, the stated impacts are under-estimates.

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.

It should be noted that the reduction in freight rates will likely have a negative impact on - airline industry revenues. This decline will be partially counterbalanced by an increase in purchases by residents of Tuktoyaktuk and hence slightly more trucking business.

3 Increase in Tourism Activity: The creation of more economical access to northern areas will result in additional tourism activity. This increase in tourist activity will stem from both an increase in the number of tourists and an increase in the number of days, on average, each tourist spends in the region. While it is possible that some industries could be adversely affected (e.g., the air charter industry), the overall 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 a full-length AWR, it is possible that the cost of building the MGP will decline and reduced MGP construction costs would result in lower tolls for moving gas through the pipeline and would therefore increase gas field profitability. However, the existence of just the Inuvik-to-Tuktoyaktuk AWR is unlikely to have any impact on overall construction costs, and therefore no changes to the impacts should be expected.
   4.2. *Impacts on natural gas field exploration and development*: Apart from any effects on the construction phase of the MGP, the AWR could reduce the cost of natural gas field drilling and well development in the Delta 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.

2.2. Economic Impacts of the AWR (Excluding Impacts on the MGP)

2.2.1. AWR Construction and Maintenance

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 economic effects stemming from the Inuvik to Tuktoyaktuk AWR construction are based on an estimated investment of $230 million

TABLE 1 AWR CONSTRUCTION COSTS

	Kms	Road Cost	Bridge Cost	Engineering Cost	Total Cost
Inuvik to Tuktoyaktuk	145	$200,000,000	$0	$30,000,000	**$230,000,000**

Source: NWT Department of Transportation

As displayed in Table 2, the direct impact on GDP is estimated at $91 million, the number of jobs at 668, and government revenues at $19 million. Indirect impacts reach $26 million in GDP, generating 282 jobs and $4 million in government revenues. Induced GDP impacts are estimated at $17 million, 135 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 $135 million with 1,086 jobs being created, and governments receiving $27 million in additional revenues (of which the GNWT will receive $11 million). The direct and indirect impacts on ROC are $73 million in GDP, 860 jobs, and $9.5 million in government revenues.

TABLE 2 ECONOMIC IMPACTS OF INUVIK TO TUKTOYAKTUK AWR CONSTRUCTION

AWR Maint. Inuvik to Tuktoyaktuk	NWT				REST OF CANADA
	Direct	**Indirect**	**Induced**	**TOTAL**	**Dir. + Indir.**
Output	$230,000,000	$55,928,500	$49,630,720	**$335,559,220**	$157,787,352
Material Inputs	$138,553,140	$29,545,230	$32,905,170	**$201,003,540**	$84,740,348
GDP	$91,446,860	$26,383,280	$16,725,550	**$134,555,690**	$73,047,004
Employment (FTE)	668.3	282.0	135.5	**1,085.8**	859.6
Wages & Salaries	$61,277,480	$15,012,190	$9,162,100	**$85,451,770**	$37,857,452
Benefits	$4,238,680	$1,089,250	$664,780	**$5,992,710**	$4,667,674
Total Gov't Revenues	$18,701,490	$3,997,460	$4,206,360	**$26,905,310**	$9,522,410
Federal	$11,801,440	$2,226,930	$1,761,250	**$15,789,620**	$5,269,710
Net Indirect Taxes	*$1,622,000*	*$317,340*	*$414,950*	***$2,354,290***	*$893,430*
Personal Income Taxes	*$10,179,440*	*$1,909,590*	*$1,346,300*	***$13,435,330***	*$4,376,280*
NWT/Provincial	$6,900,050	$1,770,530	$2,445,110	**$11,115,690**	$4,252,700
Net Indirect Taxes	*$1,882,650*	*$976,370*	*$1,825,760*	***$4,684,780***	*$2,531,360*
Personal Income Taxes	*$5,017,400*	*$794,160*	*$619,350*	***$6,430,910***	*$1,721,340*

Source: NWT Input-Output Model

2.2.2. 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.

Table 3 highlight the estimated annual economic effects associated with the maintenance budget for the Inuvik-to-Tuktoyaktuk portion of the AWR. Total economic impacts are estimated at $1.5 million in GDP with employment effects estimated at 19 jobs, $230,000 in government revenues. ROC impacts are respectively $366,000 in GDP, five direct and indirect jobs, and $47,000 in government revenues.

Table 3 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 4 displays the same information as Table 3, 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 is estimated at $27 million. The NPVs of government revenues are estimated at $4 million. Note: the concept of NPV employment is not valid and therefore no estimate is provided.

Table 4 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

NVP Inuvik to Tuktoyaktuk Maint.	NWT				REST OF CANADA
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

2.2.3. Elimination of Temporary Winter-Road Requirements

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.

Economic effects stemming from the Inuvik to Tuktoyaktuk winter-road are displayed in Table 5. 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 6.

Table 5 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*

Winter: Inuvik to Tuktoyaktuk	NWT				REST OF CANADA
Personal Income Taxes	*$2,747*	*$419*	*$335*	***$3,501***	*$990*

Source: NWT Input-Output Model

TABLE 6 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

2.2.4. REDUCTION IN THE COST OF LIVING

The AWR will reduce cost of shipping goods to Tuktoyaktuk. With lower prices on goods, people will have money left over after 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.[2]

Another effect of the AWR is that the delivery of food via the Federal Government-sponsored Food Mail programme would likely cease as food costs in Tuktoyaktuk would more closely reflect those in Inuvik. Consequently, there would be less need for food delivery via air cargo, and barge and more trucking activity.

The building of the Inuvik to Tuktoyaktuk AWR will eliminate the need for transporting food packages by mail (Food Mail) to Tuktoyaktuk. It is estimated that there are at least 400 pieces of food mail sent each month for a minimum 4,800 per annum; translating to roughly 160,000 lbs of food deliveries over the course of a year. Transport costs by plane between Inuvik and Tuktoyaktuk are $3/lb, equating to an estimated $480,000 in Food Mail costs. With the AWR in place, these flights would be discontinued and the food would be hauled by road at an estimated cost of $0.15/lb. Thus, in terms of transportation impacts, the trucking industry would receive an additional $24,000 in revenues while the air transportation industry

[2] 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.

would receive $480,000 less in revenues. The change in the economy as Tuktoyaktuk transports more freight by truck and less by air highlighted in table 7 on the next page.

TABLE 7 ECONOMIC IMPACT OF MOVING FROM AIR TRANSPORT TO TRUCK TRANSPORT

Food Mail	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	-$456,000	-$144,018	-$80,929	**-$680,947**	-$360,244
Material Inputs	-$333,200	-$104,969	-$53,660	**-$491,829**	-$187,709
GDP	-$122,800	-$39,049	-$27,273	**-$189,122**	-$172,534
Employment (FTE)	-1.6	-0.5	-0.2	**-2.4**	-2.3
Wages & Salaries	-$88,358	-$28,006	-$14,497	**-$130,861**	-$95,252
Benefits	-$9,350	-$2,952	-$1,527	**-$13,829**	-$11,984
Total Gov't Revenues	-$29,795	-$9,449	-$6,486	**-$45,730**	-$24,400
Federal	-$13,279	-$4,222	-$2,734	**-$20,235**	-$13,030
Net Indirect Taxes	*-$1,949*	*-$633*	*-$635*	***-$3,217***	*-$2,280*
Personal Income Taxes	*-$11,330*	*-$3,589*	*-$2,099*	***-$17,018***	*-$10,750*
NWT	-$16,516	-$5,227	-$3,752	**-$25,495**	-$11,370
Net Indirect Taxes	*-$11,775*	*-$3,726*	*-$2,796*	***-$18,297***	*-$7,140*
Personal Income Taxes	*-$4,741*	*-$1,501*	*-$956*	***-$7,198***	*-$4,230*

The negative impact on the economy as highlighted in Table 7 is offset by the fact that the cost of food in Tuktoyaktuk should fall due to less costly transportation. This savings in food costs (equal to the difference in transportation costs or $456,000) will be available to be re-spent on other goods and services, effectively increasing the standard of living of those living in Tuktoyaktuk.

There should also be a savings in general, non-perishable goods in Tuktoyaktuk by having the AWR in place. However, the consensus among most people interviewed is that most people in Tuktoyaktuk will choose to drive to Inuvik in order to do their shopping, treating the trip as both a necessary shopping trip and as a trip for social purposes. In this case, there would be little impact from additional trucking, but there would be a savings (after paying for additional car expenses for travelling to Inuvik) to residents of Tuktoyaktuk from less costly goods (and possibly less costly services such as dental care, restaurant food, etc.).

According the GNWT Bureau of Statistics, prices in Tuktoyaktuk are on average just over 10% higher than in Inuvik.[3] With total personal incomes in Tuktoyaktuk of around $15 million, personal disposable incomes after taxes and after savings would be approximately $12 million. Assuming prices in Tuktoyaktuk approximately match those of Inuvik after the AWR is built (or Tuktoyaktuk residents purchase more of their goods and services in Inuvik); savings (excluding any extra vehicle costs and excluding the Food Mail savings examined previously) would reach roughly $1.0 million. Adding in the savings on Food Mail of $456,000 would mean that the AWR would result in approximately $1.5 million in savings, all of which would be available to be re-spent.

[3] GNWT, Bureau of Statistics, 2005. Living Cost Differentials, Northwest Territories Federal Isolated Post Living Cost Differentials, by Community retrieved from www.stats.gov.nt.ca/Statinfo/PricesIncome/prices/Hist_LCD.html

Table 8 below highlights the impacts of this additional $1.5 million in savings that would be re-spent in the economy. Note, because of the very high import content of most consumer goods, the impacts in NWT of the $1.5 million are relatively low.

TABLE 8 IMPACTS OF $1.5 MILLION IN TRANSPORTATION COST SAVINGS

Gross Consumer Savings	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Direct + Indirect
Output	1,500,000	$106,087	$167,161	**$867,848**	$152,753
Material Inputs	$184,559	$50,342	$110,830	**$345,731**	$79,300
GDP	$410,042	$55,744	$56,333	**$522,119**	$73,453
Employment (FTE)	2.9	0.6	0.5	**3.9**	1.1
Wages & Salaries	$224,984	$28,583	$30,923	**$284,490**	$41,534
Benefits	$7,866	$2,009	$2,175	**$12,050**	$4,721
Total Govt Revenues	$83,661	$8,140	$14,101	**$105,902**	$10,040
Federal	$40,946	$4,193	$5,929	**$51,068**	$5,500
Net Indirect Taxes	*$5,635*	*$824*	*$1,381*	***$7,840***	*$900*
Personal Income Taxes	*$35,311*	*$3,369*	*$4,548*	***$43,228***	*$4,600*
NWT/Provincial	$42,715	$3,947	$8,172	**$54,834**	$4,540
Net Indirect Taxes	*$25,830*	*$2,622*	*$6,078*	***$34,530***	*$2,730*
Personal Income Taxes	*$16,885*	*$1,325*	*$2,094*	***$20,304***	*$1,810*

Overall, the reduction in cost of living will result in the GDP increasing by over $0.5 million, FTE employment increasing by four, and tax revenues of $100,000 of which just over half would go to the Government of the NWT. The rest of Canada would also benefit, although clearly at a much reduced level.

TABLE 9 NET TUKTOYAKTUK CONSUMER SAVINGS WITH AN AWR

Net Consumer Savings	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$1,044,000	-$37,928	$86,231	**$186,903**	-$207,491
Material Inputs	-$148,640	-$54,629	$57,170	**-$146,099**	-$108,409
GDP	$287,240	$16,691	$29,057	**$332,988**	-$99,082
Employment (FTE)	1.2	0.1	0.2	**1.6**	-1.3
Wages & Salaries	$136,622	$574	$16,423	**$153,619**	-$53,719
Benefits	-$1,480	-$942	$643	**-$1,779**	-$7,263
Total Gov't Revenues	$53,865	-$1,309	$7,614	**$60,170**	-$14,360
Federal	$27,661	-$32	$3,196	**$30,825**	-$7,530
Net Indirect Taxes	*$3,681*	*$187*	*$745*	***$4,613***	*-$1,380*
Personal Income Taxes	*$23,980*	*-$219*	*$2,451*	***$26,212***	*-$6,150*
NWT	$26,204	-$1,277	$4,418	**$29,345**	-$6,830
Net Indirect Taxes	*$14,055*	*-$1,106*	*$3,284*	***$16,233***	*-$4,410*
Personal Income Taxes	*$12,149*	*-$171*	*$1,134*	***$13,112***	*-$2,420*

The combined (positive) impacts of reduced cost of goods with the (negative) impacts of the elimination of the Food Mail program on flight transport are highlighted in Table 9 above. The combined impacts are lower, generating some $330,000 in GDP in the NWT, an extra 2 jobs and government revenues of roughly $60,000.

The importance of the Net Consumer Savings is not the economic impacts in terms of jobs and the like. Rather, the importance of the Consumer Savings is the impact of the standard of living for the residents of Tuktoyaktuk. In this case, overall prices would be reduced (by some 10%), the cost of food would decline markedly, the selection of available goods and services would expand, and the availability on a year-round basis would be greater. The latter consequence: the fact that many goods and services would be available all year round at more-or-less Inuvik prices rather than being limited to times of the year when the ice road is in place will have a major impact on the standard of living of residents.

2.2.5. TOURISM IMPACTS

Total tourist visits in the Inuvik-Beaufort Delta region has hovered around 5,000-recorded visitations over the last few years. With the AWR between Inuvik and Tuktoyaktuk in place, we project that the total number of tourists would increase by 10%[4], or by some 500 tourists, to reach roughly 5,500 per annum. Average spending by tourists in the Inuvik-Beaufort Delta region was $2,935 in 2008 (Northwest Territories Tourism, 2010) excluding flights to/from the NWT. Using this figure, the 500 new tourists that the Inuvik to Tuktoyaktuk AWR is expected to attract will spend a total of $1,467,500.

In addition to attracting more tourists to Inuvik and Tuktoyaktuk, the AWR should result in some of these tourists staying longer in order to take advantage of fixed overland access to Tuktoyaktuk. That is, at least an extra nights stay in Inuvik proceeded by a day trip to Tuktoyaktuk. At present, the average stay is estimated at approximately 4.5 days. How many extra days the average tourist will spend in the region will largely depend on the entrepreneurial initiatives of the local population in terms of providing interesting and cost-effective northern tourist experiences. While it is difficult to provide a definitive estimate, the assumption is that perhaps half of all tourists would spend on average an extra day and a half in the Invuik-Tuktoyaktuk region. Assuming one-half of all 5,500 annual tourist visitations to Inuvik spend an extra day and a half in the region, this translates into an additional 4,125-tourist visitations days/year. With daily spending for accommodation, food and entertainment/cultural endeavours[5] estimated at approximately $300 (excluding expenditures for travelling to and from the region); this represents an increase of another $1,237,500. In total then, the expect increase in tourism spending each year due to the building of the Inuvik-to-Tuktoyaktuk AWR is projected at $2,705,000.

The direct tourism spending of $2.7 million each year will generate an increase of over $1.2 million in GDP, create 22 FTE jobs in the NWT, and result in government revenues increasing by over $200,000, of which over $100,000 will accrue to the Government of NWT. The rest of Canada will also benefit, with GDP in other parts of the country increasing by almost $400,000, jobs increasing by six FTEs, and further government revenues rising by just over $50,000.

[4] In the earlier analysis of the full AWR, NWT tourism officials suggested that the AWR would increase visitations by 20 percent or by 2,500 – 2,700 new tourists each year, resulting in an increase in annual tourism revenues of some $2 million based on average expenditures of $800. An important impetus for this increase, however, was the existence of an all-weather road extending all the way form Yellowknife to Inuvik. Without this paved highway between Yellowknife and Inuvik, a 20% increase in tourists is unlikely.

[5] We exclude spending to travelling to and from the Delta region. As well, we are assuming that the additional days spent in the region will NOT result in additional spending on souvenirs, jewelry, handicrafts and the like since according to general research, most tourists are believed to have a set spending limit on such items irrespective of the time spent in an area.

TABLE 10 ECONOMIC IMPACTS OF INCREASED AND LENGTHENED TOURIST VISITATIONS

Tourism	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir + Indir
Output	2,705,000	$424,402	$467,084	**$891,486**	$856,477
Material Inputs	$831,158	$226,864	$309,670	**$1,367,692**	$459,685
GDP	$873,373	$197,538	$157,406	**$1,228,317**	$396,792
Employment (FTE)	18.0	2.7	1.3	**21.9**	5.8
Wages & Salaries	$533,599	$105,942	$85,344	**$724,885**	$221,230
Benefits	$43,997	$8,864	$7,138	**$59,999**	$25,573
Total Gov't Revenues	$138,770	$30,340	$37,204	**$206,314**	$54,410
Federal	$73,782	$15,460	$15,995	**$105,237**	$29,420
Net Indirect Taxes	*$21,015*	*$3,613*	*$3,520*	***$28,148***	*$5,040*
Personal Income Taxes	*$52,767*	*$11,847*	*$12,475*	***$77,089***	*$24,380*
NWT/Provincial	$64,988	$14,880	$21,209	**$101,077**	$24,990
Net Indirect Taxes	*$44,233*	*$10,220*	*$15,488*	***$69,941***	*$15,400*
Personal Income Taxes	*$20,755*	*$4,660*	*$5,721*	***$31,136***	*$9,590*

The increase in tourism will be sustained over the 45-year life of the AWR. Table 11 on the next page displays the total impacts on the NWT economy from this increase (using a Net Present Value discounted by 5% over a 45-year period). The NPV increase in NWT GDP over this period is estimated at $21 million, and government revenues up by $3.5 million. In the rest of Canada, GDP increases by another $7 million and government revenues rise by almost $1 million.

TABLE 11 NPV OF ECONOMIC IMPACTS OF INCREASED AND LENGTHENED TOURIST VISITATIONS

NVP Tourism	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$46,415,070	$7,282,310	$8,014,690	$15,297,000	$14,696,288
Material Inputs	$14,261,702	$3,892,722	$5,313,576	$23,468,000	$7,887,662
GDP	$14,986,427	$3,389,604	$2,700,969	$21,077,000	$6,808,658
Employment (FTE)					0
Wages & Salaries	$9,155,803	$1,817,815	$1,464,382	$12,438,000	$3,796,002
Benefits	$755,294	$152,168	$122,538	$1,030,000	$439,015
Total Gov't Revenues	$2,381,059	$520,583	$638,358	$3,540,000	$933,584
Federal	$1,266,192	$265,313	$274,494	$1,806,000	$504,884
Net Indirect Taxes	$360,603	$61,997	$60,401	$483,000	$86,483
Personal Income Taxes	*$905,586*	*$203,318*	*$214,096*	*$1,323,000*	*$418,409*
NWT	$1,114,885	$255,270	$363,845	$1,734,000	$428,709
Net Indirect Taxes	*$758,920*	*$175,348*	*$265,733*	*$1,200,000*	*$264,223*
Personal Income Taxes	*$355,960*	*$79,922*	*$98,118*	*$534,000*	*$164,474*

2.2.6. TOTAL ECONOMIC IMPACTS (EXCLUDING MGP EFFECTS)

Building the Tuktoyaktuk to Inuvik 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. 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 12 presents the total economic impacts (over 45 years) in 2009 dollars due to 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 12 TOTAL ECONOMIC IMPACTS OF THE AWR EXCLUDING THE MGP

TOTAL NPV IMPACTS excluding the MGP	NWT				REST OF CANADA
	Direct	Indirect	Induced	TOTAL	Dir. + Indir.
Output	$341,073,070	$75,080,810	$70,901,410	**$421,282,220**	$176,496,770
Material Inputs	$166,941,842	$37,690,952	$43,790,746	**$248,423,540**	$96,970,502
GDP	$127,490,287	$35,281,884	$23,240,519	**$186,013,690**	$84,166,547
Employ (Initial Const.)	668.3	282.0	135.5	**1,085.8**	859.6
Employ (On-Going)	$33	$7	$3	**$42**	$9
Wages & Salaries	$82,818,283	$20,148,005	$12,654,482	**$115,621,770**	$44,008,660
Benefits	$5,890,974	$1,502,418	$935,318	**$8,328,710**	$5,431,783
Total Gov't Revenues	$24,468,549	$5,373,043	$5,748,718	**$35,590,310**	$10,966,205
Federal	*$14,815,632*	*$2,938,243*	*$2,424,744*	***$20,179,620***	*$6,062,648*
Net Indirect Taxes	*$2,191,603*	*$435,337*	*$560,351*	***$3,187,290***	*$1,007,001*
Personal Income Taxes	$12,626,026	$2,503,908	$1,863,396	**$16,992,330**	$5,056,250
NWT	*$9,655,935*	*$2,433,800*	*$3,322,955*	***$15,412,690***	*$4,903,634*
Net Indirect Taxes	*$3,646,570*	*$1,404,718*	*$2,462,493*	***$7,513,780***	*$2,914,649*
Personal Income Taxes	*$6,013,360*	*$1,028,082*	*$857,468*	*$7,898,910*	*$1,988,431*

Although the initial building the Inuvik-to-Tuktoyaktuk AWR will cost the Federal and Territorial government about $230 million, after subtracting the increase in government revenues resulting from the existence of the AWR, the net cost to the Federal and Territorial Governments will only be $184 million ($230 million minus total tax revenues of $46 million). When all economic spin-offs (direct, indirect, and induced impacts) are accounted for over the 45 year existence of the AWR, this investment will create about $248 million in net purchases of goods and services (material inputs) in the NWT and an additional $97 million in ROC. This results in a net increase in GDP in the NWT of $186 million and an increase in GDP in the rest of Canada of $84 million. Building the Inuvik-to-Tuktoyaktuk AWR will create 1,086 one-time jobs in the NWT and another 860 one-time jobs in ROC. In addition, the building of the AWR will create 42 long-term jobs in the NWT and another 9 in ROC. Building the AWR will earn the Federal and Territorial governments almost $36 million from activities in the NWT and an additional $11 million accruing to governments in ROC.

LIMITATIONS

In addition to increased tourism and trucking demand to accommodate additional spending by residents and businesses in Tuktoyaktuk, 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.[6] 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. Increased regional and territorial economic development stimulated by the greater efficiency and reliability of the highway network and reduced transportation costs.
2. Reduced sense of isolation due to improved connections between Inuvik and Tuktoyaktuk.
3. improved access to government services and employment opportunities.
4. increased opportunities for Aboriginal training, employment, business development, and equity investment.
5. Attracting new inward investment from outside the area (i.e., companies relocating to a given area).
6. Retaining existing companies in the area.
7. Promoting the import substitution and export success of companies located in the area by the provision of overland transport links to key markets.
8. Enhancing the competitiveness of the regional economy and thereby reducing storage, warehousing, and medical travel costs.
9. Increasing opportunities for social and cultural interaction and development through reduced isolation, increased mobility, and expanded learning and training opportunities.

[6] 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.

2.3. IMPACTS OF THE AWR ON THE PROPOSED MACKENZIE GAS PIPELINE

2.3.1. ANALYSIS OF THE IMPACTS OF THE AWR ON THE MGP

In our previous analysis of the proposed Mackenzie Gas Project (MGP), it was concluded that the full AWR would not impact initial construction costs of the Pipeline and its Gathering System; however, some cost savings were likely for future exploration and well development. For the oil and gas sector, these savings stem principally from a reduction in logistic costs associated with the more efficient use of rented drilling rigs, camps and their support equipment; and, a reduction in risk costs by not having to carrying excess inventory and compete for scarce resources and the accompanying price inflation. Concurrently, the existence of a full-length AWR facilitates the movement of rig equipment to/from Alberta during the non-drilling season rather than companies having to store rig equipment and thus incur storage costs and extended rig rental costs.

This portion of the study analyzes the impacts of the AWR on exploration and development savings for the MGP proponents' three anchor fields (Niglingtak, Taglu and Parsons Lake) and for contingent fields in the Basin Margin and Listric Fault regions. In this analysis, our assumption is that the Inuvik to Tuktoyaktuk AWR is a stand-alone road connected to the Dempster Highway. Under that assumption, there are no savings from enabling rigs to be moved to/from Alberta during the non-drilling season. Similarly, there are no savings on exploration and well development in those areas outside the Delta region (e.g., Colville Hills). Accordingly, further discussions with knowledgeable participants in the natural gas exploration and development industry have confirmed that there would be some logistic savings, but because of the location of the AWR vis-à-vis where most of the contingent wells will likely be developed; the savings would not be major.

Using oil and gas industry estimates, we have assumed that there would be savings of 5% in development costs for all fields, with the exception of Parsons Lake where, due to its location closer to the AWR, development costs would be reduced by 10%. These percentage reductions would also apply to on-going operating costs, which extend for the life of the field.

The savings realized by the existence of the Inuvik to Tuktoyaktuk AWR 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.

1. The first scenario assumes that the MGP gas flow remains at 1.2 bcf/day over the 45-year production period, but because of the AWR, exploration and development for the appropriate wells and associated on-going operating costs are reduced by the aforementioned percentages.

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

[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.

wells increases from a 1.2 bcf/day Base Case with 435 wells to a 1.8 bcf/day scenario with 648 wells).[8]

2.3.1.1. FINANCIAL IMPACTS

1.2 BCF/DAY CAPACITY PIPELINE

Based on a 1.2 bcf/day capacity pipeline and the estimated reduction in overall logistics costs with the AWR, future exploration and well-development costs are reduced by an estimated $385 million ($2009 dollars, discount rate of 5 percent) over the 45-year operating period of the pipeline. 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 company cash flows. It is estimated that after-tax cash flows going to corporations will increase by $347 million over the 45-year period (impacts are highlighted in Table 14). This will have the effect of increasing company Internal Rate of Return (IRR) by roughly 0.7 percent.

2. Because of the AWR total revenues to governments will increase by some $20.7 million ($2009 dollars, discounted at 5 percent), although, due to the vagaries of royalty legislation, the Federal Government will increase its revenues by $29.6 million, and the NWT will see its revenues drop by $8.9 million. It is expected that the Federal and NWT Governments will sign a royalty-sharing agreement, and therefore it is likely that the AWR will result in an increase in revenues flowing to the GNWT. [9]

Table 13 below describes the impacts of the two Base scenarios (a 1.2 bcf/day pipeline and a 1.8 bcf/day pipeline) along with two impact scenarios that include the AWR. The differences in the two gas export scenarios, each with an AWR, are highlighted in Table 14.

TABLE 13 IMPLICATIONS OF AWR ($2009 CONSTANT)

	GLJ Base Case Without AWR (1.2 Bcf)	With AWR (1.2 Bcf)	Base Case Without AWR (1.8 Bcf)	With AWR (1.8 Bcf)
PRE-TAX CASH FLOWS	$38,886.1	$39,279.6	$56,754.8	$57,338.9
Pre-Tax Tax IRR*	28.3%	29.0%	25.1%	25.8%
AFTER-TAX CASH FLOWS	$24,124.3	$24,495.6	$31,649.8	$32,202.5

[8] 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 analysis submitted to the Joint Review Panel in 2007, we augmented GLJ's 1.2 bcf/day scenario with a 1.8 bcf/day production forecast produced by Sproule Associates. The present analysis includes two 1.8 bcf/day scenarios: a Base 1.8 bcf/day scenario, which excludes any AWR impacts, and a 1.8 bcf/day with the Inuvik-to-Tuktoyaktuk AWR. The difference between these two scenarios is the impact of the AWR, given that the AWR is not necessary for an expanded pipeline.

[9] 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.

	GLJ Base Case Without AWR (1.2 Bcf)	With AWR (1.2 Bcf)	Base Case Without AWR (1.8 Bcf)	With AWR (1.8 Bcf)
After-Tax IRR*	**20.6%**	**21.4%**	**17.8%**	**18.5%**
TAXES	**$25,521.9**	**$25,544.1**	**$35,917.5**	**$35,948.9**
Federal Royalties	$12,101.8	$12,133.5	$18,656.1	$18,700.5
Field Income Taxes	$8,780.1	$8,770.6	$12,625.8	$12,612.8
- to Canada	*$5,325.6*	*$5,319.9*	*$7,658.3*	*$7,650.4*
- to NWT & Alb	*$3,454.5*	*$3,450.7*	*$4,967.5*	*$4,962.4*
Pipeline Income Taxes	$4,640.0	$4,640.0	$4,635.6	$4,635.6
- to Canada	*$2,622.3*	*$2,622.3*	*$2,619.6*	*$2,619.6*
- to NWT & Alb	*$2,017.7*	*$2,017.7*	*$2,015.9*	*$2,015.9*

Table 13 above describes the impact of building the Inuvik to Tuktoyaktuk portion of the AWR on the financial characteristics of the two MGP scenarios – one based on a pipeline with a 1.2 Bcf/day capacity and the second based on a pipeline with a 1.8 Bcf/day capacity.[10] In order to clearly identify the impacts of building the AWR, Table 14 below details the same impacts as displayed in Table 13, but in this case in terms of differences with the same pipeline scenario without the AWR.

TABLE 14 DIFFERENCES BETWEEN 1.2BCF AN1.8BCF WITH AN AWR

	GLJ Base Case With AWR (1.2 Bcf)	GLJ Base Case With AWR (1.8 Bcf)
PRE-TAX CASH FLOWS	**$367.2**	**$545.0**
Pre-Tax Tax IRR*	**0.7%**	**0.7%**
AFTER-TAX CASH FLOWS	**$346.5**	**$515.7**
After-Tax IRR*	**0.7%**	**0.6%**
TAXES	**$20.7**	**$29.3**
Federal Royalties	$29.6	$41.5
Field Income Taxes	-$8.9	-$12.1
- to Canada	*-$5.4*	*-$7.4*
- to NWT & Alb	*-$3.5*	*-$4.8*
Pipeline Income Taxes	$0.0	$0.0
- to Canada	*$0.0*	*$0.0*
- to NWT & Alb	*$0.0*	*$0.0*

[10] The difference in pipelines lies mainly with added compression (with attendant additional costs) which results in a higher gas pressure. The actual size and configuration of the pipeline is not different.

1.8 BCF/DAY CAPACITY PIPELINE

Based on a 1.8 bcf/day capacity pipeline and the estimated percent reduction in overall logistics costs with the AWR, future exploration and well development costs are reduced by an estimated $572 million ($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 $516 million over the 45-year period. This will have the effect of increasing the Internal Rate of Return (IRR) to corporations by roughly 0.6 percent.

2. Total revenues to governments with the AWR will be $29.3 million greater compared to the 1.8 bcf/day pipeline without the AWR. Of total government revenues, $41.5 million will go to the Federal Government via an increase in royalties, while corporate income taxes to both the Federal Government and to the Government of the NWT will actually fall by $12.1 million. It is expected that the Federal and NWT Governments will sign a royalty agreement which would result in part of the royalty revenues flowing to the Government of the NWT, and therefore the tax impacts on both Governments will be positive.

2.3.1.2. ECONOMIC IMPACTS

The above analysis described the implications of building the Inuvik to Tuktoyaktuk section of the AWR on the financial characteristics (i.e. the implications on corporate returns) of the MGP. At the same time as their impacts on corporate financial returns, there are broader economic implications of the AWR on the economy of the NWT, which is what this section addresses.

1.2 BCF/DAY CAPACITY PIPELINE

Based on a 1.2 bcf/day capacity pipeline, the construction of the Inuvik to Tuktoyaktuk AWR affects the MGP by reducing exploration and well development costs by $385 million (discount rate of 5 percent) over the 45-year operating period of the pipeline. In economic terms (as opposed to the financial effects on corporations 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 **Error! Reference source not found.** 4, this reduction in spending by the oil and gas sector will result in the following:

1. Less buying and selling: Less buying and selling in the amount of $385 million over the 45-year period will result in the NWT accumulating $94.5 million less in GDP.

2. Fewer person-years of employment: With less buying and selling, it is estimated that over 45 years, there will be 4,811 (1,127 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 $65.4 million ($21.4 million in NWT revenues).

TABLE 15 ECONOMIC IMPACTS

	GLJ Base Case Without AWR (1.2 Bcf)	With AWR (1.2 Bcf)	Base Case Without AWR (1.8 bcf)	With AWR (1.8 Bcf)
TOTAL INVESTMENT	$27,093.3	$26,680.1	$34,109.7	$33,496.4
GROSS DOMETIC	$19,467.3	$19,189.8	$24,239.0	$23,827.1

	GLJ Base Case Without AWR (1.2 Bcf)	With AWR (1.2 Bcf)	Base Case Without AWR (1.8 bcf)	With AWR (1.8 Bcf)
PRODUCT (GDP)				
Rest of Canada	**$9,911.4**	**$9,735.2**	**$12,818.5**	**$12,556.8**
NWT	**$9,555.9**	**$9,454.7**	**$11,420.5**	**$11,270.3**
LABOUR INCOME	**$9,597.5**	**$9,435.6**	**$12,318.8**	**$12,078.6**
Rest of Canada	**$6,428.0**	**$6,312.4**	**$8,331.4**	**$8,159.9**
NWT	**$3,169.5**	**$3,123.2**	**$3,987.4**	**$3,918.6**
EMPLOYMENT (jobs)	**312,446**	**307,291**	**391,284**	**383,967**
Rest of Canada	**234,030**	**230,082**	**293,969**	**288,367**
NWT	**78,416**	**77,208**	**97,314**	**95,600**
GOVERNMENT REVENUES	**$3,917.0**	**$3,846.9**	**$5,072.7**	**$4,968.7**
Rest of Canada	**$2,694.6**	**$2,647.5**	**$3,476.4**	**$3,406.4**
- Federal	*$1,743.7*	*$1,712.9*	*$2,254.1*	*$2,208.3*
- Provincial	*$950.9*	*$934.6*	*$1,222.3*	*$1,198.2*
NWT	**$1,222.3**	**$1,199.4**	**$1,596.3**	**$1,562.3**
- Federal	*$908.8*	*$891.4*	*$1,191.1*	*$1,165.2*
- Prov/Territorial	*$313.5*	*$308.0*	*$405.2*	*$397.1*

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. Less buying and selling: Less buying and selling in the amount of $572 million over the 45-year period will result in the NWT accumulating $140.2 million less in GDP.

2. Fewer person-years of employment: With less buying and selling, it is estimated that over 45 years, there will be 6,827 (1,600 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 $97.1 million ($31.8 million in NWT revenues).

In order to clearly identify the economic impacts of building the AWR, Table 16 below details the same economic impacts as displayed in Figure 3, without the AWR. Figure 3 above describes the impact of building the Inuvik-to-Tuktoyaktuk portion of the AWR on the economics of the two MGP scenarios – one based on a pipeline with a 1.2 Bcf/day capacity and the second based on a pipeline with a 1.8 Bcf/day capacity.

TABLE 16 WHAT AN AWR DOES FOR THE 1.2BCF AND THE 1.8BCF BASE CASE MGP SCENARIOS

	GLJ Base Case With AWR (1.2 Bcf)	GLJ Base Case With AWR (1.8 Bcf)
TOTAL INVESTMENT	**-$385.5**	**-$572.3**
GROSS DOMETIC PRODUCT (GDP)	**-$259.0**	**-$384.4**
Rest of Canada	**-$164.5**	**-$244.2**
NWT	**-$94.5**	**-$140.2**
LABOUR INCOME	**-$151.1**	**-$224.2**
Rest of Canada	**-$107.8**	**-$160.0**
NWT	**-$43.2**	**-$64.2**
EMPLOYMENT (jobs)	**-4,811**	**-6,827**
Rest of Canada	**-3,684**	**-5,228**
NWT	**-1,127**	**-1,600**
GOVERNMENT REVENUES	**-$65.4**	**-$97.1**
Rest of Canada	**-$44.0**	**-$65.3**
- Federal	*-$28.8*	*-$42.8*
- Provincial	*-$15.2*	*-$22.5*
NWT	**-$21.4**	**-$31.8**
- Federal	*-$16.3*	*-$24.1*
- Prov/Territorial	*-$5.1*	*-$7.6*

TABLE 17 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*

3. TOTAL ECONOMIC IMPACTS

The MGP Economic impacts affect GDP, Incomes and Taxes while the MGP Financial impacts relate to profits and taxes. Combining all non-MGP impacts and MGP impacts (in GDP, in Labour income, in Taxes) provides a comprehensive picture of the potential impacts of building the Inuvik-to-Tuktoyuktak AWR. These comprehensive impacts are displayed in Table 18 below.

TABLE 18 TOTAL ECONOMIC AND FINANCIAL IMPACTS

TOTAL NPV IMPACTS	NWT	REST OF CANADA	TOTAL CANADA
	All Impacts	Dir. + Indir.	
MGP Profits (increase)	$346,452,555		**$346,452,555**
GDP	$91,553,744	-$80,325,032	**$11,228,712**
Employ (Initial Const.)	1,028.6	807.5	**1,836.1**
Employ (On-Going)	-1,085.1	-3,674.9	**-4,760.0**
Labour Income	$80,715,792	-$58,375,168	**$22,340,623**
Total Gov't Revenues	$34,922,135	$5,431,783	**$40,353,918**
Federal	*$28,134,698*	*-$22,760,477*	***$5,374,221***
NWT/Other Provinces	*$6,787,436*	*-$10,278,448*	***-$3,491,012***

Again, the reader is cautioned that the above impacts are highly influenced by the impacts on the MGP which, increasing corporate profits considerably, generally reduce GDP, Incomes and taxes because of the

effect on more efficient logistics. The building of the AWR with the concomitant positive impacts on profits may however be an important inducement to the (as yet unconfirmed) decision to construct the MGP. Furthermore, while the immediate impacts of the AWR on the MGP have been accounted for in this analysis, the presence of the AWR and the basin-opening MGP could have a profound influence on a myriad of economic opportunities available to local individuals and companies.

4. 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 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.).[11] 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.[12] However, since the base information is coming from financial statement

[11] 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*.

[12] 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

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.[13]

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.

[13] *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 B OIL AND GAS INDUSTRY INTERVIEWS

Bob Ball, BP Operations Manager, North American Arctic Exploration, (per. com. 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 with exploration drilling and concludes with 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 an impact except for in logistics and its associated costs. Current constraints include the Ft. 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 Tuktoyuktuk 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 effect 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 Tuktoyuktuk; supplies that will have already mobilized to Tuktoyuktuk by barge. Helicopters transport crew changes between the ships and Tuktoyuktuk. A port harbour connected by a 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 latter 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 an 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% 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 Tuktoyuktuk to support the level of activity that will occur and the type of vessels that will be frequenting the Beaufort Sea ii) National sovereignty and security.

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

Scheduling is the key driver in an exploration/development program. With that in mind, the key question is how will an AWR affects scheduling (as it will probably not effect project scope). An 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%-40% of exploration and production costs (in the Delta it is between 40%-50% 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 are less expensive. An AWR will not eliminate or reduce the need to carry redundant equipment during exploration and therefore will not effect exploration costs too much. However, if a company is in its development and production phase an AWR will reasonably reduce logistics costs by 15%.

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 time (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 increase the community costs for those resources by as much as 25%. 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.

Rod Maier, Manager, Frontier Development, and Doug Connon, Mackenzie Delta Coordinator Chevron Canada Ltd. (per. com. 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 Tuktoyuktuk, the AWR will not profoundly reduce Chevrons 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 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. There will still be some restrictions in the Delta, as logistics will still rely on seasonal transportation to and from the Delta to the AWR staging point in Inuvik. The benefit may be more profound further 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 be 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.

From a broader socio-economic 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 more 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 50-60 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 (per. com. 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 use of drilling rigs involves the following steps:

1. 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 land 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.
2. 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.
3. The successful firm (upon finding a hydrocarbon resource) obtains authorizations and negotiates benefits agreements (Government, landowners) to undertake drilling. This can take upwards of 1 year.
4. 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 be 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.
5. 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, the rig dismantled, moved, and reconstructed.

An 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 near by and no community objections to constructing all season access roads off the main highway system, drilling can happen all 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.

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