North Yukon
Conceptual Oil and Gas Development Scenario
And
Local Benefits Assessment

Prepared for:
North Yukon Oil and Gas Working Group

Prepared by:

Fekete Associates Inc.
and
Vector Research

Fekete Associates Inc.

Vector Research

Reservoir Engineering & Geology - Oil & Gas Property Evaluation - Well Test Interpretation - Software Development

November 23, 2005

Yukon Government
Oil and Gas Management Branch
Suite 300, 211 Main Street
3rd Floor Shopper's Plaza
Box 2703
Whitehorse, YT
Y1A 2C6

Attention: Mr. John Masterson
Director

Dear Sir:

Re: North Yukon
Conceptual Oil and Gas Development Scenario
And Local Benefits Assessment

As per the terms of contract Yukon Government contract # 531-402001-0207, we submit our completed report (attached).

Should you have any questions, please contact David Dunn at 1-800-625-2488.

Yours truly,

FEKETE ASSOCIATES INC.

"original signed by"

David W. Dunn, P.Eng.
Vice President

VECTOR RESEARCH

"original signed by"

Paul Kishchuk, B.A. M.A.
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DWD/

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North Yukon
Conceptual Oil and Gas Development Scenario
And Local Benefits Assessment

Executive Summary

- This report presents a development scenario that the authors deem reasonable given the current information available. Actual development will inevitably evolve differently as wells are drilled and new discoveries are made. The intent of this report is not to construct a definitive plan, but to project plausible levels of oil and gas activities and then assess the local benefits and challenges to the Yukon people.
- Development scenarios in this report are based on the resource estimates previously prepared by the Yukon Geological Service ("YGS")
- Of the six North Yukon geological basins, Eagle Plain has the greatest potential for development and is the focus of this report. Peel Plateau is secondarily addressed.
- The YGS study identifies a gas resource of 5.39 Tcf at Eagle Plain, enough to supply as 20" gas pipeline for more than 20 years.
- Development of the North Yukon gas resources depends on prior construction of the Mackenzie Valley Pipeline ("MVP") or the Alaska Highway Pipeline Project ("AHPP").
- The optimal pipeline route for a North Yukon Gas Pipeline is along the Dempster highway to connect with the Mackenzie Valley Pipeline at Inuvik.
- Start-up of the Mackenzie Valley pipeline is predicted to occur in 2014. North Yukon gas is predicted to begin flowing by 2017.
- Based on available geological data, it is predicted that exploration activity will be focused in the southeastern part of the Eagle Plain basin.
- Drilling activity is predicted to commence in earnest in 2008, once construction of the Mackenzie Valley Pipeline has been approved.
- A total of 873 wells are ultimately predicted to be drilled at Eagle Plain. Multiple directional wells are expected to be from pads, thereby reducing surface disturbance.
- Employment levels will peak at 1500 during pipeline construction. The on-going direct employment level is estimated to be 178 year-round positions plus another 153 jobs during winter. Secondary jobs are estimated to be 100 to 200.
- Royalty revenue from gas production is estimated to be 61.9 – 143.4 MM$ per year.
- Although Yukon and First Nations governments will receive significant royalty revenue, the bulk of the royalties will flow to the federal government. The major benefit of oil and gas development to the Yukon people is therefore not in the royalty revenue but rather in direct investment, local business development and ensuing taxes.
- Oil development may proceed separately from, and possibly in advance of, a gas pipeline. Oil production from Eagle Plain could conceivably meet much of the demand for refined petroleum products within the Yukon.
- A framework has been presented in which the socio-economic effects of oil and gas development can be weighed and considered with respect to the span, degree and timing of each effect.

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1 Introduction

In April 2005, the North Yukon Oil and Gas Working Group, comprised of representatives from the Yukon government, Vuntut Gwitchin First Nation, Trondek Hwech' First Nation and the First Nation of the Na-cho Nyak Dun, recommended that a consultant be hired to prepare a strategic overview of oil and gas prospects and the potential oil and gas development scenario in North Yukon. The objective of the strategic analysis is to enable the Yukon government and First Nations to collectively plan for future oil and gas development in North Yukon through examining the supply/demand scenario, development objectives, opportunities for community participation, short-term and longer-term benefits as well as constraints to development. The study may also serve to inform the North Yukon and Peel Watershed Land Planning Commissions.

2 Consulting Expertise

A consortium of Fekete Associates Inc. ("Fekete") and Vector Research ("Vector") were commissioned to prepare the strategic overview report.

Fekete is an independent consulting firm that provides engineering and geological services and software to the oil and gas industry. The company has been in business for over 30 years and employs a full-time staff of 126 engineers, geologists, technologists, programmers and support staff in its Calgary office. Fekete's expertise with respect to this project is the calculation of oil and gas volumes present underground, the estimation of production rates and the calculation of the economic value of the production, including royalties to governments/First Nations and netbacks to operators. Fekete undertook to conduct the Resource Assessment, Development Scenarios and Timeline, Local Market, Operating Environment and Yukon Benefits sections of the project scope. Principal authors were Fekete's Vice President, David Dunn, P.Eng. and Project Engineer, Jason Wilhelm, P.Eng.

Vector Research is an independent economic research consultancy based in Whitehorse, Yukon with expertise in five focus areas: Economic Effects and Project Assessment, Energy and Resource Policy, Public Finance and Northern Economics, First Nation Taxation and Finance, Strategic Planning and Performance Measurement.

Paul Kishchuk, President of Vector Research, holds BA and MA degrees in economics and has more than 14 years of experience in the fields of economics and public finance. He is a skilled researcher and analyst whether working with numbers or words and is adept at presenting findings in a clear manner in both written and presentation formats. Paul has successfully managed a wide variety of projects including intergovernmental initiatives. He is an experienced trainer having designed, constructed and delivered several workshops on research and finance-related topics.

Prior to moving to Whitehorse in 1992, Paul worked for the Office of the Comptroller General as well as the Department of Indian Affairs and Northern Development. Since 1992 he has worked in both government and private industry. When employed in government he was Senior Economist for Yukon Economic Development and Director of Revenue Services for Yukon Finance. While in private industry Paul has gained in-depth experience in energy and resource policy and an extensive understanding of the fiscal aspects of the Yukon First Nation land claim agreements. He has also been active in the fields of economic effects/project assessment, strategic planning and performance measurement.

Paul is an adjunct faculty member at Yukon College where he teaches introductory microeconomics and macroeconomics. He has also guest lectured in the University of Alaska Southeast's Master of Public Administration Program on various public finance topics. Vector undertook to write the Community Preparation section of the project scope.

3 Terms of Reference

The consultant's primary task was to synthesize and analyze existing information and data, although some original research was required, and to advise the North Yukon Oil and Gas Working Group and the OGMB of the potential North Yukon oil and gas development scenario over the next twenty years. Specifically, the consultant's mandate was to:

- Provide contextual information including operating environment both for industry and governments (Yukon, Yukon First Nations and Canada) and core assumptions needed to develop a sustainable and responsible oil and gas industry in North Yukon.
- Using existing oil and gas resource assessments provide an overview of North Yukon's oil and gas development production potential.
- Indicate the potential size and type of development with and without the Mackenzie and Alaska Natural Gas Pipelines. Information on pipeline development will be provided by the Business Development and Pipeline Branch. Based on this information, the consultant will provide an estimate of potential upstream oil and gas development, including seismic programs, wells, and potential projects.
- Indicate to what extent, if any, Yukon oil and gas development could supply the local market (for instance by natural gas and propane).
- Identify constraints to short and medium term oil and gas development in North Yukon.

To assist the North Yukon Oil and Gas Working Group in its planning, the consultant will:

- Indicate the potential benefits of oil and gas development to the North Yukon First Nation communities and Yukoners, in both short term (up to five years) and future scenarios i.e. employment and economic spin-offs.
- Indicate in which North Yukon basins, over a twenty year time period, the likely sequence in which development may occur.
- Indicate what communities can do to prepare for sustained and responsible oil and gas development i.e. capacity development, gaining the knowledge to make informed decisions, training for jobs, managing expectations (plans for potential bust or boom scenarios).

4 Scope of Work

The specific work plan was developed in conjunction with OGMB as follows:

Resource Assessment

- Tabular summary by basin/area/zone/well of oil and gas resources based on YGS/GSC reports (no new, independent reserve assignments).
- Ranking of basin/area/zone/wells by propsectivity for production and conditions precedent required for development.
- Short comparison of North Yukon resources versus Mackenzie Valley/North Slope.

Development Scenario

- Pipelines
    - Mackenzie Valley pipeline
    - Alaska Highway pipeline
    - Dedicated pipeline
    - other
- Seismic
- Drilling
- Roads
- Pipelines
- Facilities
- Production Forecasts

Local Market

- Summary of current energy demand by type, sources and delivery costs.
- Analysis of potential for energy replacement/supplementation including expected delivered cost including effect of major pipelines on assumptions.
- This work will rely on demand data to be provided by the Yukon government for the towns of Whitehorse, Faro, Old Crow and Dawson.

Operating Environment

- Expectations of industry based on southern learnings (solicit input from operators)
    - Oil and gas development regulations
    - Open access to data
    - Application process/forecastable timing
    - Royalties/taxes/local requirements
    - Land sale procedures/tenure
    - Infrastructure

- Pipeline access
- Conditions for continued production growth
- Risk mitigation

Yukon Benefits

♦ Economic Benefit
- Royalties
- Direct investment
- Jobs
  - Pipeline
  - Drilling
  - Seismic
  - Well Servicing
  - Road Construction
  - Gathering Pipelines
    - Operations
- Business Opportunities

Community Preparation

♦ Capacity Development

♦ Knowledge Capture

♦ Training

♦ Managing Expectations

♦ Boom/Bust scenarios

Constraints to Development

♦ Risk Analysis Workshop

Note that this section was contemplated in the original project scope but was later deleted from the project terms.

5 Certificates of Qualification

CERTIFICATE OF QUALIFICATION

I, David W. Dunn, certify that:

1. I graduated from the University of Alberta with a B.Sc. (Distinction) in Petroleum Engineering in 1982. I have in excess of 22 years experience in the petroleum industry.

2. I am a registered Professional Engineer in the Province of Alberta, Canada.

3. I am employed by the consulting engineering firm, Fekete Associates Inc., named as having prepared a report titled, "Conceptual Oil and Gas Development Scenario and Local Benefits Assessment, North Yukon Project" dated October 21, 2005.

4. I have no interest, directly or indirectly, in the Yukon Government or in the Yukon First Nations, nor in the properties evaluated. I do not expect to obtain any interest, directly or indirectly in the properties evaluated, nor in any securities pertaining thereto.

"original signed by"

David W. Dunn, P. Eng.

CERTIFICATE OF QUALIFICATION

I, Jason K. Wilhelm, certify that:

1. I graduated from the University of Saskatchewan with a B.Sc. in Chemical Engineering in 1996 and have in excess of 8 years experience in the petroleum industry.

2. I am a registered Professional Engineer in the Province of Alberta.

3. I am employed by the consulting engineering firm, Fekete Associates Inc., named as having prepared a report titled, "Conceptual Oil and Gas Development Scenario and Local Benefits Assessment, North Yukon Gas Pipeline Project" dated October 21, 2005.

4. I have no interest, directly or indirectly, in the Yukon Government or in the Yukon First Nations, nor in the properties evaluated. I do not expect to obtain any interest, directly or indirectly in the properties evaluated, nor in any securities pertaining thereto.

"original signed by"

Jason K. Wilhelm, P. Eng.

CERTIFICATE OF QUALIFICATION

I, Paul Kishchuk certify that:

1. I hold a Bachelors Degree in Economics from the University of Saskatchewan and a Masters Degree in Economics from Carleton University and have in excess of 14 years experience in the fields of economics and public finance.

3. I am employed by the consulting firm, Vector Research, named as having prepared a report titled, “Conceptual Oil and Gas Development Scenario and Local Benefits Assessment, North Yukon Gas Pipeline Project” dated October 21, 2005.

4. I have no interest, directly or indirectly, in the Yukon Government or in the Yukon First Nations, nor in the properties evaluated. I do not expect to obtain any interest, directly or indirectly in the properties evaluated, nor in any securities pertaining thereto.

“original signed by”

Paul Kishchuk

6 Limitations of Report

This report presents a development scenario that the authors deem reasonable given the current information available. Actual development will inevitably evolve differently as wells are drilled and new discoveries are made. The intent of this report is not to construct a definitive plan, but to project plausible levels of oil and gas activities and then assess the local benefits and challenges to the Yukon people.

This is a conceptual study, undertaken with the intent of thinking through the development process. This report therefore is neither comprehensive nor definitive in its scope and conclusions. It means to highlight issues for further discussion and action. It is understood that the results of this report will be used by the North Yukon Oil and Gas Working Group, and possibly other interested parties, as a basis for open discussion on planning for oil and gas development in North Yukon. For example, the focus area we have identified for seismic, wells, roads and pipelines comes from looking at the available underground geological and engineering data. Further planning will be necessary to integrate surface considerations such as ecosystems, First Nations lands and best practices into a comprehensive development plan.

7 Resource Assessment

7.1 Gas Resources – North Yukon Basins

Between November 2000 and June, 2005, the Yukon Geological Survey published a series of reports detailing the geology and resource potential of the North Yukon basins. The term "resource potential" refers to the total volumes of oil and gas that are inferred, from available geological and engineering data, to exist underground. Resource potential includes those volumes discovered to date plus those volumes that remain undiscovered.

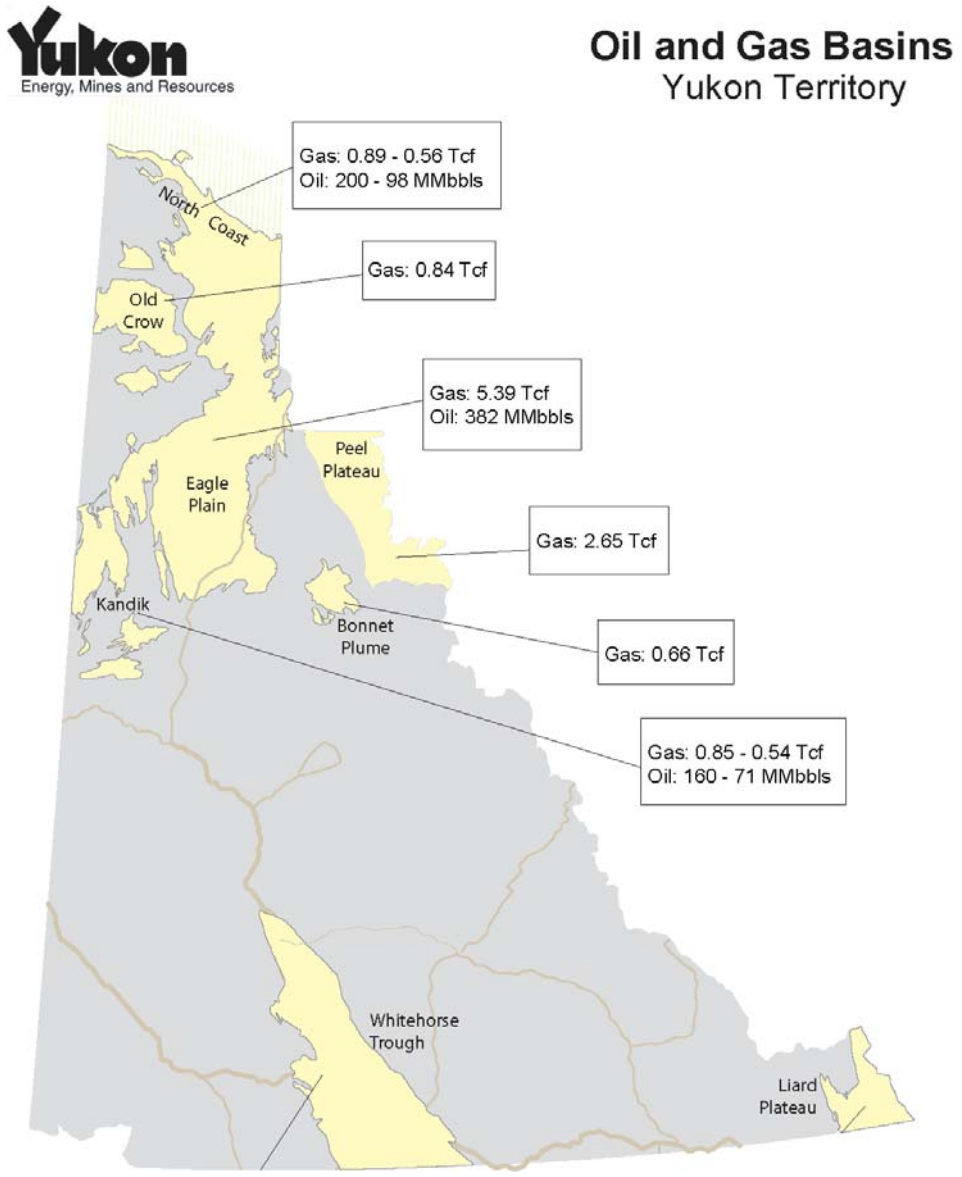


Figure 1: North Yukon Basins: Geographical Location and Resource Potential

Details of the gas resource potential, as determined by the YGS, is included in Table 1 below.

Basin and Play	Median Gas Reservoir Potential (Bcf)	Expected No. of Reservoirs	Median Largest Reservoir (Bcf)
Eagle Plain			
Permian, Jungle Creek Formation Sandstones stratigraphic gas	1,925	16	613
Carboniferous, Hart Creek Formation Sandstones and Carbonates stratigraphic gas	1,582	11	453
L. Paleozoic (Cambrian to Middle Devonian) Carbonates stratigraphic gas	801	20	192
L. Carboniferous Tuttle Formation Sandstones stratigraphic gas	304	18	65
L. Paleozoic (Cambrian to Middle Devonian) Carbonates structural gas	295	6	179
Cretaceous Sandstones structural gas	217	16	50
Cretaceous Sandstones stratigraphic gas	109	16	28
Carboniferous, Hart Creek Formation Sandstones and Carbonates structural gas	103	6	44
Permian, Jungle Creek Formation Sandstones structural gas	58	5	32
Sub-Total	**5,392**	**114**	**1,656**
Peel Plateau and Plain			
Peel Plain east of limit of deformation			
Mesozoic clastics	1,640	55	118
Upper Paleozoic clastics	237	9	48
Paleozoic carbonate platform [2]	5	1	5
Horn Plateau reef [3]	-	1	31
Peel Plateau west of limit of deformation			
Mesozoic clastics	424	12	101
Upper Paleozoic clastics	201	2	195
Paleozoic carbonate margin	138	7	47
Peel Plateau west of Trevor Fault			
Upper Paleozoic clastics [1]	-	1	4
Sub-Total	**2,645**	**88**	**550**
Kandik			
Paleozoic marine structural [4]	481	10	171
Mesozoic marine structural [5]	270	8	110
Tertiary / Upper Cretaceous nonmarine [6]	101	30	30
Sub-Total	**852**	**48**	**311**
Bonnet Plume			
Lower Paleozoic Carbonate / Shale Facies Transition	601	6	236
Upper Cretaceous-Tertiary Clastics	46	6	18
Upper Cretaceous-Tertiary Clastic Subthrust	15	2	11
Sub-Total	**662**	**14**	**264**
North Coast *			
Herschel [7]	508	5	252
Yukon Coastal Plain	299	3	212
South Delta-Paleozoic [8]	65	15	61
South Delta-Mesozoic [9]	15	8	14
Sub-Total	**886**	**31**	**539**
Old Crow **			
Upper Paleozoic carbonate	496	5	246
Kekiktuk conglomerate	345	5	150
Mesozoic clastics [10]	-	1	41
Sub-Total	**841**	**11**	**396**
Totals	**11,280**	**305**	**3,715**

* No allowance is made for portion of play within Ivvavik National Park and Herschel Island Territorial Park
** No allowance is made for portion of play within Vuntut National Park

1. Single accumulation expected with no median value predicted. Used mean play potential for median of largest pool.
2. Single accumulation expected. Used meadian play potential for median of largest pool.
3. Single accumulation expected with no median value predicted. Used mean play potential for median of largest pool.
4. Yukon encompasses 52% of total play area
5. Yukon encompasses 40 to 45% of total play area
6. Yukon encompasses 35% of play area
7. Yukon encompasses 81% of total play area
8. Yukon encompasses 2.5% of total play area
9. Yukon encompasses 2.5% of total play area
10. Single accumulation expected with no median value predicted. Used mean play potential for median of largest pool.

Table 1: North Yukon Basins Gas Resource Potential

To put the size of the resource potential into perspective, Table 2 below is a comparison of published resource potential from other northern areas.

Region	Pipeline	Resource Potential (Tcf)
Alaska North Slope[1]	AHPP	126.0
Mackenzie Delta/Beaufort Sea[2]	MVP	52.0
North Yukon	MVP or AHPP	11.3

Table 2: Resource Potential Comparison

The comparatively small size of the Yukon resource potential, in relation to the Alaska North Slope and the Mackenzie Delta/Beaufort Sea, means that development in the North Yukon is unlikely to proceed independently, but will depend upon being able to build a connecting pipeline to either the Mackenzie Valley Pipeline ("MVP") or the Alaska Highway Pipeline Project ("AHPP").

The resource size and the proximity of each of the North Yukon basins to potential pipelines were the two factors considered in estimating where oil and gas activity is likely to develop first. All of the basins are 250 km or more away from the closest anticipated pipeline routes for MVP and AHPP. To justify building a 250 km lateral, our estimate is that a minimum of 1 Tcf of gas would be required to guarantee a 20 year supply of gas. The resource potential of each of the North Coast, Old Crow, Bonnet Plume and Kandik basins falls below this threshold. In future, offshore development may increase the resources of the North Coast sufficiently to exceed the threshold. Also, coal-bed methane ("CBM") resources could increase the potential within the Bonnet Plume basin. The YGS study for Bonnet Plume notes the presence of extensive coals however no gas content data is available that permits an assessment of the CBM volumes at this time. Development of CBM is expected to follow conventional gas exploration, and is projected to occur more than 20 years in the future.

The Eagle Plain and Peel Plateau basins have the greatest resource potential and were therefore concluded to be the key areas for initial exploration. The proximity of Bonnet Plume to both Eagle Plain and Peel Plateau make it the logical choice as next-in-line for development.

7.2 Gas Resources – Eagle Plain

The YGS report on Eagle Plain is very recent, having been issued in June, 2005. The YGS assessment of the resource potential is significantly greater than previous estimates prepared by the National Energy Board ("NEB") and the Canadian Gas Potential Committee ("CGPC") and GLJ Petroleum Consultants. The GLJ numbers were available from their supply study report that was prepared for the MVP proponents.

[1] http://www.bp.com/sectiongenericarticle.do?categoryId=2011306&contentId=2016535
[2] "An Evaluation of the Economic Impacts Associated with the Mackenzie Valley Gas Pipeline and Mackenzie Delta Gas Development", Wright Mansell Research Ltd., pS2

A comparison of the GLJ and YGS gas-in-place (not gas resource) estimates for the Eagle Plain basin is shown in Table 3 below:

	Original Gas-in-Place		Original Oil-in-Place	
	GLJ	YGS	GLJ	YGS
Imperial	**Bcf**	**Bcf**	**MMbbls**	**MMbbls**
Low	293	2379	-	132
Best Estimate	607	6055	-	437
High	1183	12000	-	926

Table 3: Gas-in-Place Comparison, Eagle Plain Basin

To understand why the YGS resource numbers for Eagle Plain are higher than previous GLJ, NEB and CGPC studies, we quote from the YGS report as follows:

"Much of the difference in the assessed values results from differences in input parameters, most specifically the number of expected prospects and the prospect level risks. Comparisons indicated that the CGPC routinely produces more conservative estimates than the assessors employed to prepare this report. Since the differences arise from subjective interpretations, extrapolations and selection of analogues, it is impossible to vindicate one interpretation over the other. However, historical analysis of basins assessments and even the historical vindication of individual plays, as presented above in the methodology section, indicates that there is a tendency to be conservative in the estimate of undiscovered potential, that is not borne out historically.

Most notably, even the optimistic assessors of Western Canadian Sedimentary Basin crude oil and natural gas potential have found that the assessments of ultimate potential inferred between 10 and 20 years ago are now seen to be smaller that the established reserve, while the basin is still an active and successful target of continued exploration. Whether the estimates produced herein will also be shown to be conservative cannot be known now, but the trends of history, in basins with much more data and activity, suggest that assessments performed early in the exploratory history of a basin are a very conservative relative to the ultimate potential proved by decades of active exploration and thousands of wells. Certainly the numerous indications of petroleum in wells in the Eagle Plain Basin suggest that it should be considered a highly prospective region, which would tend to prefer the current assessment over the previous efforts…"[3]

Which number is correct? At this early stage of development, there is no "correct" number, just a range of estimates. The YGS study is the most comprehensive work to date, having taken two or more years to complete. GLJ did not have the benefit of the YGS report (the GJL report was issued in May 2005). Also, the MVP proponents have stated they do not wish to build a lateral pipeline to the Yukon and hence it is understandable that they may not have given GLJ a mandate to study the Yukon in depth. (see further discussion in the Pipelines Timeline and Regulations section of this report).

[3] YGS Open File 2005-2/GSC Open File 4922. pp 80-81.

We estimate that 1.9 Tcf of gas will be required to fill the North Yukon Gas Pipeline ("NYGP") for 20 years. Our view therefore is that, even if the YGS median gas resource estimate of 5.39 Tcf is optimistic, finding 1.9 Tcf is reasonable and we conclude that the eventual construction of NYGP is feasible.

This study used the YGS resource estimates in preparing the expected development scenario.

7.3 Gas Resources – Peel Plateau

With estimated gas resources of 2.6 Tcf, Peel Plateau has the potential for justifying the NYGP on a stand alone basis. The rugged topography in the Peel area suggests that development will lag Eagle Plain.

7.4 Oil Resources – Eagle Plain

Table 4 below is a summary of the potential oil resources within the Yukon as determined by the YGS. Note that Peel Plateau basin is not predicted to be oil-prone.

Basin and Play	Median Oil Play Reservoir Potential (MMbbls)	Expected No. of Reservoirs	Median Largest Reservoir (MMbbls)
Eagle Plain			
Permian, Jungle Creek Formation Sandstones structural oil	87	4	51
Carboniferous, Hart Creek Formation Sandstones and Carbonates structural oil	69	5	31
Carboniferous, Hart Creek Formation Sandstones and Carbonates stratigraphic oil	68	5	32
L. Carboniferous Tuttle Formation Sandstones stratigraphic oil	62	5	28
Cretaceous Sandstones structural oil	60	6	25
Cretaceous Sandstones stratigraphic oil	36	7	14
Sub-Total	**382**	**32**	**182**
Kandik			
Paleozoic marine structural [1]	85	3	72
Tertiary / Upper Cretaceous nonmarine [2]	76	30	23
Sub-Total	**160**	**33**	**94**
North Coast *			
Herschel [3]	195	5	98
South Delta-Mesozoic [4]	5	4	4
Sub-Total	**200**	**9**	**102**
Totals	**742**	**74**	**228**

* No allowance is made for portion of play within Ivvavik National Park and Herschel Island Territorial Park

1. Yukon encompasses 15% of total play area
2. Yukon encompasses 35% of total play area
3. Yukon encompasses 81% of total play area
4. Yukon encompasses 2.5% of total play area

Table 4: Eagle Plain and Peel Plateau/Plain Plays and Resource Potential

The oil resources are 44% of the size of the gas resources within the North Yukon, based on a conversion factor of 6.77 Mcf/bbl. Natural gas is the main attraction for producing companies and will form the backbone of development in North Yukon, but gas production will be dependant on a connecting pipeline to MVP or AHPP. Conversely, oil development will be dependant on local demand in the Yukon, albeit some of that demand may come from the construction of the NYGP.

8 Pipelines

8.1 Mackenzie Valley Pipeline

This report has been compiled between August and November, 2005 and, as such, reflects the current state of knowledge about the Mackenzie Valley Pipeline ("MVP") and Alaska Highway Pipeline Project ("AHPP") applications. Development of North Yukon gas resources is dependent on one of the two pipelines proceeding whereas development of the oil resources could proceed independently, without the need for any pipelines.

The MVP will be closer to Eagle Plain and is the more economical option however a tie-in to either MVP or AHPP is technically feasible.

The Mackenzie Valley Pipeline is a joint venture between Imperial Oil Ventures Limited, the Aboriginal Pipeline Group ("APG"), ConocoPhilips Canada (North) Limited, Shell Canada Limited and ExxonMobil Canada Properties (collectively called the Mackenzie Valley Pipeline Co-Venturers). TransCanada Pipelines ("TCPL") is providing funding to APG in return for rights to acquire an interest in the pipeline and future expansions as well as a financial return if the project goes ahead.

The MVP will be a 30 inch pipe extending 1220 km from Inuvik to northern Alberta where it will tie into the existing TCPL system (Figure 2). Initially the MVP will transport gas volumes of 1.2 Bcf/d with expansion capacity to 1.9 Bcf/d upon installation of additional compression. To put this in perspective, the pipeline will transport enough gas to heat between 5 and 8 million Canadian homes. In addition, a liquids pipeline will run parallel to the gas pipeline route from Inuvik to Norman Wells where it will connect with the existing oil pipeline. Total cost of the pipeline is estimated at $7.7 billion Cdn.

Figure 2: Proposed MVP Route[4]

[4] http://www.mackenziegasproject.com/theProject/

In a press release dated April 28, 2005 Imperial Oil, on behalf of the Mackenzie Valley Co-Venturers announced that all geotechnical, engineering and construction contract work was halted due to "insufficient progress on key areas critical to the project – the finalization of benefits and access agreements and the establishment of a clear regulatory process, including timelines". The benefits in question included hospitals, schools and other infrastructure to be built by MVP in First Nations communities. Imperial went on to express concern that the "Co-Venturers were being asked to assume responsibility for matters beyond the project scope and that they had asked the Canadian Federal and NorthWest Territories governments to take ownership of these matters".

Just before this report was finalized, Imperial Oil issued a press release on November 23, 2005, that it had "advised the National Energy Board" that, given recent progress in a number of key areas, the proponents are now ready to proceed to public hearings on the proposed project, with the expectation that recently negotiated benefits and access agreement terms with northern aboriginal groups will be fully ratified and executed in December 2005."[5]

8.2 Alaska Highway Pipeline Project

The Alaska Highway Pipeline Project is being promoted by the North Slope Producers Group consisting of BP, ExxonMobil and ConocoPhilips. Note that ExxonMobil and ConocoPhilips are also members of the Mackenzie Producers Group. The AHPP would consist of a 48 to 52 inch pipeline extending 2916 km from the gas fields at Prudhoe Bay in Alaska, through Fairbanks and Whitehorse and on through northeastern British Columbia to Boundary Lake on the British Columbia/Alberta border where the new pipeline will connect with the existing TCPL gas system (Figure 3).

Figure 3: Proposed AHPP route[6]

[5] http://www.mackenziegasproject.com/moreInformation/upload/MGP_readiness_112305.pdf
[6] http://www.emr.gov.yk.ca/pipeline/ahpp.html

Initial capacity on AHPP will be 4.5 Bcf/d with an ultimate capacity of 6.0 Bcf/d as compression is added. Costs are estimated to be in the order of $25 - 30 billion Cdn.[7]

Planning for the AHPP began in the 1970's. The "pre-build" portion of the line was built by Foothills Pipelines in the 1980's and 1990's from Caroline, Alberta to markets in eastern Canada and the US. Foothills is now wholly owned by TCPL who maintain that they still hold the rights, under the Northern Pipeline Act ("NPA") to build the remaining Canadian portion of the line through the Yukon and northern British Columbia. Regulatory approvals for the pipeline were issued under the NPA and, if implemented, would reduce the planning phase by 2 – 3 years, giving the AHPP a time advantage over MVP. Nonetheless, BP is questioning the validity of the now 30 year old NPA, and new hearings in front of the NEB may result, again delaying the project.

8.3 Pipeline Timeline and Regulations

Which pipeline will proceed first? Each has its own regulatory hurdles. The general consensus in the media is that MVP is closer to being constructed however, if delayed, AHPP could leap ahead. From the perspective of the development scenarios and prospective social benefits contemplated in this report, one of the two pipelines must be built first before a lateral can be constructed to connect northern Yukon gas to southern markets. Eventually both pipelines are expected to be built however the first will have a distinct advantage in meeting the immediate market demand and the laggard will likely be delayed for a number of years until market demand again exceeds supply. An extensive discussion of the North American supply/demand situation can be found in a report prepared by Navigant Consulting, Inc. and Environmental Analysis, Inc. in support of the MVP.[8]

The only certainty is that MVP and AHPP construction will be staged as there are not enough pipeline crews and steel mills to build both large-diameter pipelines at once. For the purposes of this study, it has been assumed that the MVP issues will be resolved by 2008 and that the pipeline will come on-stream in 2014. The AHPP pipeline has been assumed to come on-stream in 2018. The resulting timelines are shown in Figure 4.

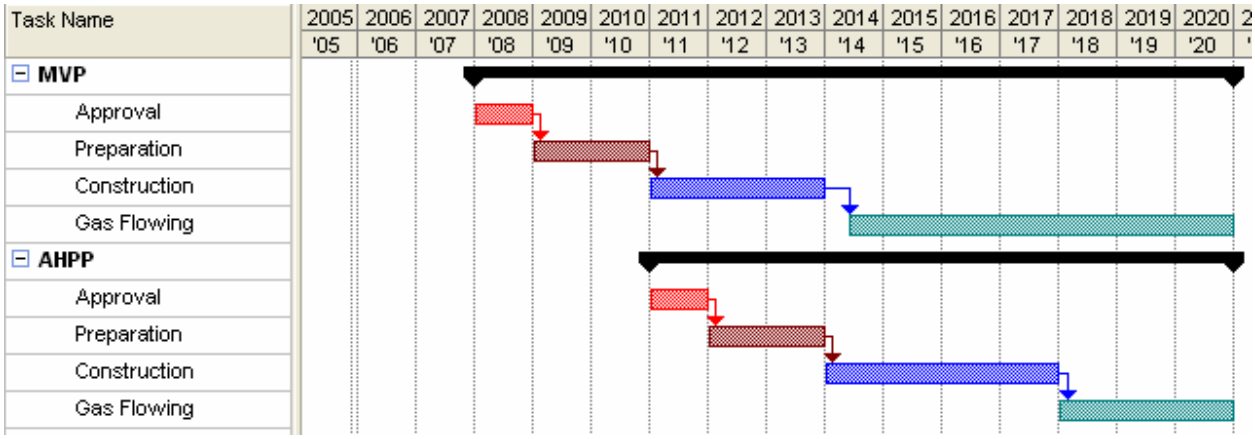


Figure 4: Pipeline Timelines

[7] http://www.camput.org/documents/Kvisle-paper.pdf
[8] http://www2.ngps.nt.ca/applicationsubmission/navigant.html

Two, inter-related, issues with respect to the MVP are key to development of North Yukon gas resources. The first is that the Yukon government has intervened in the MVP hearings, advocating that MVP should be regulated as a "basin opening" pipeline and that tariffs for any laterals such as the NYGP would be rolled into the rate base of the entire MVP system. MVP's opening position is that it is a dedicated pipeline for the Mackenzie Producers Group and that it will not contemplate building laterals. The Yukon government commissioned a report from Confer Consulting Ltd. that concluded that the public good was best served if costs for all extensions to the MVP were rolled into the rate base.[9]

The second, and greatest, issue of relevance to the Yukon at the MVP hearings is the estimated size of natural gas resources in the North Yukon. As discussed earlier in this report, the MVP proponents submitted a Gas Resource and Supply Study[10] prepared by GLJ Petroleum Consultants, an engineering consulting firm. The GLJ report, dated May 1, 2004, focused principally on the resource potential in the Mackenzie delta, offshore and Coleville Hills and briefly addressed Eagle Plain. They relied upon two previous geological and engineering studies, one conducted by the NEB in 2000 and another conducted by the Canadian Gas Potential Committee ("CGPC") in 2001. GLJ concluded that Eagle Plain "has been excluded at this time because the currently recognized resource potential is insufficient to support a separate, connecting pipeline". As part of its intervention in the NEB hearing, the Yukon government has submitted the YGS study to counter this argument.

8.4 North Yukon Gas Pipeline Routes

Four connecting pipeline scenarios have been contemplated and prioritized in Table 5:

Rank	Source	Destination	Connecting Pipeline	Distance (km)
1	Eagle Plain	Inuvik, NWT	MVP	350
2	Eagle Plain	Tok, Alaska	AHPP	513
3	Eagle Plain	Whitehorse, YT	AHPP	750
4	Eagle Plain	Little Chicago, NWT	MVP	400

Table 5: NYGP Route Options and Distances

The route from Eagle Plain to Inuvik would follow the Dempster highway and is the shortest, easiest and least expensive pipeline route however compression costs will be higher due to the higher operating pressure of MVP. Option 2 is an interconnect to AHPP with the shortest route being a connection at Tok, Alaska. Part of the route follows the Dempster Highway for 253 km to the Dawson junction and then follows the Top of the World Highway to Tok. Higher pipelining costs have been included for this steep portion of the route. Option 3 is a significantly longer tie-in to AHPP at Whitehorse but has lower costs per kilometer as it has less topographical relief and follows existing road allowances for its entire distance. It also has the benefit of retaining all of the infrastructure within the Yukon Territory. The last, and least likely option, is a direct connection to MVP at their first compressor site named Little Chicago, north of Fort Good Hope. In order for this option to

[9] https://www.neb-one.gc.ca/ll-eng/livelink.exe/fetch/2000/90464/90550/338535/338661/343078/345737/367972/A0R0Q7_-_Written_Evidence.pdf?nodeid=367979&vernum=0

[10] www2.ngps.nt.ca/applicationsubmission/Documents/MGP_GLJ_Final_Gas_Resources_and_Supply_Study_Contents_Set_3_S.pdf

have merit, significant reserves would need to be discovered at Peel Plain which would justify situating the major pipeline in that direction. Construction costs are significantly higher for this option as the route is across difficult terrain. The four option routes are illustrated in Figure 5.

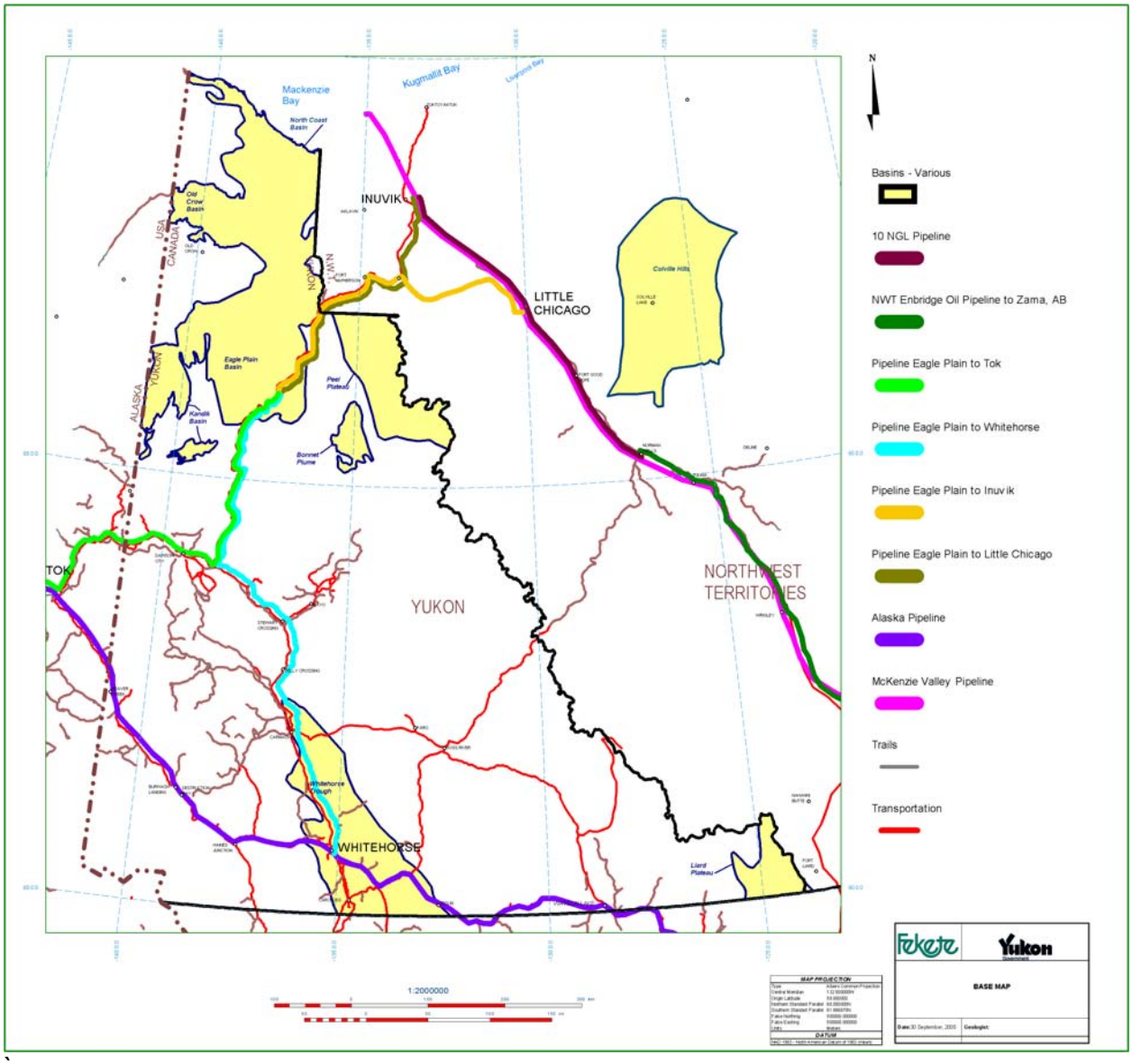


Figure 5: NYGP Route Options

8.5 North Yukon Gas Pipeline Size

A connecting pipeline from Eagle Plain to either MVP or AHPP is expected to be 12", 16" or 20" (305 mm, 406 mm or 508 mm) in diameter. Costs to prepare a pipeline right-of-way are a large portion of the costs and are the same regardless of the pipeline size. A pipeline smaller than 12" would have insufficient gas flow to justify the high right-of-way costs. At the other end of the spectrum, our view is that the size of the Eagle Plain resource, and the expected discovery rate, does not merit a pipeline larger than 20".

A computer simulation of the three pipeline pipeline options was undertaken using Fekete's F.A.S.T. Piper™ software to determine throughput and compression requirements. Pipeline operating pressure was assumed to be 12.4 MPa (1800 psi). By comparison, AHPP was

originally contemplated to operate at 14.1 MPa (2050 psi) but the final design pressure may be at higher. MVP has been designed to operate at 18 MPa (2610 psi).

Maximum gas rates were determined by imposing a maximum frictional pressure loss of 16.5 kPa/km (4 psi/mile) and one compressor station per 250 km. A base case was then run assuming the maximum gas rate was reduced by a factor of 1.6. Major pipelines are generally constructed with sufficient compression for the base case and then expanded by 1.6 times with the installation of additional compression to achieve the maximum gas rate. Both MVP and AHPP have been designed on this basis.

The resulting gas base and maximum gas rates are shown in Table 6 below:

Pipe Size	Case	Gas Rate (MMcf/d)
305 mm(12”)	Base	69
	Max	110
406 mm (16”)	Base	138
	Max	220
508 mm (20’)	Base	256
	Max	410

Table 6: Pipeline Sizes and Gas Rates

Pipelining and compression costs have been gathered from Fekete’s internal files and from published details for MVP. Costs vary according to the type of terrain, the size of the pipe and the amount of compression required. The results are summarized in Table 7:

Distances (km)	EP to Inuvik	EP to Tok	EP to WT	EP to LC
All Weather Road Distance	350	513	750	
Off Road Distance	0		0	400
Gas Rates (MMcf/d)				
305 mm (12") - Base	69	69	69	69
305 mm (12") - Max	110	110	110	110
406 mm (16") - Base	138	138	138	138
406 mm (16") - Max	220	220	220	220
508 mm (20") - Base	256	256	256	256
508 mm (20") - Max	410	410	410	410
Pipelining Costs (MM$)				
305 mm (12")	525	1,000	1,125	1,229
406 mm (16")	560	1,067	1,200	1,312
508 mm (20")	595	1,134	1,275	1,400
Compression Requirements (HP)				
305 mm (12") - Base	9,000	7,900	8,600	8,800
305 mm (12") - Max	17,300	21,200	24,800	16,800
406 mm (16") - Base	17,700	15,400	16,800	17,400
406 mm (16") - Max	34,400	37,300	43,500	32,300
508 mm (20") - Base	25,200	21,400	24,200	24,900
508 mm (20") - Max	51,400	65,100	77,800	49,300
Compression Costs (MM$)				
305 mm (12") - Base	81	71	77	79
305 mm (12") - Max	156	191	223	151
406 mm (16") - Base	159	139	151	157
406 mm (16") - Max	310	336	392	291
508 mm (20") - Base	227	193	218	224
508 mm (20") - Max	463	586	700	444
Total Costs (MM$)				
305 mm (12") - Base	606	1,071	1,202	1,308
305 mm (12") - Max	681	1,191	1,348	1,380
406 mm (16") - Base	719	1,206	1,351	1,469
406 mm (16") - Max	870	1,403	1,592	1,603
508 mm (20") - Base	822	1,326	1,493	1,624
508 mm (20") - Max	1,058	1,720	1,975	1,844
Cost/Rate (MM$/MMcf/d)				
305 mm (12") - Base	8.78	15.53	17.43	18.96
305 mm (12") - Max	6.19	10.83	12.26	12.55
406 mm (16") - Base	5.21	8.74	9.79	10.64
406 mm (16") - Max	3.95	6.38	7.23	7.29
508 mm (20") - Base	3.21	5.18	5.83	6.34
508 mm (20") - Max	2.58	4.19	4.82	4.50

Table 7: Pipeline Size Analysis

The conclusion is that a 508 mm (20” line) from Eagle Plain to an MVP connection at Inuvik is the most economically viable option with an initial rate of 256 Mcf/d and capacity to increase to 410 MMcf/d with additional compression.

This report does not advocate a 508 mm (20”) pipeline as the only economic option, merely that it appears to be a reasonable choice and reflects the type of activity that may be expected in North Yukon.

8.6 North Yukon Gas Pipeline Timeline

As discussed above, MVP is projected to come on-stream in 2014. We expect that NYGP will tie into MVP as it is the closer, less expensive and earlier option. We estimate an on-stream date of 2017 for NYGP as this would give MVP sufficient time to install the additional compression required to handle the gas volumes flowing in from NYGP. We estimate that NYGP will deliver the base rate of 256 MMcf/d into MVP in 2017 and that the rate will increase to the maximum NYGP capacity of 410 MMcf/d in 2021.

Even if MVP comes on earlier, it will still take five years for gas development at Eagle Plain to be ready to justify proceeding to the approval process for the North Yukon gas pipeline, meaning that the earliest this could proceed would be 2011, or one year earlier than shown in Figure 6. Overall, the timelines may move forward or back by one or two years, but our estimate of the activity levels doesn’t change.

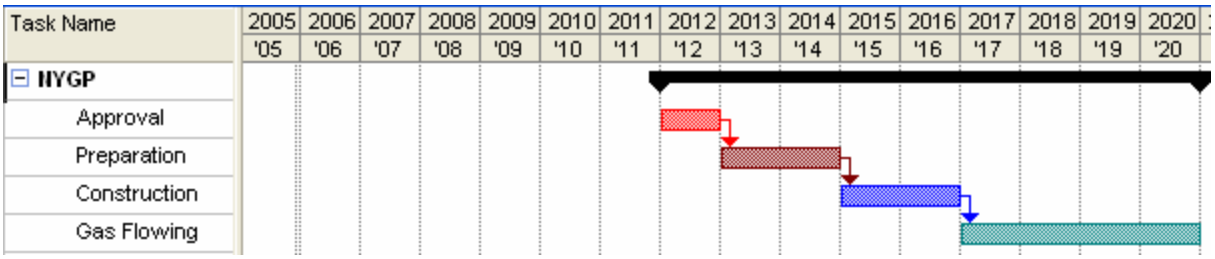


Figure 6: NYGP Timeline

9 Development Scenario

9.1 Operating Economics

Before considering where to drill, it is first necessary to conduct an economic test of whether the production of gas in North Yukon is profitable. This test evaluates whether gas producers can make an operating profit once the gas is on production. If this test fails, operators will not even consider drilling as they would not realize the positive cashflow needed to payout their investment in drilling, pipelines and facilities.

Table 8 below illustrates the operating netback calculation on a year by year basis. Beginning with the forecasted price of natural gas in the Alberta market (AECO Hub price from Fekete's price forecast), pipeline tariffs (Intra-Alberta, MVP and the estimated NYGP tariff) are deducted to yield a net sales price at Eagle Plain. After paying local compression/processing costs, the Yukon royalty of 10% is then calculated on the wellhead price. Finally, operating costs (fixed plus variable) are deducted to arrive at the net operating profit (right-hand column in Table 8). Fixed costs include wages and benefits, overhead and maintenance, items that do not fluctuate with production rates. Variable operating costs include consumables such as fuel.

The analysis shows that companies can expect to make an operating profit. Whether the operating cashflow is sufficient to payout the drilling investment will depend on how successful companies are in their exploration efforts, a question that is outside the scope of this study. What this analysis says is that the North Yukon has positive economics that will attract competitive exploration from numerous companies.

Note that the price for gas is forecasted to decline from the current level of $10.69/Mcf to a low of $6.80/Mcf in 2010, reflecting an expected softening of the supply/demand balance as new gas production is brought on-stream in response to the current high prices. Nonethless, the operating profit is predicted to be positive in all years. Production is not expected to commence until 2017 however if that timeframe is either accelerated or delayed, a positive cashflow remains attainable.

Year	Fekete AECO-C Gas Price Forecast	Tariffs ($/Mcf) Intra-Alberta	MVP	NYGP	Total Tariffs	Net Gas Price at Eagle Plain	Facilty/ Comp. Cost	Wellhead Price	Royalty @ 10%	Fixed Operating Costs[1,2]	Variable Operating Costs[2]	Total Operating Costs[2]	Net Operating Profit[3,4]
	$Cdn	$/Mcf	$/Mcf	$/Mcf	$/Mcf	$/Mcf	$/Mcf	$/Mcf	$/Mcf	$/well/month	$/Mcf	$/Mcf	$/Mcf
2005 (Q4)	10.69	0.31	1.29	0.45	2.05	8.64	$0.25	$8.39	0.84	$ 7,500.00	$ 0.60	$ 1.74	$ 6.90
2006	9.66	0.31	1.29	0.45	2.05	7.61	$0.25	$7.36	0.74	$ 7,725.00	$ 0.60	$ 1.64	$ 5.97
2007	8.57	0.31	1.29	0.45	2.05	6.52	$0.25	$6.27	0.63	$ 7,956.75	$ 0.60	$ 1.53	$ 4.99
2008	7.68	0.31	1.29	0.45	2.05	5.64	$0.25	$5.39	0.54	$ 8,195.45	$ 0.60	$ 1.44	$ 4.20
2009	6.80	0.31	1.29	0.45	2.05	4.75	$0.25	$4.50	0.45	$ 8,441.32	$ 0.60	$ 1.36	$ 3.40
2010	7.14	0.31	1.29	0.45	2.05	5.09	$0.25	$4.84	0.48	$ 8,694.56	$ 0.60	$ 1.39	$ 3.70
2011	7.49	0.31	1.29	0.45	2.05	5.45	$0.25	$5.20	0.52	$ 8,955.39	$ 0.60	$ 1.43	$ 4.02
2012	7.87	0.31	1.29	0.45	2.05	5.82	$0.25	$5.57	0.56	$ 9,224.05	$ 0.60	$ 1.47	$ 4.35
2013	8.26	0.31	1.29	0.45	2.05	6.22	$0.25	$5.97	0.60	$ 9,500.78	$ 0.60	$ 1.51	$ 4.71
2014	8.68	0.31	1.29	0.45	2.05	6.63	$0.25	$6.38	0.64	$ 9,785.80	$ 0.60	$ 1.55	$ 5.08
2015	9.11	0.31	1.29	0.45	2.05	7.06	$0.25	$6.81	0.68	$ 10,079.37	$ 0.60	$ 1.60	$ 5.47
2016	9.57	0.31	1.29	0.45	2.05	7.52	$0.25	$7.27	0.73	$ 10,381.75	$ 0.60	$ 1.64	$ 5.87
2017	10.04	0.31	1.29	0.45	2.05	8.00	$0.25	$7.75	0.77	$ 10,693.21	$ 0.60	$ 1.69	$ 6.30
2018	10.55	0.31	1.29	0.45	2.05	8.50	$0.25	$8.25	0.82	$ 11,014.00	$ 0.60	$ 1.75	$ 6.75
2019	11.07	0.31	1.29	0.45	2.05	9.03	$0.25	$8.78	0.88	$ 11,344.42	$ 0.60	$ 1.80	$ 7.22
2020	11.63	0.31	1.29	0.45	2.05	9.58	$0.25	$9.33	0.93	$ 11,684.76	$ 0.60	$ 1.86	$ 7.72

Notes:
1 Average well rate of 5.0 MMcf/d.
2 Assumes annual inflation rate of 3%
3 Net operating profit before (risked) capital investment for seismic, drilling, roads and pipelines.
4 All prices and costs in $Cdn

Table 8: Operating Netback Analysis

9.2 Drilling Fairways – Gas

Whereas it is the size of the North Yukon resources that justifies the construction of a gas pipeline, it is the distribution of the resources, both geographically and by depth, that will dictate the level of field activity including seismic, drilling, pipeline and road construction. The majority of the drilling will target gas plays.

Referring back to Table 1, the gas plays are categorized as structural and stratigraphic traps. Historically drilling has targeted the structural plays as they are easier to identify on seismic which explain why the wells drilled to date have been clustered around the two major structural highs at Chance and Blackie. While gas and oil have been discovered in these plays, the size of the individual pools discovered are relatively small. The YGS study concludes the larger targets are the stratigraphic plays, particularly in the Jungle Creek, Hart Creek and Tuttle Formations that occur at depths of 500 to 3500 metres (Figure 7), well within the capability of standard drilling rigs in western Canada.

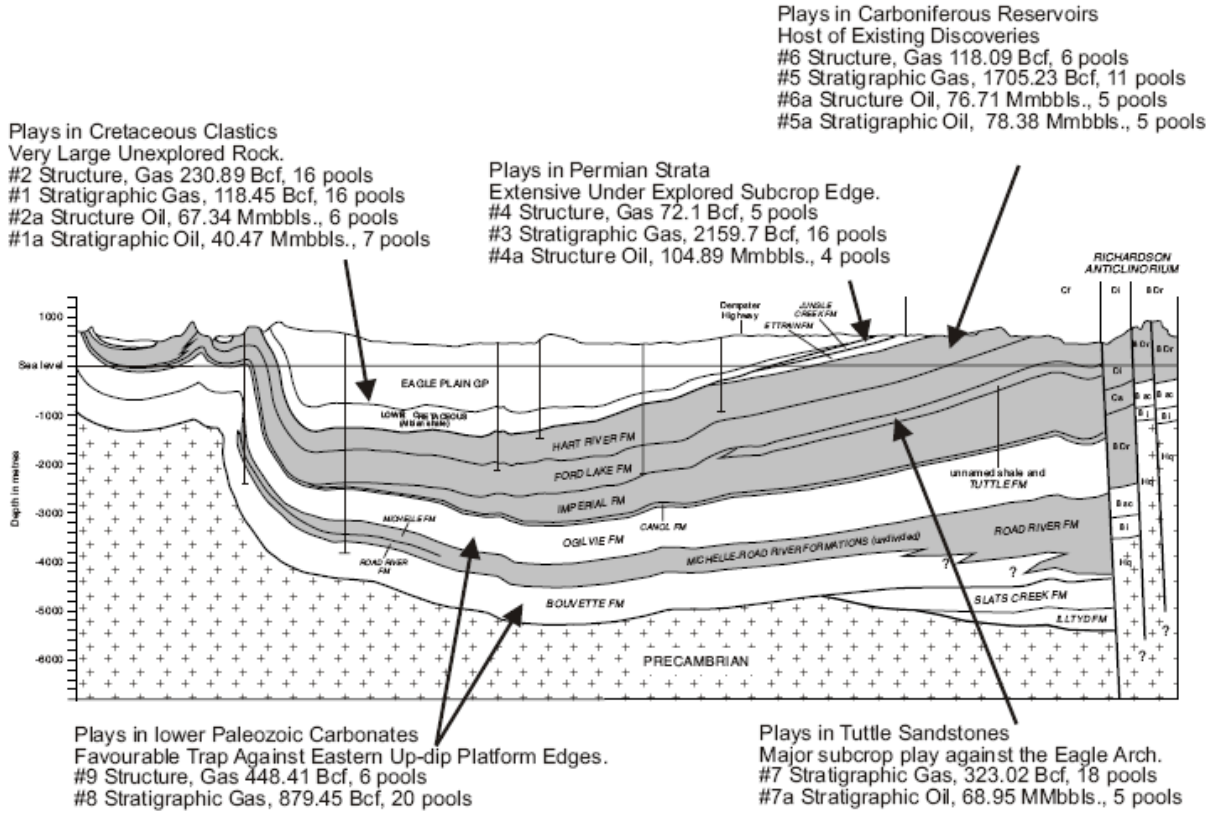


Figure 7: Eagle Plain Geological Cross Section [11]

Geographically, the Jungle Creek formation is limited to the Blackie area of the Eagle Plain basin, southeast of the Dempster Highway. The Hart Creek and Tuttle formations are also present in the Blackie area and the prospectivity of encountering multiple horizons in this area leads us to predict that it will be the prime area for drilling. From the southeast, drilling

[11] YGS Open File 2005-02: Figure 9

will progress through the discovered pools at Chance and will continue northward following the Hart Creek and Tuttle trends. Natural topographical obstructions consisting of the Porcupine River to the west and the Eagle River to the east are expected to focus drilling within this fairway (Figure 8).

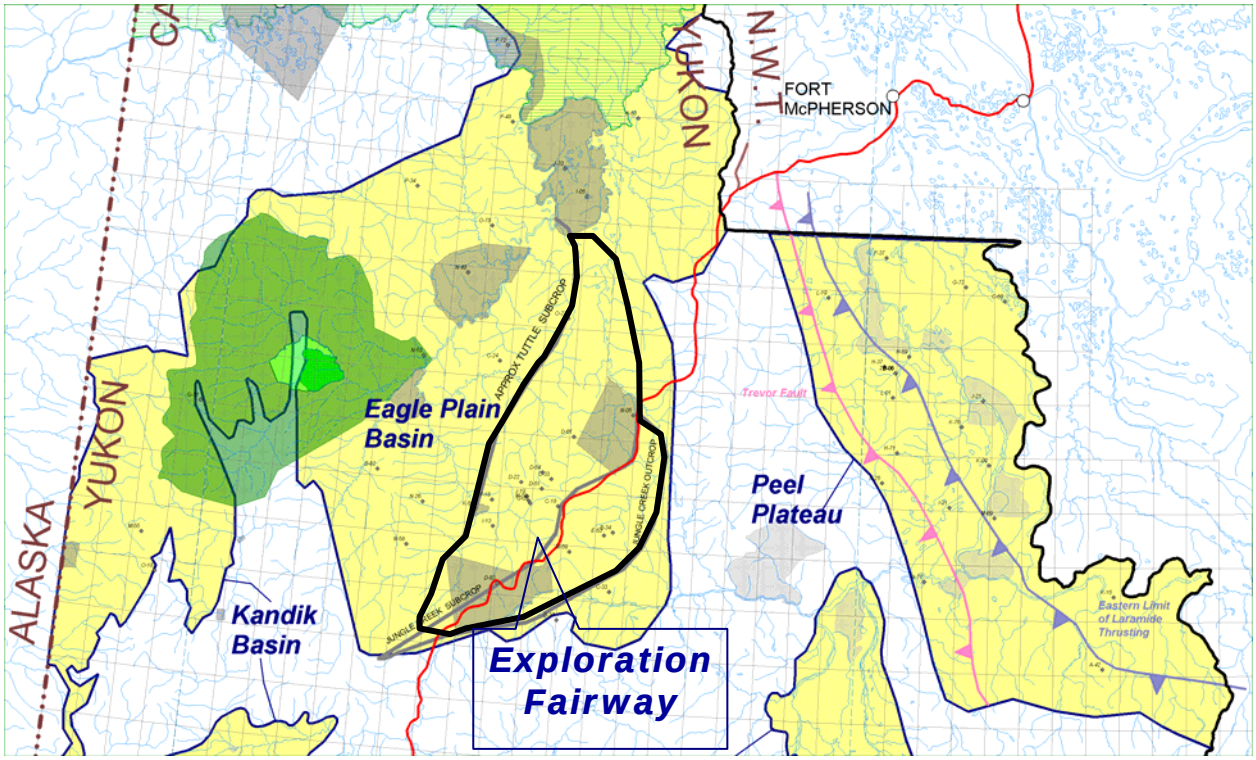


Figure 8: Exploration Fairway

9.3 Drilling Timeframe and Number of Wells – Gas

To date, 33 wells have been drilled at Eagle Plain and 19 at Peel Plateau/Plain within the Yukon and an additional 24 in the NWT. Much of this drilling occurred between 1957 and 1985. Drilling has been suspended due to the lack of a gas pipeline.

In order to contract for pipeline capacity, operating companies will need to be assured that they have sufficient gas reserves to deliver the fixed contract volume for 20 years. Our NYGP base case is 256 MMcf/d which, over twenty years, equals 1.9 Tcf. We predict that operating companies will drill exploration wells until they have discovered approximately half this amount, or 934 Bcf and have sufficient confidence that the remaining 934 Bcf can be discovered. At that time, we predict that drilling activity will cease until a pipeline is approved and operators are certain that any future wells can be produced.

The number of exploration wells required to discover 934 Bcf of gas depends on the drilling success rate, defined as the number of exploration wells that need to be drilled in order to discover one gas pool. The YGS study provides an indication of expected success rates by providing estimates of the number of prospects and number of pools in each formation as shown in Table 9.

Area	Play #	Formation	Play Type	Pools	Prospects	Exploration Success Rate	Delineation Success Rate	Development Success Rate
Eagle Plain	Play 1	Eagle Plain Gp	Stratigraphic	16	58	3.63	1.67	1.25
Eagle Plain	Play 2	Eagle Plain Gp	Structural	16	57	3.56	1.67	1.25
Eagle Plain	Play 3	Jungle Creek	Stratigraphic	16	55	3.44	1.67	1.25
Eagle Plain	Play 4	Jungle Creek	Structural	5	31	6.20	1.67	1.25
Eagle Plain	Play 5	Hart Creek	Stratigraphic	11	45	4.09	1.67	1.25
Eagle Plain	Play 6	Hart Creek	Structural	6	23	3.83	1.67	1.25
Eagle Plain	Play 7	Tuttle	Stratigraphic	18	113	6.28	1.67	1.25

Table 9: Drilling Success Rates

Once a pool is discovered by an exploration well, delineation wells are drilled to define the boundaries and confirm the size of the pool. When the pool is scheduled to be placed on production, additional development wells are drilled to provide sufficient gas flowrate to fill the pipeline on a daily basis. Delineation and development well success rates have been estimated by Fekete.

Finally, in our calculations we have estimated 1 in 6.66 wells will encounter more than one pool, as shown in Figure 9, thereby reducing the total number of wells needed.

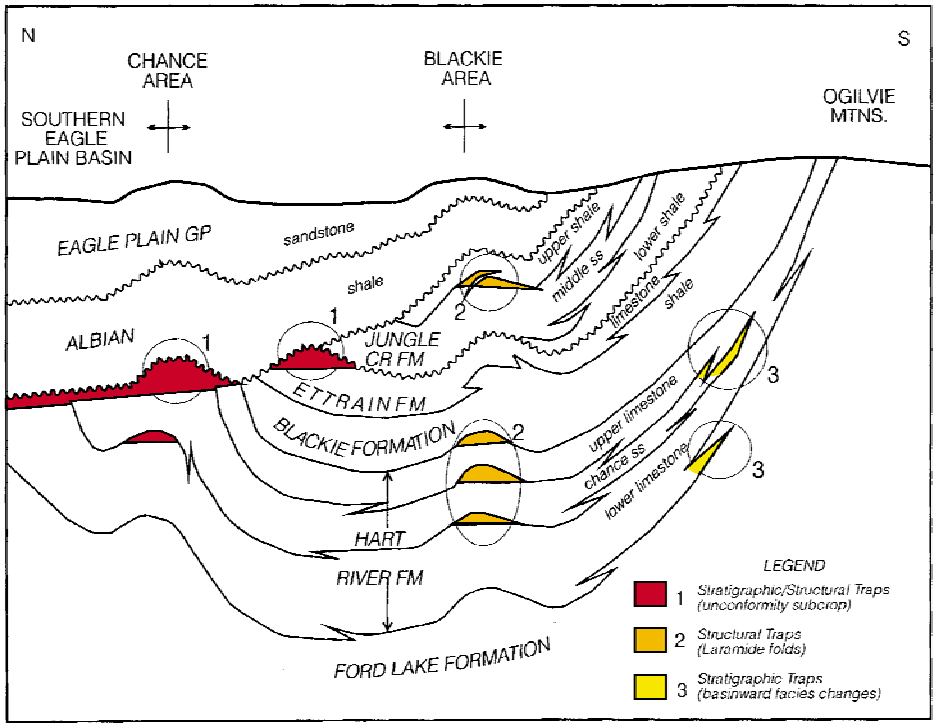


Figure 9: Illustration of stacked pools in Eagle Plain Basin[12]

[12] Source: Yukon OGMB

The YGS reports provide a statistical distribution of the size of the 114 gas pools at Eagle Plain, sorted by formation and pool size. Operating companies will drill the largest, least expensive (i.e. shallowest) targets first, however, there will be hits and misses. Modeling of the discovery sequence has been done by applying weighting factors to the formation depth and pool size. A third, random weighting factor was applied to each pool to account for the unpredictability of the size of each discovery. A graph of the projected discovery order is shown in Figure 10.

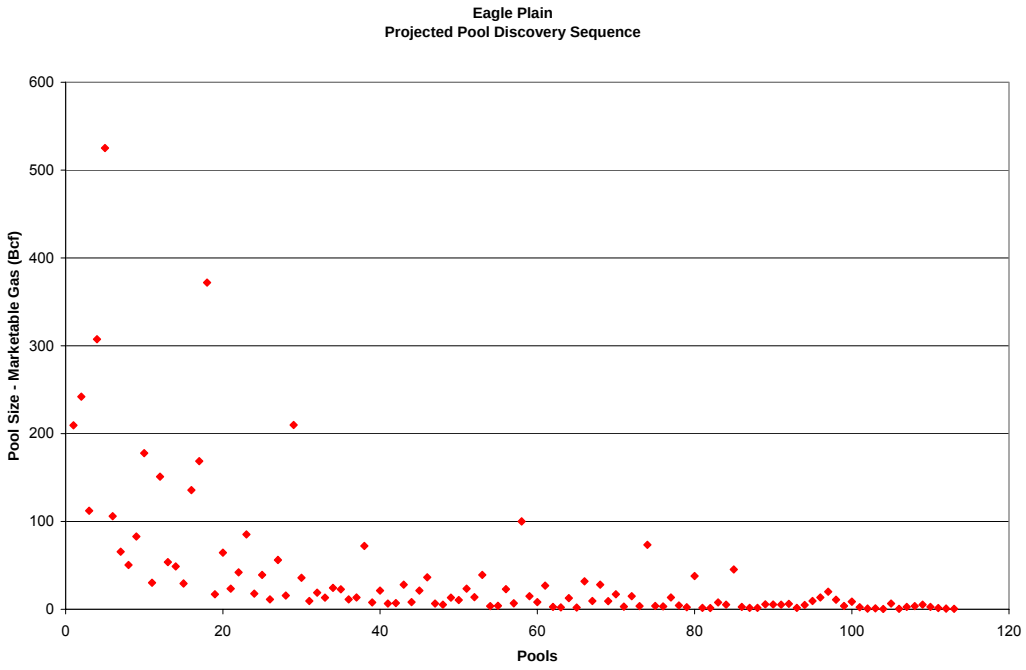


Figure 10: Predicted Pool Discovery Sequence

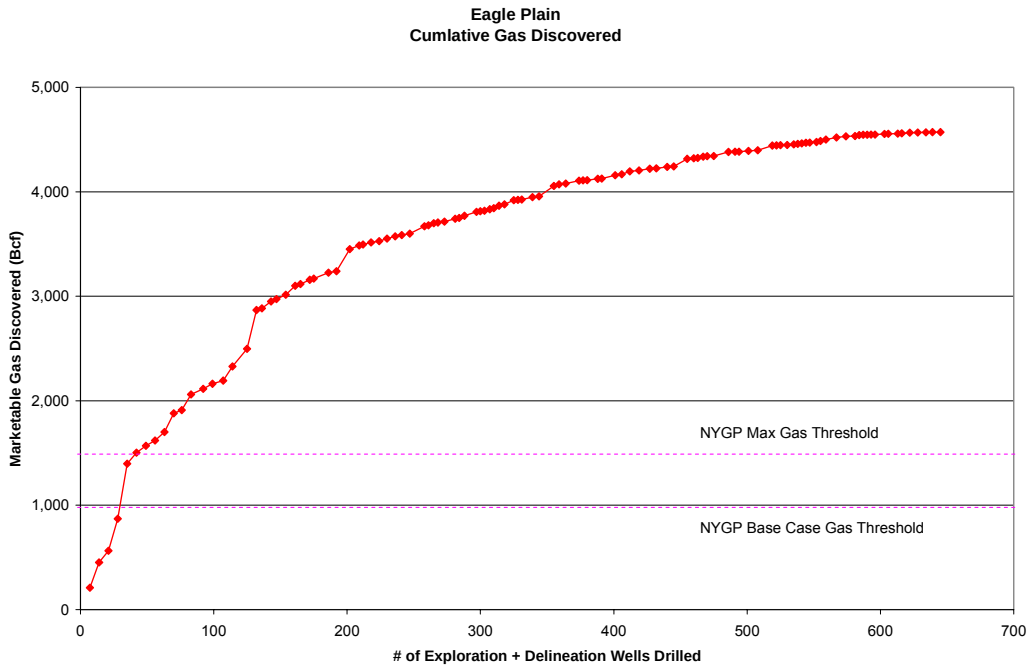


Figure 11: Cumulative Gas Discoveries

Figure 11 shows the same data as Figure 10 but with the vertical axis plotted as cumulative gas discovered. The graph show that 28 exploration wells will need to be drilled to discover the threshold 934 Bcf of reserves. Thereafter, drilling will proceed to i) discover enough additional gas reserves to justify expanding the NYGP and ii) to drill the development wells to ensure sufficient daily gas production to fill the pipeline.

An average initial flowrate of 5.0 MMcf/d has been used for all wells. Data available to date shows rates from 0.5 to 10 MMcf/d. An annual decline rate of 15% was applied to all wells. Figure 12 below illustrates the contribution of the pools, in the discovery sequence corresponding to Figure 9.

The total number of drilling pads (up to 4 wells per pad), production wells and the total number of wells drilled is shown in Figure 13.

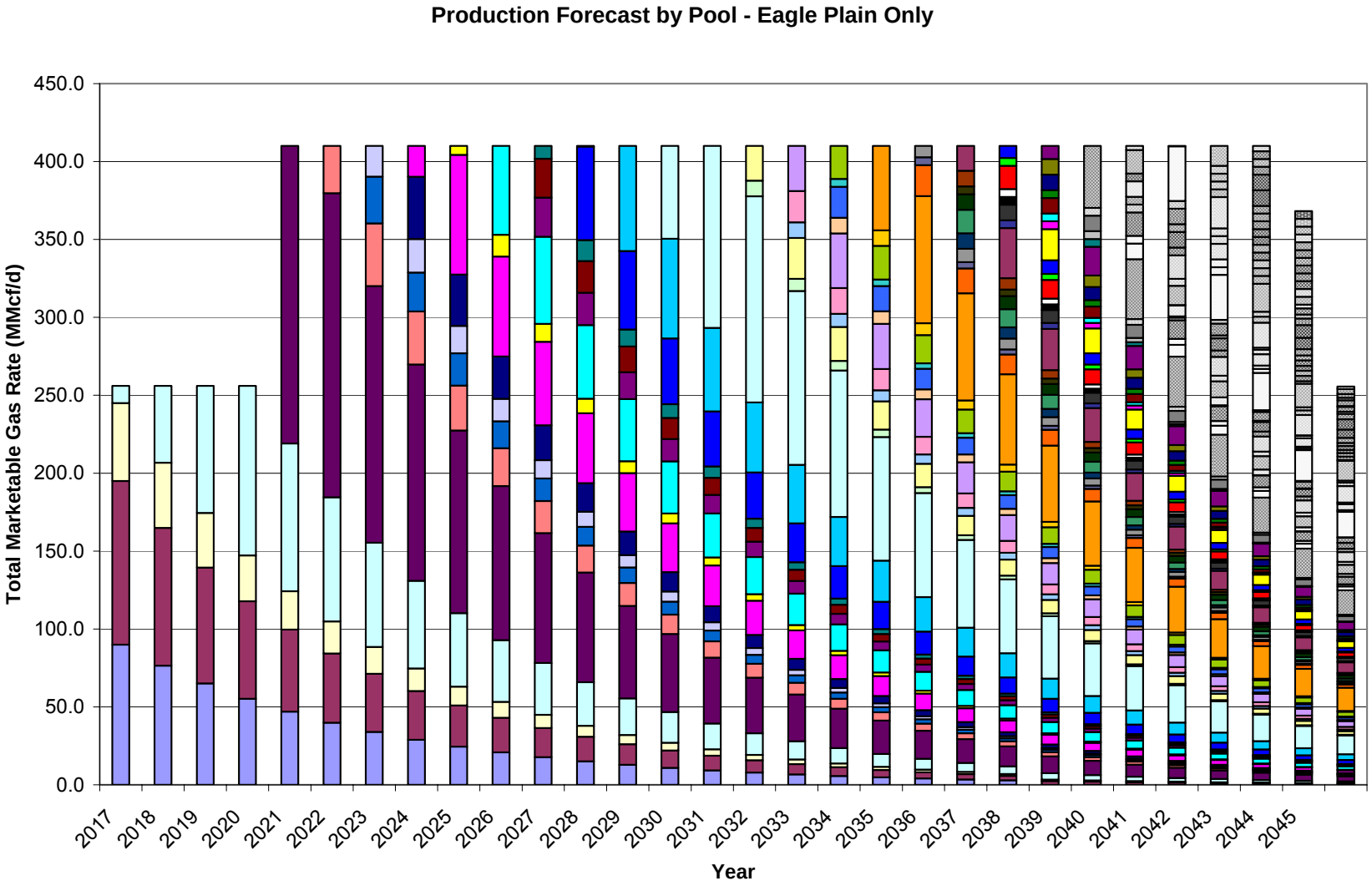


Figure 12: Production Forecast by Pool – Eagle Plain Only

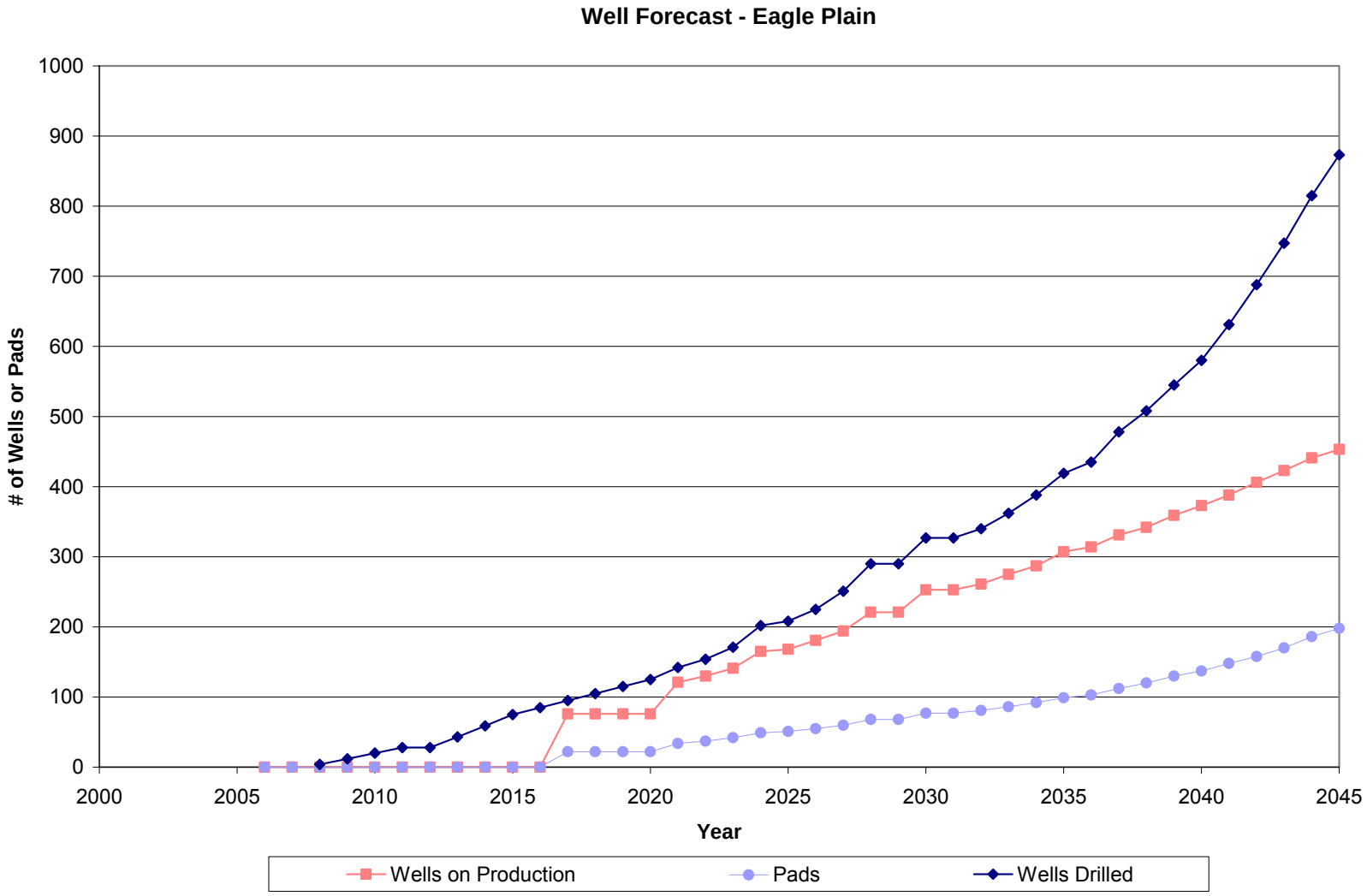


Figure 13: Drilling Forecasts

The final step in this development scenario was to map where the wells, calculated in Figure 13, are likely to be located. A series of "snapshot" maps at 5, 10, 15 and 20 year intervals are shown in Figure 14 to Figure 18.

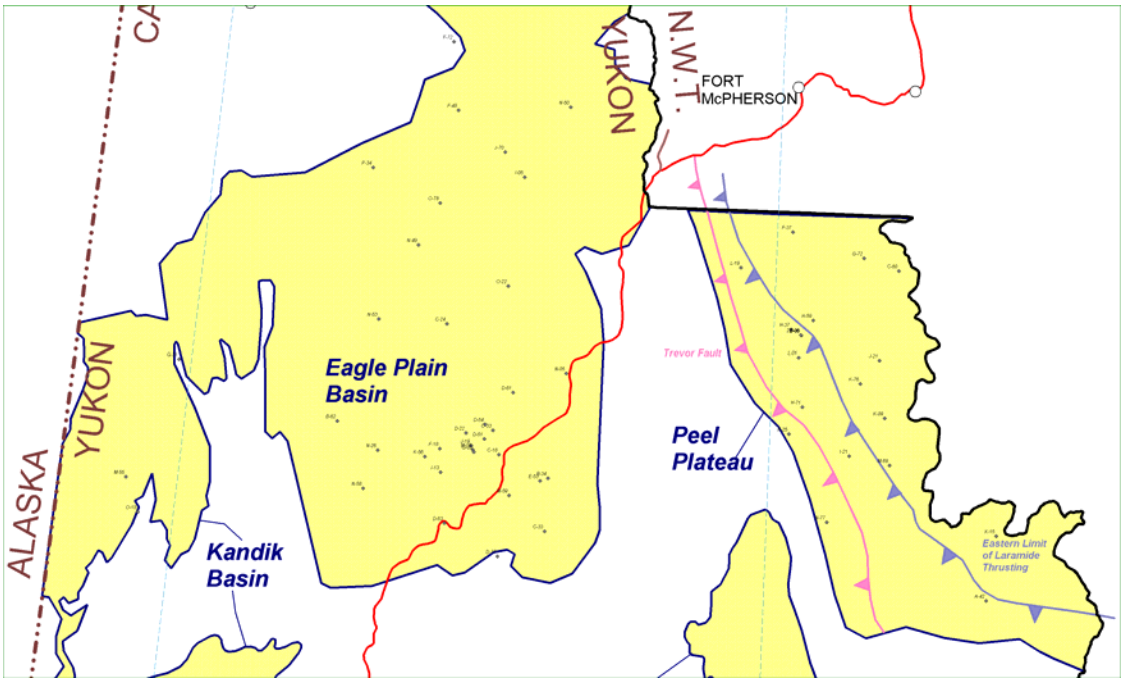


Figure 14: Current snap-shot

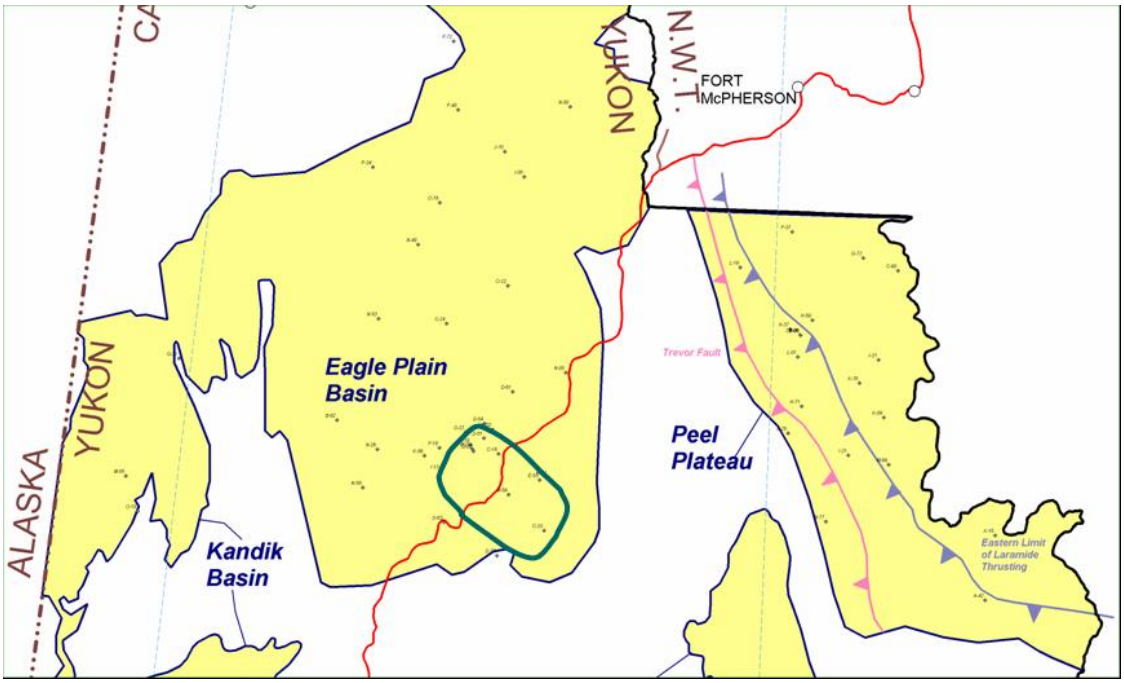


Figure 15: 5 year snap-shot - Eagle Plain

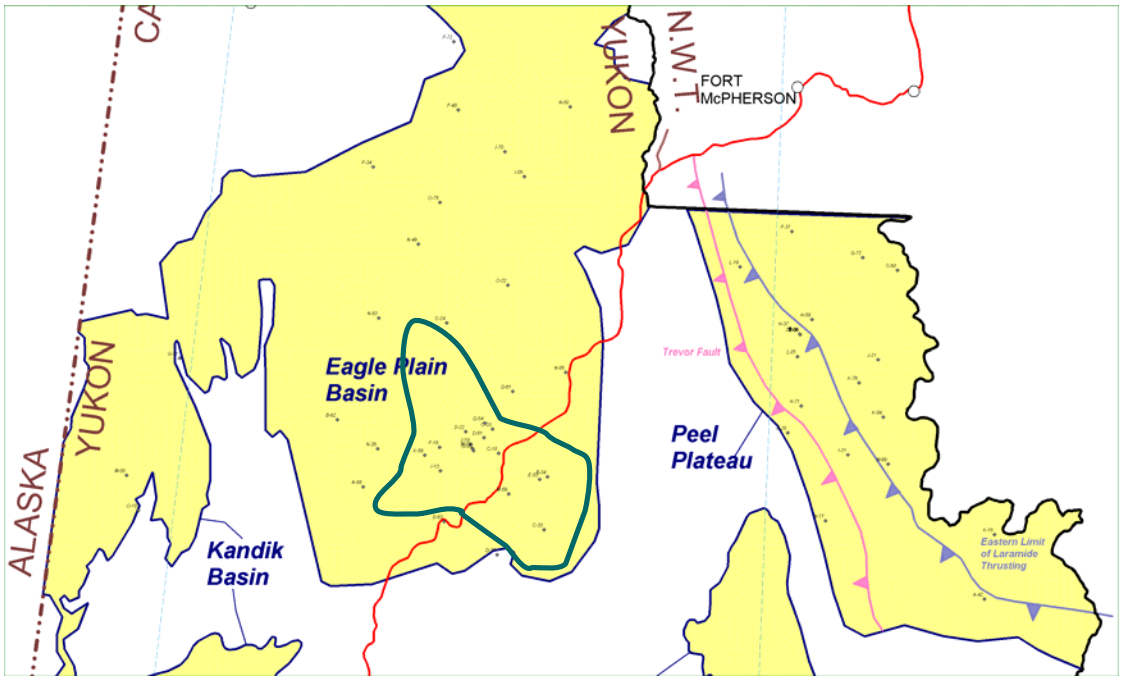


Figure 16: 10 year snap-shot – Eagle Plain

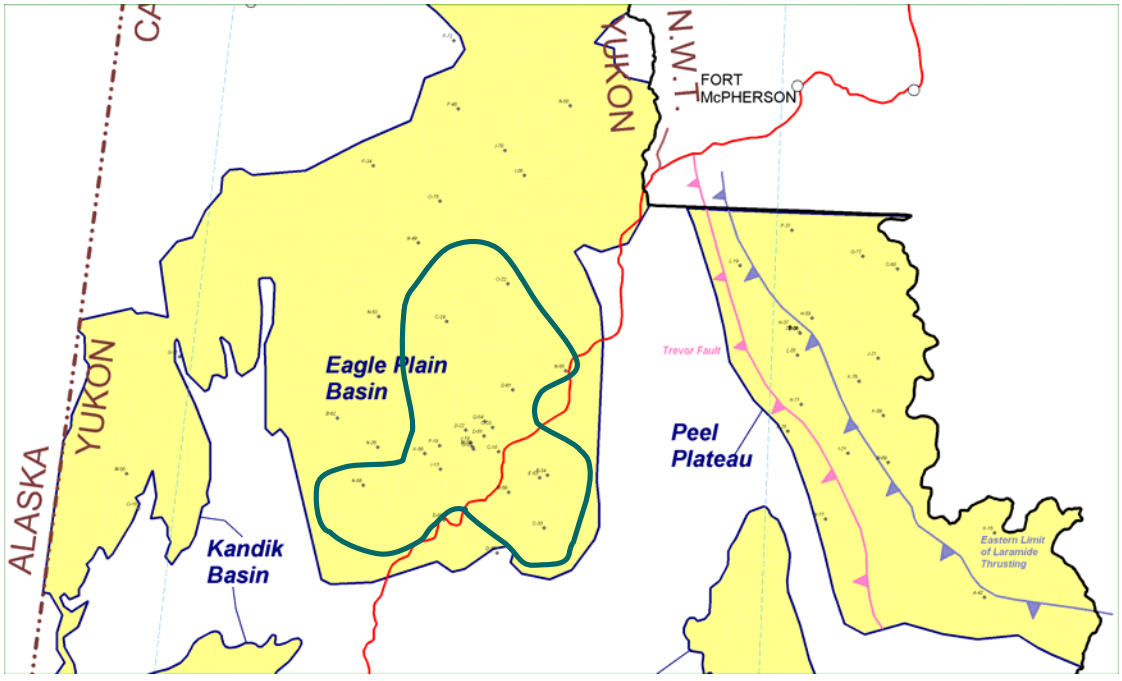


Figure 17: 15 year snap-shot – Eagle Plain

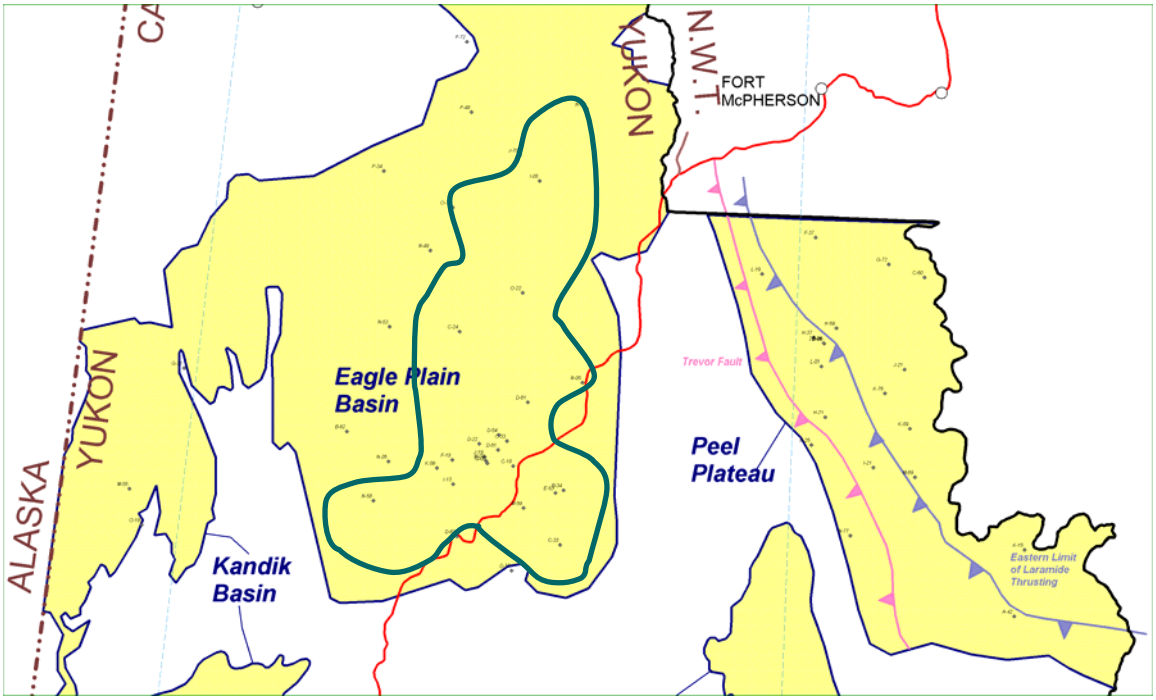


Figure 18: 20 year snap-shot – Eagle Plain

These snapshots show our projected development pattern based on our current knowledge of the geology. As stated in the limitations to this report, the sequence of actual discovery events will inevitably vary from this prediction. In particular, it should not be inferred from this scenario that drilling will initially be confined only to the south area of the exploration fairway. Operating companies will each stake out their respective areas across the basin based on success at competitive land sales. Which of those companies will have drilling success will depend upon their efforts and expertise.

9.4 Peel Plateau

All of the discussion to this point has focused on Eagle Plain. With the largest gas resource it has the potential for filling the NYGP for more than 20 years. Peel Plateau requires a longer pipeline to connect to NYGP and the pipeline would have to traverse difficult terrain with deeply incised valleys. As such, we project that tie-in of Peel Plateau wells will occur more than 20 years after Eagle Plain and have therefore not included Peel wells in the drilling forecast.

When Peel is eventually developed, the Mesozoic clastics (Trevor Formation, Arctic Red Formation and Martin House Formation) will be the principal targets as they constitute 78% of the total resource at Peel and occur at shallow depths as shown on Figure 19.

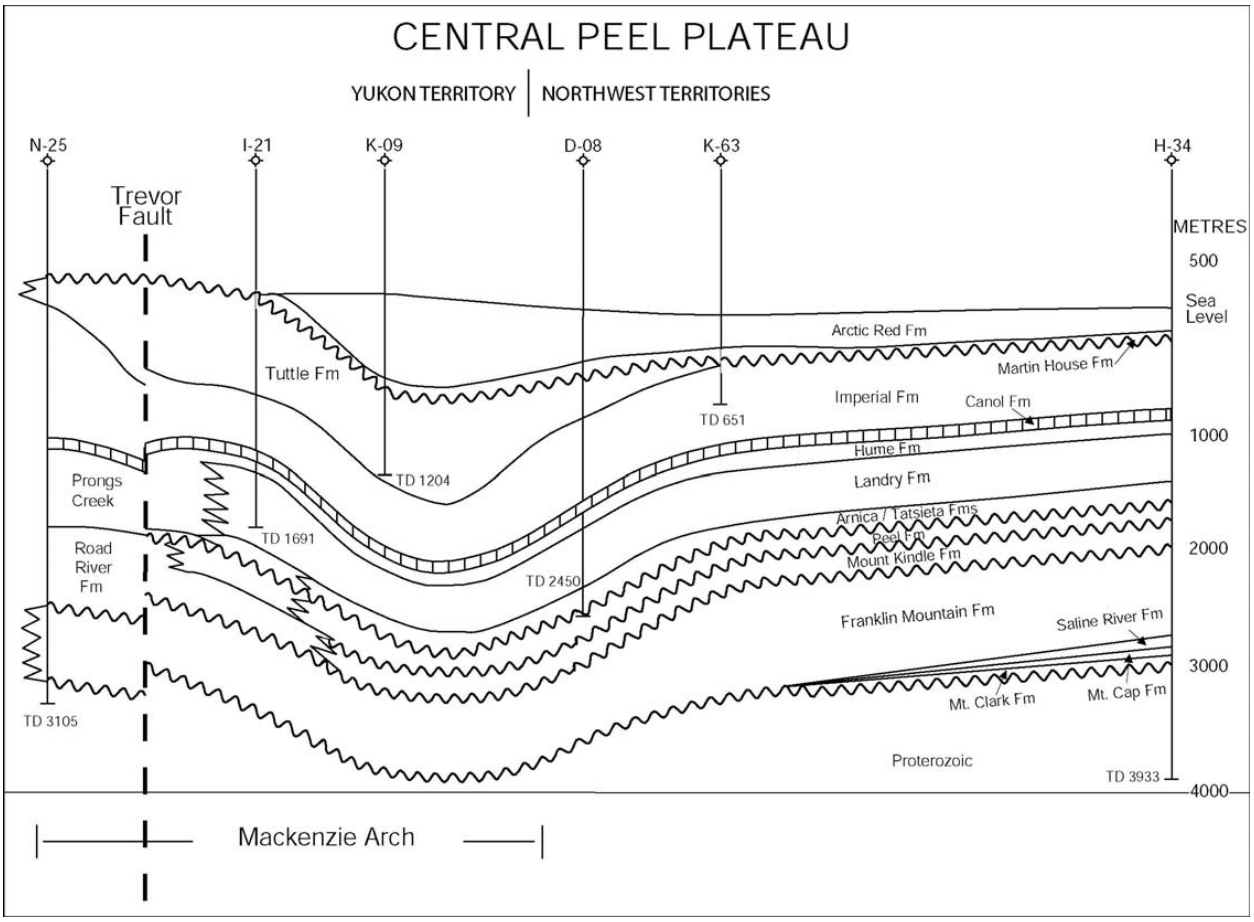


Figure 19: Peel Plateau Geological Cross Section[13]

Geographically the Trevor, Arctic Red and Martin House Formations are limited to a narrow corridor along the east side of Peel Plateau up to the Yukon/NWT boundary. A single development snapshot for Peel after 20 years (i.e. some 50 years from now) is shown in Figure 20.

[13] Yukon Government, Call for Bids, 2001, Figure 3

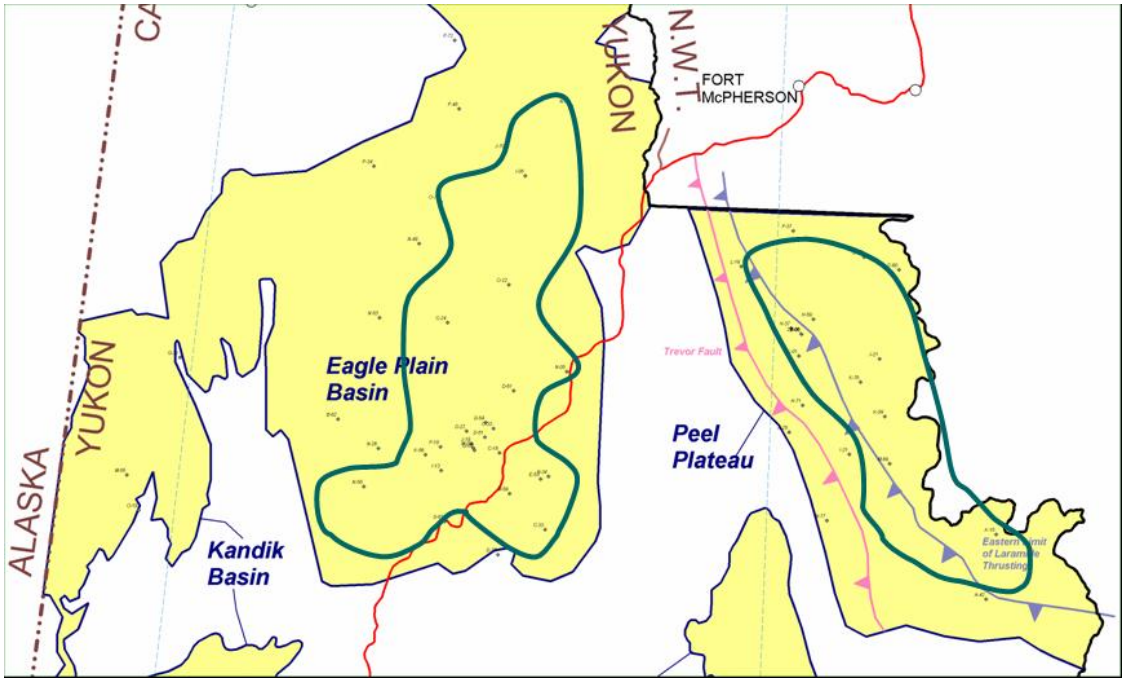


Figure 20: 50 year snap-shot: Eagle Plain and Peel Plateau

9.5 Drilling Rigs

Following on the number of wells required, the level of drilling rig activity has been predicted based on a winter drilling season of 14 weeks from mid-December through to the end of March. The average well takes approximately 3 weeks to drill. Accounting for rig moves, each rig is capable of drilling 4 wells per drilling season. Figure 21 shows the resulting projected rig activity. Note that the drop in activity in 2012 reflects the waiting period during which operators will delay further drilling pending confirmation that construction of the NYGP will proceed.

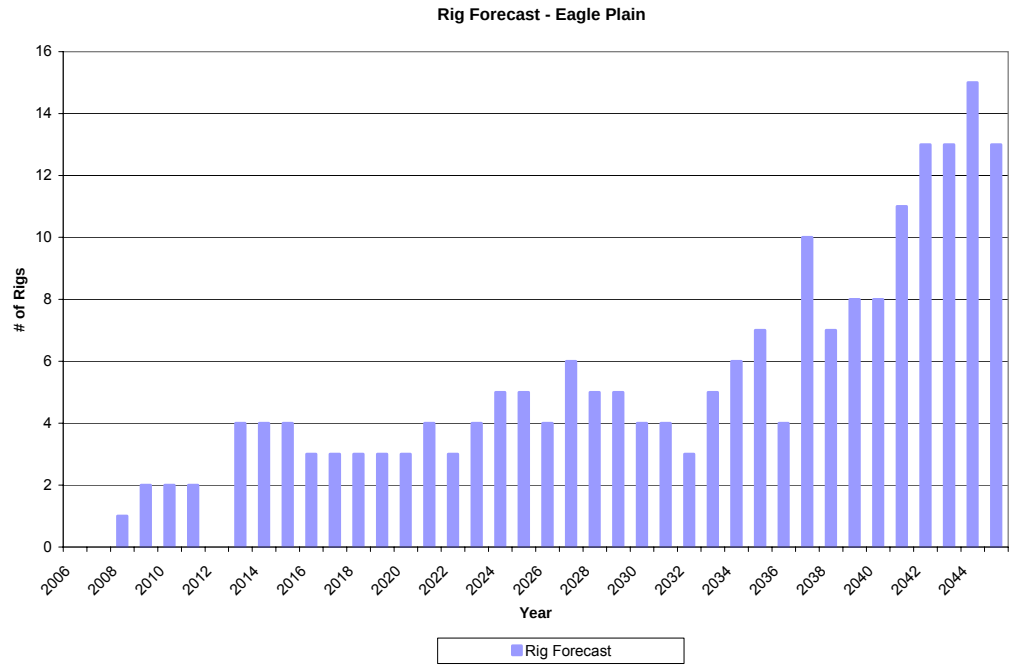


Figure 21: Drilling Rig Forecast

9.6 Seismic

The number of seismic lines required is a function both of the depth of the target pools as well as their areal size. As a rule of thumb, the spacing between seismic lines should be no larger than the depth of the target formation that the seismic attempts to image. For both Eagle Plain and Peel Plateau/Plain, average formation depth is approximately 3000 m. Therefore it is estimated that the initial seismic lines will be spaced 3000m (3 km) apart. A 3 km x 3 km grid in the drilling fairway is calculated to eventually reach an ultimate length of 5000 km of seismic. To support drilling activity of 4 to 6 rigs, this equates to 200 km of seismic each year.

Detailed seismic at a spacing of 1 km x 1 km will then be required to precisely image the boundaries of an estimated 50% of the 114 gas pools. Given an average pool size of 20 sq km, we estimate an ultimate length of 4600 km of detailed seismic or 200 km per year.

Seismic will be shot over a landscape at Eagle Plain and Peel Plateau that transgresses from alpine tundra in the southern Ogilvie Mountains to sub-arctic boreal forest (taiga) in the central part of the plain to Arctic tundra at the Arctic circle (66° 33' 39" lat) near the center of the basin. Scudder describes the tundra as open canopy woodland with very stunted stands of pine, black spruce, larch and lesser quantities of white spruce. Typical arctic tundra consists of sheathed cottongrass, aquatic sedge, arctic willow and white arctic bell-heather. A photo of the area is shown in Figure 22.

Figure 22: Eagle Plain at Arctic Circle. Richardson Mountains in background (photograph by S.G. Cannings).[14]

Within the Taiga ecosystem, low impact seismic is expected to navigate through the open forest by cutting the undergrowth, leaving the standing timber intact as much as possible. A photo of conventional vs low impact seismic is shown in Figure 23 and Figure 24.

Figure 23: Conventional Seismic

Figure 24: Low-impact seismic[15]

Within the sub-alpine and arctic tundra regions, winter access seismic should result in minimal residual footprint.

9.7 Processing Plant

A central processing facility and compressor station will need to be located along the Dempster Highway at the NYGP terminus near the town of Eagle Plain. At the central

[14] p 42 in G.G.E. Scudder, Environment of the Yukon, University of British Columbia, undated
[15] http://www.emr.gov.yk.ca/oilandgas/info/faq.html

processing plant, the gas is treated to dehydrate the gas to meet pipeline specifications and to compress the gas into the NYGP.

The limited gas analysis available to date (Table 10) shows limited natural gas liquids. Indeed, the gas has an average inert (N2 + CO2) composition of 5.4% and any natural gas liquids ("NGL") and liquefied petroleum gases ("LPG") would need to remain in the gas stream in order to meet pipeline heating value specifications. We therefore predict that no liquids will be separated at Eagle Plain.

Sample #	1	2	3	4	5	6	7	8	9	10	11	Average
Well	M-08	M-08	G-08	M-59	B-34	J-19	J-19	M-08	M-08	J-19	J-19	
N2	2.55	1.54	4.39	0.68	0.83	3.60	0.59	2.49	2.00	0.42	0.37	**1.77**
CO2	0.14	0.37	0.31	0.76	1.91	5.33	5.19	7.35	7.19	7.24	5.08	**3.72**
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.07	0.42	0.00	**0.05**
C1	96.97	97.55	94.53	94.47	86.64	76.01	83.61	80.70	80.79	80.93	84.29	**86.95**
C2	0.24	0.24	0.12	0.01	6.91	6.82	6.32	5.69	5.83	9.15	5.99	**4.30**
C3	0.04	0.06	0.01	0.07	2.35	4.66	2.41	2.34	2.43	2.58	2.49	**1.77**
iC4	0.14	0.17	0.03	0.01	0.25	0.69	0.33	0.31	0.34	0.35	0.31	**0.27**
nC4	0.02	0.02	0.05		0.51	1.21	0.83	0.56	0.66	0.71	0.64	**0.52**
C5+ Bbl/MMcf	0.0	0.5	5.4	0.0	5.9	15.7	6.7	5.2	6.6	11.6	8.1	**6.0**
BTU/cf	987	999		997	1107	1152	1093	1029	1046	1089	1094	**1059**

Table 10: Gas Analyses – Eagle Plain[16]

9.8 Gathering Pipelines

Gathering pipelines are required to connect each producing well (not every well drilled). Multiple wells drilled from pads will share a pipeline and all pipelines will ultimately connect to a main trunk flowing to a central processing plant at the Eagle Plain terminus of the NYGP. At the time of start-up of the NYGP, we have predicted that approximately 76 wells, located on 22 pads will be tied-in by pipelines and placed on production. These pads will be clustered near the southeast corner of Eagle Plain.

Dehydration surface facilities will be required at each drilling pad.

Gathering pipelines will extend from each pad to a mainline gathering system. It is estimated that an average of 5 km of pipeline will initially be required to connect each pad. Over time this average will decrease to 2 km as more development wells are drilled from existing pads. We have calculated total gathering pipelines of 1276 km.

The initial mainline system will connect wells to the central processing facility. Initially, 50 km of mainline pipeline will connect the closest pools near Chance and Blackie. The system is projected to expand by approximately 20 km each year for 25 years resulting in a total of 540 km of mainline pipeline.

9.9 Roads

Drilling will be conducted during the winter season only. Winter roads are required to each well drilled with all weather roads built to the producing wells only. Minimum disturbance

[16] Source: Fekete internal files – data gathered from Yukon public well data

practices dictate that roads will follow existing seismic lines with widening conducted where necessary within the taiga ecosystem. In the alpine and arctic tundra regions, winter roads will follow the most gradual terrain with no clearing required and minimal residual footprint. All weather roads will again follow pipeline routes to producing wells and will be built up with gravel. Total permanent road distance is therefore predicted to be the same as the pipeline distances.

9.10 Oil Development

Oil development may proceed independently of, and possibly in advance of, the gas development. One operator, Northern Cross, has proposed plans to begin producing two oil wells in Eagle Plain. Initially oil would be trucked to southern refineries until such time as the wells' productivity is confidently established and justifies construction of a refinery at Eagle Plain capable of processing 2500 bbls/d, sufficient to meet the demand within the Yukon for refined petroleum products.

Oil supply to the refinery can be met by approximately 10 - 20 wells. Seismic and drilling procedures discussed above for gas are also applicable to oil however the exploration area will be confined to Chance area. As such, the seismic shot for gas in this area will also be used for identifying oil targets. Exploration drilling will identify both gas and oil pools. No additional exploration wells are required over those estimated above for gas. Roads will be required to each oil well in order to truck the oil from storage tanks, at the well pads, to the refinery.

Refined products will be trucked along the Dempster Highway to mines and towns in southern Yukon. At this time, there are no foreseeable plans to build an oil or refined products pipeline.

10 Local Markets

10.1 Oil Products

Demand for refined oil products within the Yukon is shown in Table 11 below:

	Aviation Gasoline	Motor Gasoline	Aviation Turbo Fuel	Stove Oil Kerosene	Diesel Fuel Oil	Light Fuel Oil	Lube Oils & Greases	Other	Total
				(bbls/yr)					
Beaver Creek	28	1,010	181	228	1,108	437	12	68	3,072
Burwash Landing	19	695	125	157	763	301	8	47	2,114
Carcross	106	3,837	688	866	4,209	1,659	46	258	11,668
Carmacks	104	3,791	679	855	4,158	1,639	45	255	11,527
Dawson City	456	16,571	2,970	3,739	18,179	7,165	198	1,116	50,394
Destruction Bay	15	528	95	119	580	228	6	36	1,607
Faro	88	3,197	573	721	3,508	1,382	38	215	9,724
Haines Junction	202	7,322	1,312	1,652	8,032	3,166	87	493	22,266
Marsh Lake	71	2,586	464	583	2,837	1,118	31	174	7,863
Mayo	101	3,661	656	826	4,016	1,583	44	246	11,133
Old Crow	68	2,456	440	554	2,694	1,062	29	165	7,469
Pelly Crossing	73	2,641	473	596	2,898	1,142	32	178	8,033
Ross River	88	3,188	571	719	3,498	1,378	38	215	9,695
Tagish	47	1,724	309	389	1,891	745	21	116	5,242
Teslin	106	3,865	693	872	4,240	1,671	46	260	11,753
Watson Lake	396	14,374	2,577	3,243	15,770	6,215	172	968	43,714
Whitehorse	5,720	207,832	37,255	46,894	228,005	89,859	2,480	13,993	632,039
Other	31	1,121	201	253	1,230	485	13	76	3,410
Total	**7,718**	**280,399**	**50,263**	**63,268**	**307,616**	**121,235**	**3,346**	**18,879**	**852,724**

Table 11: Yukon Petroleum Product Consumption

Average data on total Yukon consumption was obtained from Yukon government files for the years 2000-2003 and was allocated to individual communities in Table 11 based on population. Total consumption of 852,724 bbls/yr equates to 2336 bbl/d or roughly the size of the refinery proposed by Northern Cross. The potential oil resources at Eagle Plain are easily capable of meeting both the current oil demand supply and the forecasted demand as new mines come into production. Properties of the oil may not be amenable to refining into all of the above products but it is reasonable to assume that the major products of diesel, fuel oil and stove oil can be readily refined.

The economic viability of a refinery at Eagle Plain is based on its proximity to the local Yukon markets. Trucking distances within the Yukon for the refined products are 300 – 750 km, much less than the 2100 – 2800 km distance from refineries at Strathcona near Edmonton. While more efficient, the Strathcona refineries must purchase their crude oil feedstock at market rates. Conversely, a refinery at Eagle Plain will have higher operating costs but lower input costs as it will likely be built by a producing company such that there is no transfer pricing between the wellhead and the refinery. It is not possible at this time to estimate how much lower fuel costs would be, merely that a local supply is feasible.

10.2 Electrical Demand and Natural Gas Generation

Yukon electrical demand generation is shown in Table 12 and electrical generation capacity is shown in Table 13.

Yukon Total Electricity Generation (MW.h)			
	Hydro	Thermal	Wind
2003	287,257	32,808	925
2002	270,377	38,000	1,100
2001	265,874	36,131	1,125
2000	259,064	36,989	394
1999	247,342	48,147	267
1998	270,011	41,815	259
1997	258,924	117,302	226
1996	362,032	138,899	221
1995	317,205	70,316	227
1994	259,934	33,138	243
1993	289,300	47,999	86

Table 12: Yukon Electrical Demand

		Capacity	
	Utility	Summer	Winter
Hydro Facilities		(MW)	(MW)
Whitehorse	YEC	40.0	24.0
Aishihik Lake	YEC	30.0	30.0
Mayo Lake	YEC	5.4	5.4
Fish Lake	YECL	1.3	0.7
	Total	**76.7**	**60.1**
Wind Facilities			
Haeckel Hill (Bonus)	YEC	0.15	
Haeckel Hill (Vestas)	YEC	0.66	
	Total	**0.81**	
Diesel Facilities			
Whitehorse	YEC	25.0	
Faro	YEC	5.4	
Dawson City	YEC	6.0	
Mayo	YEC	2.0	
Watson Lake	YECL	5.0	
Carmacks	YECL	1.3	
Haines Junction	YECL	1.3	
Teslin	YECL	1.3	
Ross River	YECL	1.0	
Beaver Creek	YECL	0.9	
Destruction Bay	YECL	0.9	
Old Crow	YECL	0.7	
Pelly Crossing	YECL	0.7	
Stewart Crossing	YECL	0.3	
Swift River	YECL	0.3	
	Total	**52.1**	
	Total Capacity	**129.6**	

Table 13: Yukon Electrical Generation Capacity

Thermally generated electricity burns expensive diesel that currently accounts for 11% of territorial electrical supply. As discussed above, a refinery at Eagle Plain has the potential for lowering diesel costs however the greatest benefit would occur by replacing diesel generated electricity with turbines fueled by cleaner burning natural gas. An off-take from AHPP could fuel a gas fired combined-cycle generator that would feed electricity into the existing Aishinhik/Whitehorse/Carmacks/Faro/Ross River 138kV transmission system. Remote communities would still rely on diesel powered generators. Nonetheless, Whitehorse accounts for the largest electrical demand and a gas turbine would be a distinct advantage. New mines scheduled to come into production at Minto and Willams Creek would add an estimated additional 40 – 50 MW of demand that could be tied into the

existing grid and would benefit from lower operating costs. Table 14 illustrates the potential fuel cost saving.

	Diesel		Natural Gas	
Cost at Whitehorse	1.05	$/l	7.65	$/Mcf (1)
Heating Value	33700	Btu/l	1000	Btu/Mcf
Heating Cost	31.16	$/MMBtu	7.65	$/MMBtu
Generator Efficiency	25	%	45	%
Net Fuel Cost	124.63	$/MMBtu	17.00	$/MMBtu

1. Estimated cost in 2013 when AHPP begins shipping gas

Table 14: Electrical Generation Fuel Cost Comparison

Note that the above table does not take into account capital and operating costs for a gas turbine versus a diesel generator. Clearly however, natural gas holds the potential to significantly reduce electrical costs.

11 Operating Environment

This section presents the views of industry companies on issues that they would consider in any decision to resume exploration in North Yukon.

Letters were sent to four companies who currently hold leases in the Yukon:

Chevron Canada Resources Limited
Devon Canada Limited
Hunt Oil Company
Northern Cross Energy Limited

Text of the letter was as follows:

Fekete Associates Inc. has been commissioned by the Oil and Gas Management Branch ("OGMB") of the Yukon Government to prepare a strategic overview of oil and gas prospects and potential development scenarios in North Yukon assuming that either the Mackenzie Valley or Alaska Highway pipeline projects proceed.

The objective of the strategic analysis is to enable the Yukon government and First Nations to collectively plan for future oil and gas development in North Yukon through examining supply/demand scenarios, development objectives, opportunities for community participation, and short-term and longer-term benefits as well as constraints to development. The study may also serve to inform the North Yukon and Peel Watershed Planning Commissions.

One portion of the study will focus upon the physical and regulatory environment faced by companies operating in the Yukon. The Yukon government and First Nations wish to promote an open dialogue with operators in order to understand the needs of industry and to streamline procedures in order to expedite development of the territories oil and gas assets. To this end, they have asked that we solicit from the key operators in the Yukon with respect to:

i. Oil and gas development regulations
ii. Access to data
iii. Application process and timing
iv. Royalties/taxes/local requirements
v. Land sale procedures/tenure
vi. Infrastructure
vii. Pipeline access requirements
viii. Conditions needed for on-going production growth and increasing ROR
ix. Risk mitigation

We respectfully seek your input on the above points or any other issues you wish to raise, including both the positive and the challenges. The responses will be collated and summarized by Fekete and included anonymously in our report.

Feed back was obtained from two of the companies in the form of meetings and phone conversations. Their views are presented here in an amalgamated form, without reference to the specific companies.

11.1 Oil and gas development regulations

One operator commented that they would expect the Yukon to have similar regulations to other jurisdictions such as Alberta, British Columbia or NWT, and if that were the case, they had no concerns. However, operators need to understand the regulations, in advance, for everything from seismic to drilling to pipelining to production in order to plan the details of their work plans.

11.2 Open access to data

Spurring competitive drilling activity requires an open and transparent system whereby all operators have equal access to data including core data, drilling cuttings, well logs, drill stem and production tests and more. Responsibility for collecting, collating and making available relevant data falls under the jurisdiction of the Yukon Oil and Gas Management Branch. Operators have expressed that they have found OGMB staff approachable and knowledgeable.

The Yukon government has commissioned comprehensive geological studies on the northern sedimentary basins by the Yukon Geological Survey. These reports are publicly available and the most recent of these, the Eagle Plain report, which has generated renewed interest in the Yukon will have been reviewed by many industry operators, not just the four companies who currently hold oil and gas rights in Eagle Plain. In summary, data access is not an impediment for operators electing to work in the north Yukon.

11.3 Application process and timing

The common theme from operators is “tell us the rules and set out a timeline that we can all live by”. Exploration in the Yukon is complicated by the short winter working season. All equipment and manpower must be organized, staged and ready to move immediately upon freeze-up.

Equipment organization and mobilization requires long lead time and it is expensive to stage equipment only to have the work delayed. Operators will therefore insist on having approvals in hand well in advance of the winter activity season.

11.4 Royalties/taxes/local requirements

Yukon’s royalty regulations (draft) use a formula that is similar to Alberta’s and is familiar to operators. Overall the royalties are lower than southern jurisdictions, thus offsetting the higher operating costs in the north and equalizing the attractiveness of North Yukon in comparison to other areas.

Municipal taxes, road permits etc. are minor issues that need to be understood by operators.

11.5 Land sale procedures/tenure

The Yukon government is actively working to address concerns that land sale procedures were difficult to understand. Proposed revisions have been announced that would make the process more efficient and responsive. Companies will be able to request lands that they wish to have posted and the government will set out, in advance, dates on which those requests will be opened and considered. From that date, the process of evaluating and consulting on environmental, socio-economic and surface access issues would take 120 days before issuing a call for bids, considerably shorter and less cumbersome than the 300

days under the current land sale procedure. By comparison, the land sale process in Alberta takes approximately 60 days.

In a competitive bidding situation, operators submit sealed bids including a "bonus" that they are willing to pay to the government in consideration for being awarded the oil and gas rights. The rights go the highest bidder. Since 1998, four land sales in the Yukon have netted a total of $24 million in work commitments. Currently four operators hold leases at Eagle Plain.

Land sale procedures do not apply on Category A lands on which First Nations manage the oil and gas rights directly, nor in areas of unsettled land claims.

As land sales are the point of entry for all oil and gas activities, revising this process was a logical starting point in updating and clarifying the conditions for operators wishing to explore in the Yukon.

11.6 Infrastructure

The Dempster Highway is a significant piece of infrastructure without which development of the Eagle Plain and Peel Plateau oil and gas resources would be much more difficult. Still, additional infrastructure is essential to support the level of activity described above. In the employment and business opportunity sections below, we describe the type of services required to support the pipeline construction and drilling activities. All of these people will create a demand at Eagle Plain for the typical infrastructure found in a small town including the street, water and sewer, accommodations, restaurants, grocery store, medical post, gas station and a supply store.

Initially the pipeline company will construct a camp that will provide all of these services within a confined, dedicated facility. Inevitably, private enterprises will spring up around the camp forming the nucleus of the town that will remain once most of the workers and the camp have departed. Operators will look to use the available resources, only building their own infrastructure where none exists.

11.7 Pipeline access requirements

As discussed in Section 1 of this report, all of the assumptions for development of the Yukon's oil and gas resources hinge on not only the construction of either MVP or AHPP, but also the right to have Yukon gas accepted for delivery into either system at reasonable toll rates. To begin exploration in earnest, operators need a clear signal on the regulatory and pipeline access issues. This doesn't mean the pipe has to be going in the ground, but there has to be a clear timeline (which means no further regulatory hurdles) as to when the pipeline will start to be built.

11.8 Conditions needed for on-going production growth

The drilling scenario presented in this report is based upon assessments of a reasonable pipeline size and volumes of gas needed to fill that pipeline. The assumptions are considered reasonable with respect to the size of the resources identified in the YGS report. If however, the exploration success rate proves to be better than the 1 in 6 ratio used in this report, operators may well have excess gas that they would then want to transport to market. Operators will have greater incentive to continue exploration if there is a process in place whereby pipeline capacity can be further expanded, with additional compression or line looping. They will want to feel confident that their on-going gas discoveries can be

brought on production quickly, thereby increasing the rate of return on their investment. If not, those investment dollars will be directed to more immediate prospects in the Mackenzie Delta, southern Canada or elsewhere in the world.

11.9 Risk mitigation

There are many uncertainties facing oil and gas operators venturing into the Yukon. Regulations, infrastructure, available manpower, supplies, different technical and environmental challenges are but some of the issues that need to be addressed. In southern Canada, all such issues are well understood and operators can easily assess the level of risk that drilling may not be permitted or able to proceed. Bringing the Yukon up to a comparable level will ensure that its potential is not discounted by operators simply due to a lack of understanding. The corollary is that operators will expect that regulations, once in-place, will not be changed unexpectedly, arbitrarily or on short-notice .

12 Economic Benefits

Economic benefits to the people of the Yukon from oil and gas development have been subdivided into four headings:

- Royalties
- Direct Investment
- Employment
- Business opportunities

12.1 Royalties

Yukon Oil and Gas Royalty Regulations (Draft) is the legislation governing the amount of royalty paid by oil and gas producers to the Yukon government. The legislation covers most lands in the Yukon including all of the North Yukon lands addressed in this report. Royalty structures have a significant impact on the economics that producers consider before deciding to proceed with drilling. The royalty rate reflects a balance between attracting investment from industry yielding a fair return to the people of the Yukon. The draft regulations propose an ad valorem royalty with a base rate of 5 percent for the first 36 months of production. Thereafter, the royalty rate has a base of 10 percent with a formula under which the royalty can increase up to a maximum of 15 percent depending on gas prices. The regulations have been formulated to be clearly understood, attractive to producers, fair to the people of the Yukon and easy to administer by the government.

A forecast of the potential royalties from gas production, assuming a flat 10% royalty rate is shown in Table 15.

Year	Fekete AECO-C Gas Price Forecast	Tariffs ($/Mcf)				Net Gas Price at Eagle Plain	Pipeline Gas Rate	Annual Revenue	Annual Yukon Royalty at 10%
		Intra-Alberta	MVP	NYGP	Total Tariffs				
	$Cdn/Mcf	$/Mcf	$/Mcf	$/Mcf	$/Mcf	$/Mcf	MMcf/d	MM$ Cdn	MM$ Cdn
2005 (Q4)	10.69	0.31	1.29	0.45	2.05	8.64	0	0.0	0.0
2006	9.66	0.31	1.29	0.45	2.05	7.61	0	0.0	0.0
2007	8.57	0.31	1.29	0.45	2.05	6.52	0	0.0	0.0
2008	7.68	0.31	1.29	0.45	2.05	5.64	0	0.0	0.0
2009	6.80	0.31	1.29	0.45	2.05	4.75	0	0.0	0.0
2010	7.14	0.31	1.29	0.45	2.05	5.09	0	0.0	0.0
2011	7.49	0.31	1.29	0.45	2.05	5.45	0	0.0	0.0
2012	7.87	0.31	1.29	0.45	2.05	5.82	0	0.0	0.0
2013	8.26	0.31	1.29	0.45	2.05	6.22	0	0.0	0.0
2014	8.68	0.31	1.29	0.45	2.05	6.63	256	619.4	61.9
2015	9.11	0.31	1.29	0.45	2.05	7.06	256	660.0	66.0
2016	9.57	0.31	1.29	0.45	2.05	7.52	256	702.5	70.3
2017	10.04	0.31	1.29	0.45	2.05	8.00	256	747.2	74.7
2018	10.55	0.31	1.29	0.45	2.05	8.50	410	1271.9	127.2
2019	11.07	0.31	1.29	0.45	2.05	9.03	410	1350.8	135.1
2020	11.63	0.31	1.29	0.45	2.05	9.58	410	1433.6	143.4

Table 15: Potential Gas Royalty Revenue

This analysis illustrates the total projected royalties from all wells drilled in the Eagle Plain basin, including those wells that may be drilled on Crown lands or on Settlement (Category A) lands. Assuming that First Nations with Category A lands adopt royalty regulations in common with the Yukon government, the proportion of the total royalty attributable to Category A lands would be in proportion to the gas production rate from those wells located on Category A lands.

In addition, oil production has the potential to generate additional royalties amounting to approximately 5% of the gas royalties as shown in Table 16.

Fekete Edmonton Oil Price Forecast ($Cdn/bbl)	Trucking[1] ($/bbl)	Taylor to Edm tariff ($/bbl)	Net Oil Price at Eagle Plain ($/bbl)	Oil Production Rate (bbl/d)	Annual Revenue (MM$ Cdn)	Annual Yukon Royalty at 10% (MM$ Cdn)
77.25	25.00	1.50	50.75	0	0.0	0.0
72.10	25.00	1.50	45.60	0	0.0	0.0
66.00	25.00	1.50	39.50	0	0.0	0.0
59.90	25.00	1.50	33.40	250	3.0	0.3
53.80	25.00	1.50	27.30	500	5.0	0.5
54.88	25.00	1.50	28.38	2500	25.9	2.6
55.97	25.00	1.50	29.47	2500	26.9	2.7
57.09	25.00	1.50	30.59	2500	27.9	2.8
58.23	25.50	1.50	31.23	2500	28.5	2.9
59.40	26.01	1.50	31.89	2500	29.1	2.9
60.59	26.53	1.50	32.56	2500	29.7	3.0
61.80	27.06	1.50	33.24	2500	30.3	3.0
63.04	27.60	1.50	33.93	2500	31.0	3.1
64.30	28.15	1.50	34.64	2500	31.6	3.2
65.58	28.72	1.50	35.36	2500	32.3	3.2
66.89	29.29	1.50	36.10	2500	32.9	3.3

1 Trucking costs estimated to nearest refinery at Taylor, B.C.

Table 16: Potential Oil Royalty Revenue

Under federal/territorial agreements, 60% to 80% of royalties in excess of 3 MM$/yr flow back to the federal government. It is evident therefore that the major benefit of oil and gas development to the Yukon people is not in the royalty revenue but rather in the local business development, investment and taxes. This situation is similar to the experience of Newfoundland and Nova Scotia in the development of their offshore resources. Further discussion on this point is included in Section 13: Community Preparation of this report.

12.2 Direct Investment

It has yet to be determined who will build and own the NYGP. Possible owners include:

- Producers
- Pipeline companies
- Local Investors including First Nations

Producers have the greatest motivation to advance the pipeline project. Once the pipeline is in place, the producers will be able to develop natural gas that is currently stranded. However, construction and operation of a major pipeline is not generally undertaken by operators and they may not have the specific experience and skills to conduct the detailed work required. Also, pipeline investment has a very long-term payout, lower risk and lower rates of return than drilling for oil and gas. Investors in producing companies are looking for higher returns on their investment and generally don't like to see these operating companies have significant capital tied up in long-term investments that are not part of their core business.

TransCanada Pipelines Limited, Enbridge Inc., Duke Energy Services and a number of other pipeline companies are candidates to build the pipeline. Each has experience in building the pipelines as well as operating the compressors needed to manage flow volumes through the pipe. TransCanada's pipeline system extends from northwestern Alberta to Chicago and New York and TransCanada will be the operator of the MVP and is the leading candidate to operate the AHPP as well. Enbridge is a competitor for the AHPP. They currently have a 50% interest in the Canadian portion of the Alliance Gas Pipeline between Fort St. John, B.C. and Cromer, Saskatchewan. The pipeline continues on to Chicago. Duke Energy Services operates the natural gas gathering and mainline transmission system in British Columbia.

A pipeline company will be prepared to spend the capital to build a pipeline once they have firm contracts with producers for pipeline capacity. These contracts are often for twenty years and commit the producer to ship a specific volume of gas and to pay a fixed tariff to the pipeline company for shipping the gas. The producer is obligated to pay for the contracted volume of gas even if, for some reason, its wells are unable to deliver enough gas.

The MVP model is one that could be followed for NYGP. MVP is a consortium of producers and First Nations. In turn, a pipeline company (TransCanada) funded the First Nations portion of the costs. TransCanada will build and operate the pipeline in return for a portion of the First Nations' share in the project. The First Nations will retain an interest in the project and will share in the profits from the pipeline. This is one model that brings together all interested parties with the necessary expertise to address environmental and cultural issues during the construction and operation of the pipeline.

Many of the issues regarding ownership, pipeline access and tariffs with respect to the public good in developing new oil and gas resources in a remote part of Canada are being discussed at the National Energy Board ("NEB") hearings on the MVP. The MVP consortium has announced that it does not wish to consider building lateral pipelines to tie into their mainline. The gas fields belonging to the individual producers within MVP (Imperial, ConocoPhilips, Shell and Exxon) are located in the Mackenzie delta and these companies do not benefit from building laterals to connect wells owned by other operators as those wells would displace MVP Producers gas in the MVP mainline.

Interventions by the Yukon Government in the MVP hearings before the NEB have advocated that laterals connecting to MVP be part of that system (not operated separately) and that a "rolled-in" toll system be adopted. Both measures would ultimately benefit orderly development of North Yukon oil and gas fields. The NEB's decision on these matters will establish some of the framework under which the NYGP will eventually proceed.

12.3 Employment

Direct employment resulting from oil and gas activities have been estimated for the following sectors:

- Pipeline
    - Feasibility Phase
    - Planning Phase
    - Pipeline Construction Phase
    - Pipeline Operation Phase
- Drilling Rigs
- Seismic

- Well Servicing
- Road Construction
- Pipelining
- Operating Companies

12.4 Pipeline

12.4.1 Feasibility Phase

The feasibility phase generally requires one to two years to complete. During this time, the consortium proposing to build the pipeline will prepare first estimates of the project economics and identify key hurdles that must be cleared in order to proceed. Legal frameworks, contractual arrangements and internal budget approvals constitute much of the work. During this time, the work is expected to be located at the various company head offices in Calgary with a few jobs in the Yukon, in the form of community relations and traditional knowledge staff manning a satellite office in Whitehorse. At the end of the feasibility phase, the consortium will decide whether to proceed with a regulatory application that will require production of extensive details on all aspects of the proposed project

12.4.2 Planning Phase

The planning phase involves preparation of all the technical studies including pipeline routing, river crossings, soil studies, sizing, equipment design, pressure ratings, facilities, compressors, infrastructure needs, environmental studies, public consultation, manpower and skill requirements, right-of-way agreements, formal supply commitment and tariff agreements plus all the other plans essential to a large and concentrated construction effort. The conclusion of the planning phase is marked by successfully obtaining regulatory approval.

The MVP planning phase was projected to be 3 – 4 years and, with the latest regulatory delays, will inevitably stretch to at least 5 years. For the NYGP, the planning phase could be shortened to 2 – 3 years as it is expected that many of the regulatory precedents and procedures will have been established by the MVP and AHPP projects.

During the planning phase, field work will generate further Yukon employment for environmental studies, surveying, public consultation and assessing the impact on local communities. Staffing in the Whitehorse office is expected to grow to approximately 30 people.

12.4.3 Pipeline Construction Phase

Construction of the NYGP will be much faster than either MVP or AHPP because, regardless of which direction the pipeline goes, it will follow the Dempster Highway. For remote pipelining projects such as these, clearing the pipeline right-of-way and building access roads and air-strips along the right-of-way is not only a very large part of the cost, but also the slowest part of the work. The existing Dempster Highway infrastructure is situated through the middle of the North Yukon oil and gas fields and its use would cut almost two years of time and cost from what would otherwise be expected in a pipeline project across remote lands.

Employment levels escalate rapidly during the pipeline construction phase. Crews of approximately 750 people are required to build each section of the pipeline, extending some 120 km long. Total pipeline length is from Eagle Plain to Inuvik is approximately 350 km. It is expected that construction would extend over two winter construction seasons, with two pipeline sections built each season. The total construction workforce is therefore estimated to be 1500 each winter for two years. For an AHPP connection, the distance from Eagle Plain to a tie-in near Tok, Alaska is 513 km. An additional section crew would be added each bringing the total workforce to 2250 each season.

Jobs will be readily available to Yukoners, with the remaining positions filled by southerners. All staff would be housed in temporary camps constructed along the Dempster Highway.

12.4.4 Pipeline Operation Phase

Facilities built along the pipeline will include a processing and compression plant located at Eagle Plain and a booster compressor located approximately half the distance between Eagle Plain and Inuvik. Once constructed, essentially all jobs will be located at these two locations. A total permanent workforce of approximately 30 people is anticipated. Most of the jobs will be located at Eagle Plain, where plant operators will be responsible for ensuring any oil is separated from the gas and that the gas is then dehydrated and compressed for delivery into the pipeline. The booster compressor facility will run automatically for most of the time and will require only 1 – 2 people to monitor and maintain the equipment. A few (2 – 5) jobs for environmental and corrosion monitors will be spread along the pipeline length.

A lateral to AHPP would have an additional 2 booster compressors, resulting in an additional 4 jobs at those locations plus an additional 5 – 10 jobs for environmental and corrosion monitors along the length.

12.4.5 Total Direct Pipeline Employment Levels and Job Types

Figure 25 below shows the total employment levels, by year and phase, directly resulting from pipeline construction.

Table 17 lists the type of jobs that would be available within the Yukon throughout the four stages of a pipeline project.

Reference: Job titles, descriptions and salary ranges for the Pipeline Construction phase in the above table have been obtained from the Mackenzie Valley Pipeline website: (http://www.mackenziegasproject.com/opportunities/employment/index.html). Detailed job descriptions may be viewed on the MVP website. Salaries in the above table have been estimated by increasing the 2001 data by 21.5%, reflecting a compound 5% annual inflation rate in salaries since 2001. In addition, for field positions, room and meals in temporary camps are generally provided by the employer.

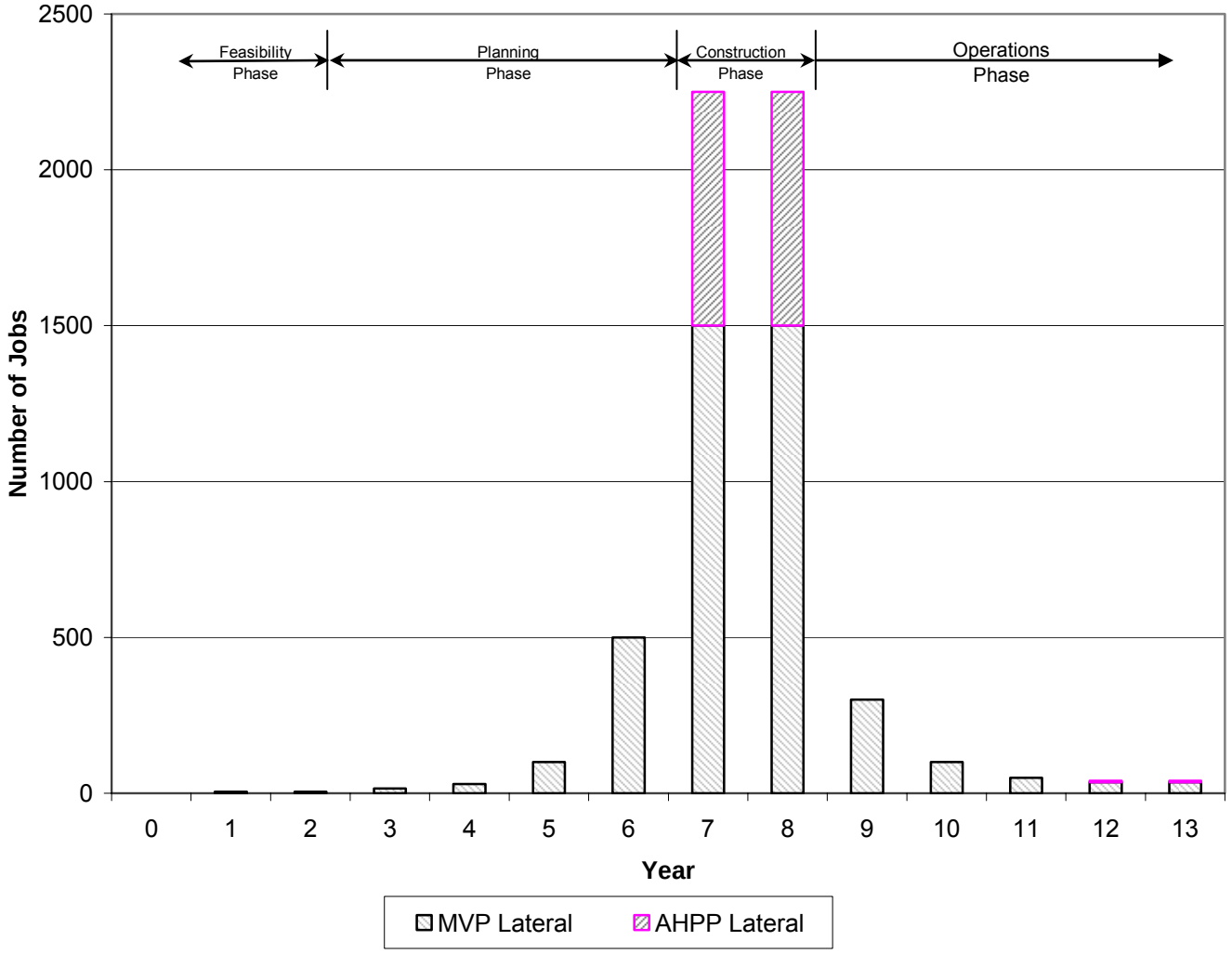


Figure 25: NYGP Estimated Direct Employment Levels

Phase	Job Category	Job Type	Specific Job Title	Skill Level	Annual Salary
Feasibility	Support Services	Knowledge Specialists	Traditional Knowledge (TK) Specialists	Skilled	$38,000 -$50,000
			Community Consultation and Socio-Economic Coordinator	Skilled	$38,000 -$50,000
			Administrative Assistant	Skilled	$28,000 - $55,000
Planning	Project Management	Management	Project Manager	Professional/Technical	$47,000 - $95,000
	Engineering	Engineer	Professional Engineer	Professional/Technical	$60,000 – 110,000
	Support Services	Knowledge Specialists	Traditional Knowledge (TK) Specialists	Skilled	$38,000 -$50,000
			Community Consultation and Socio-Economic Coordinator	Skilled	$38,000 -$50,000
			Cultural Relations Coordinator	Skilled	$38,000 -$50,000
			Administrative Assistant	Skilled	$28,000 - $55,000
		Procurement and Purchasing	Logistics Coordinator	Professional/Technical	$49,000 - $98,000
			Contracts Coordinator	Professional/Technical	$49,000 - $98,000
		Environmental	Environmental Monitor	Skilled	$38,000 -$50,000
		Information	Information Technologist	Skilled	$38,000 -$50,000
			Survey Technologist	Skilled	$30,000 - $43,000
			Drafting Technologist	Skilled	$30,000 - $43,000
Pipeline Construction	Construction	Supervisory	Construction Manager	Professional/Technical	$90,000 - $110,000
			Foreman	Professional/Technical	$66,000 - $72,000
			Assistant Foreman	Professional/Technical	$66,000 - $72,000
			Assistant (Lead Hand)	Professional/Technical	$55,000 - $72,000
		Equipment Operators	Heavy Equipment Operator (Cat Skinner, Grader, Front-end Loader, Boom Trucks, Excavators)	Skilled	$62,000 - $72,000
			Truck Drivers	Skilled	$62,000 - $72,000
			Bus Driver	Skilled	$62,000 - $72,000
		Trades People	Welders	Skilled	$47,000 - $77,000
			Mechanics	Skilled	$47,000 - $77,000
			Electricians	Skilled	$47,000 - $77,000

			Pipefitters	Skilled	$47,000 - $77,000
		Labour	Swamper,	Unskilled	$17,000 - $32,000
			Nozzleman	Unskilled	$17,000 - $32,000
			Oiler	Unskilled	$17,000 - $32,000
			Parts Runner	Unskilled	$17,000 - $32,000
			Welder's Helper	Unskilled	$17,000 - $32,000
			Labourer	Unskilled	$17,000 - $32,000
			Painter	Unskilled	$17,000 - $32,000
			Mechanic's Helper	Unskilled	$17,000 - $32,000
	Engineering	Engineer	Professional Engineer	Professional/Technical	$60,000 – 110,000
	Project Management	Management	Project Manager	Professional/Technical	$47,000 - $95,000
			Operations Manager	Professional/Technical	$97,000 - $182,000
			Engineering Manager	Professional/Technical	$90,000 - $110,000
			Information Manager	Professional/Technical	$45,000 - $90,000
	Support Services	Accommodations	Camp Manager	Skilled	$60,000 - $75,000
			Camp Attendants	Unskilled	$17,000 - $25,000
			Camp Maintenance	Unskilled	$17,000 - $25,000
		Food Services	Cook/Baker	Unskilled	$30,000 - $43,000
			Food Preparer	Unskilled	$17,000 - $28,000
			Kitchen Help	Unskilled	$17,000 - $28,000
		Health and Safety	HSE Coordinator	Professional/Technical	$72,000 - $120,000
			First Aid Technologist	Professional/Technical	$60,000 - $72,000
			Logistics Coordinator	Professional/Technical	$49,000 - $98,000
			Contracts Coordinator	Professional/Technical	$49,000 - $98,000
		Office Support	Office Manager	Skilled	$45,000 - $79,000
			Administrative Assistant	Skilled	$28,000 - $55,000
		Procurement and Purchasing	Procurement Manager	Professional/Technical	$36,000 - $79,000
			Purchasing Agent	Professional/Technical	$36,000 - $79,000
			Materials Coordinator	Professional/Technical	$36,000 - $79,000
			Security Guard	Unskilled	$17,000 - $43,000
			Field Coordinator	Skilled	$38,000 -$50,000

		Knowledge Specialists	Traditional Knowledge (TK) Specialists	Skilled	$38,000 -$50,000
			Community Consultation and Socio-Economic Coordinator	Skilled	$38,000 -$50,000
			Cultural Relations Coordinator	Skilled	$38,000 -$50,000
			Employment and Training Counselor	Skilled	$38,000 -$50,000
		Environmental	Environmental Monitor	Skilled	$38,000 -$50,000
		Information	Information Technologist	Skilled	$38,000 -$50,000
			Survey Technologist	Skilled	$30,000 - $43,000
			Drafting Technologist	Skilled	$30,000 - $43,000
Pipeline Operation	Management	Management	Operations Manager	Professional/Technical	$97,000 - $182,000
	Engineering	Engineer	Professional Engineer	Professional/Technical	$60,000 – 110,000
	Operations	Operators	Foreman	Professional/Technical	$66,000 - $72,000
			Assistant Foreman	Professional/Technical	$66,000 - $72,000
			Pipeline Operator	Skilled	$50,000 - $65,000
			Plant Operator		$50,000 - $65,000
		Trades People	Welders	Skilled	$47,000 - $77,000
			Mechanics	Skilled	$47,000 - $77,000
			Electricians	Skilled	$47,000 - $77,000
			Pipefitters	Skilled	$47,000 - $77,000
	Support Services	Health and Safety	HSE Coordinator	Professional/Technical	$72,000 - $120,000
		Office Support	Office Manager	Skilled	$45,000 - $79,000
			Administrative Assistant	Skilled	$28,000 - $55,000
		Procurement and Purchasing	Purchasing Agent	Professional/Technical	$36,000 - $79,000
			Materials Coordinator	Professional/Technical	$36,000 - $79,000
			Security Guard	Unskilled	$17,000 - $43,000
		Knowledge Specialists	Traditional Knowledge (TK) Specialists	Skilled	$38,000 -$50,000
			Employment and Training Counselor	Skilled	$38,000 -$50,000
		Environmental	Environmental Monitor	Skilled	$38,000 -$50,000
		Information	Information Technologist	Skilled	$38,000 -$50,000

Table 17: Pipeline Job Descriptions

12.4.6 Oil Related Employment Levels and Job Types

Additional jobs will also be generated at Eagle Plain to staff an oil refinery. Trucking of refined oil products will generate jobs throughout the Yukon. As discussed in the market section, much of the oil demand will be predicated on the development of new mines in the Yukon. Steady employment levels are detailed in Table 18.

Location	Number of Jobs
Eagle Plain – Oil Refinery	8
Throughout Yukon – Trucking	10-15

Table 18: Oil Related Employment Levels

The types of oil related jobs are listed in Table 19 below.

Oil Refining and Transportation	Management	Management	Operations Manager	Professional/Technical	$97,000 - $182,000
	Engineering	Engineer	Professional Engineer	Professional/Technical	$60,000 – 110,000
	Operations	Operators	Foreman	Professional/Technical	$66,000 - $72,000
			Assistant Foreman	Professional/Technical	$66,000 - $72,000
			Plant Operator		$50,000 - $65,000
		Trades People	Welders	Skilled	$47,000 - $77,000
			Mechanics	Skilled	$47,000 - $77,000
			Electricians	Skilled	$47,000 - $77,000
			Pipefitters	Skilled	$47,000 - $77,000
	Transportation		Truck Drivers	Skilled	$62,000 - $72,000
	Support Services	Health and Safety	HSE Coordinator	Professional/Technical	$72,000 - $120,000
		Office Support	Office Manager	Skilled	$45,000 - $79,000
			Administrative Assistant	Skilled	$28,000 - $55,000
		Procurement and Purchasing	Purchasing Agent	Professional/Technical	$36,000 - $79,000
			Materials Coordinator	Professional/Technical	$36,000 - $79,000
			Security Guard	Unskilled	$17,000 - $43,000
		Knowledge Specialists	Traditional Knowledge (TK) Specialists	Skilled	$38,000 -$50,000
			Employment and Training Counselor	Skilled	$38,000 -$50,000
		Environmental	Environmental Monitor	Skilled	$38,000 -$50,000
		Information	Information Technologist	Skilled	$38,000 -$50,000

Table 19: Oil Related Job Descriptions

12.4.7 Drilling Rigs

Drilling rig activity and related oil and gas field activities will generate the greatest number of jobs. A drilling rig consist of two crews of six consisting of a tool-pusher, driller, derrickhand, motorhand and two floorhands. In addition to the twelve immediate jobs, approximately 15 additional jobs are generated in support companies to haul the rig equipment, provide cementing services, drilling mud, acidizing or fracturing services, wellhead equipment, water hauling, wellsite preparation, surveying and environmental assessment. Drilling rig activity will be limited to winter access months. The development scenario generated in Section 9 of this report predicts five drilling rigs will be required each winter.

12.4.8 Seismic

Seismic crews consist of four to six members using light duty trucks and quads. The predicted activity level would support three seismic crews each winter.

12.4.9 Well Servicing

Well servicing requires a smaller, truck mounted, rig that can access well sites year round. Service rigs have one daylight crews of four workers: driller, derrickhand/motorhand and two floor hands. The same ancillary services provided to drilling rigs are also needed for service rigs. Two year-round service rigs are sufficient to support all wells in Eagle Plain.

12.4.10 Road Construction

Road construction will be required to each new well pad. Three crews of ten are predicted.

12.4.11 Gathering Pipelines

Gathering pipelines between the wells and the inlet plant to the NYGP are generally built by the individual producer companies. Small pipelining crews will be required to lay lines that would be one to twenty kilometers in length at a time. The type of jobs are identical to those itemized in the main pipeline section with additional requirements for surveying and clearing the right-of-way. Pipelining activities will generally be restricted to the winter season. Some summer can take place in summer when small diameter pipe can be installed with light duty equipment along existing roadways. Two year-round pipeline crews and an additional two crews each winter are predicted.

12.4.12 Operations

Finally, a permanent level of drilling and production will mean that four to eight operating companies will each have an office in either Eagle Plain or Whitehorse, staffed by approximately 10 people each including managers, well operators, rig supervisors, accountants and support staff.

12.4.13 Total Employment Levels

The total predicted employment levels are shown in Table 20.

Activity Type	Winter Jobs	Year Round Jobs
Seismic (3 crews)	18	
Drilling Rigs (5 rigs each winter)	75	
Service Rig (2 rigs year round)		8
Road Construction (3 crews)		30
Pipelining (2 winter+2 yr round)	60	60
Operating Company office (8)		80
Total	**153**	**178**

Table 20: Drilling and Production Predicted Employment Levels

Job descriptions and salaries for these jobs are shown in Table 21. Wages have been obtained from various company, industry group and employment websites.

Seismic	Operations	Field Crew	Crew Chief	Skilled	$75,000
			Vibrator Operator	Skilled	$65,000
			Observer	Skilled	$60,000
			Shooter/Jughand	Unskilled	$35,000
Drilling	Operations	Drilling Rigs	Tool Pusher	Skilled	$75,000
			Driller	Skilled	$60,000
			Derrickhand	Skilled	$45,000
			Motorhand	Skilled	$42,000
			Floorhand	Unskilled	$36,000
Drilling	Operations	Service Rig	Driller	Skilled	$60,000
			Derrickhand	Skilled	$45,000
			Motorhand	Skilled	$42,000
			Floorhand	Unskilled	$36,000
Drilling	Support Services	Cementing	Cementing Operator	Skilled	$50,000
		Stimulation	Acid Stimulation Operator	Skilled	$50,000
			Fracture Stimulation Operator	Skilled	$70,000
		Wireline	Electric Wireline Operator	Skilled	$70,000
			Slickline Operator	Skilled	$60,000
		Packers/Tools	Tool Hand	Skilled	$60,000
Drilling	Road Construction	Equipment Operators	Heavy Equipment Operator (Grader, Front-end Loader, Excavators)	Skilled	$62,000 - $72,000
Drilling	Pipeline	Equipment Operators	Heavy Equipment Operator (Cat Skinner, Boom Trucks, Excavators)	Skilled	$62,000 - $72,000
Operating Company	Engineering	Engineer	Professional Engineer	Professional/Technical	$60,000 – 110,000
	Operations	Operators	Foreman	Professional/Technical	$66,000 - $72,000
			Assistant Foreman	Professional/Technical	$66,000 - $72,000
			Well Operator	Skilled	$50,000 - $65,000
	Support Services	Health and Safety	HSE Coordinator	Professional/Technical	$72,000 - $120,000
		Office Support	Office Manager	Skilled	$45,000 - $79,000
			Administrative Assistant	Skilled	$28,000 - $55,000
		Procurement and	Purchasing Agent	Professional/Technical	$36,000 - $79,000

		Purchasing			
		Environmental	Environmental Monitor	Skilled	$38,000 -$50,000
		Information	Information Technologist	Skilled	$38,000 -$50,000

Table 21: Drilling and Production Related Job Descriptions

12.5 Business Opportunities

Operating companies are not in the business of providing the myriad of support services required for their operations. Whenever possible, they will look to secure the services of local companies and, only when those services are missing will the company be forced to do the work themselves. Local business opportunities are the greatest opportunity for First Nations economic development and self-directed employment. It is estimated that some 100 to 200 additional jobs would be generated as a result of oil and gas activity at Eagle Plain.

Business Type	Description
Drilling	Drilling Rigs, Service Rigs, Coiled Tubing, Cementing, Stimulation, Wireline, Downhole Tools
Transportation	Vehicle Rental, Trucking, Helicopter, Fixed Wing Aircraft
Fuel	Bulk fuel, propane, diesel fuel, aircraft fuel, gasoline, fuel oil, grease, lubricating oil, glycol and chemicals
Communication	Telecommunications, cellular phones, high-speed internet and cable TV
Construction - Facilities	Surveying Building supplies, hardware, paint, lumber supply and plywood Electrical contracting and supplies Plumbing contracting and supplies Carpentry and finishing Heating, ventilation and air conditioning supply, installation and maintenance Electrical power generation and supply
Construction - Pipeline	General contracting Timber for pipeline skids and survey laths Welding services and supplies, such as acetylene and oxygen
Office Requirements	Office space, supplies, furniture, computers and other equipment
Personnel Requirements	Secretarial, clerical, word processing, accounting, bookkeeping and payroll services
Safety and Medical	Medical facilities, supplies, services, air and ground ambulance, safety officers
Logistics	Materials handling, expediting, freight transport, light delivery and courier services
Accommodation and Meals	Apartments, hotels and motels, camps, restaurants, grocery stores

Table 22: Business Opportunities[17]

[17] adapted from http://www.mackenziegasproject.com/opportunities/businessOpportunities/index.html

13 Community Preparation

With knowledge of the potential scale and timing of oil and gas development in North Yukon now in hand, this section of the paper turns to look at how Yukon communities can prepare for sustained and responsible oil and gas development. As prelude to describing potential approaches and strategies for community preparation, a framework for the identification of potential socio-economic effects resulting from oil and gas activity in North Yukon is introduced below.

13.1 Potential socio-economic effects: a framework

Development of oil and natural gas resources in North Yukon will spawn a variety of socio-economic effects. The relevance and importance of a given effect is a matter of perspective. In terms of economic effects, typical perspectives include labour (households), businesses and government. In terms of social effects, perspectives can include health (mental and physical), cultural well-being, lifestyles, demographics, land use, community, and social organization.[18]

Within each of the economic and social perspectives, each project effect can be described according to three dimensions: timing, degree and span.

In terms of *timing*, socio-economic effects can be direct or flow-on in nature. Direct effects are the most immediate of all project effects and are generally a clear result of the project. Flow-on effects are the result of direct effects. Flow-on effects last for a longer period of time than do direct effects and typically involve more individuals located in a broader geographic area. The duration of the effect (the length of time an effect lasts) is also an important aspect.

With regard to *degree*, a socioeconomic effect may be positive or negative in nature. Positive effects are usually described as benefits (e.g., jobs) while negative effects are often described as impacts (e.g., changes in family structure). Whether positive or negative, the scale (or, size) of the effect is also important.

The *span* of an effect refers to how far afield the effect is experienced – locally, territorially or nationally. Social effects tend to be experienced more at the local and territorial level while economic effects flow according to the economic linkages associated with the project. As a result, it is possible for some economic effects to be experienced only at distances far removed from the project location.

The socio-economic effects framework is illustrated in Table 23 together with some examples of potential socio-economic effects. The list of potential effects has been derived from documentation describing the experiences in other oil and gas frontier regions, namely Atlantic Canada, the Northwest Territories (Mackenzie Valley) and coastal British Columbia. Note that the framework applies to each of the three main phases of oil and gas activity: exploration, development and production.

[18] Adapted from C.N. Taylor, C.H. Bryan, and C.G. Goodrich, *Social Assessment: Theory, Process and Techniques (third edition)*, 2004, p.108.

	--Timing --			-- Degree --			-- Span --		
	direct	**flow-on**	**duration**	**positive**	**negative**	**scale**	**local**	**territorial**	**national**
Economic Effects									
Labour ▪ employment ▪ wages/salaries ▪ training/education	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no
Business ▪ business opportunities ▪ business revenue ▪ capital/rental income ▪ technology transfers	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no
Government ▪ royalties ▪ provision of public services ▪ price inflation ▪ changes in fiscal flows ▪ economic output (GDP)	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no
Social Effects[19]									
Health ▪ stress and anxiety related to working conditions ▪ substance abuse	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no
Cultural well-being ▪ changes in the cultural composition of communities ▪ effects on known cultural, historical, spiritual and archeological resources	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no
Lifestyles ▪ loss of traditional livelihood ▪ change in wage/non-wage focus of community	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no
Demographics ▪ population change ▪ influx of temporary workers ▪ dissimilarity in age, gender, racial or ethnic composition	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no
Land use ▪ competing uses ▪ environmental degradation ▪ land acquisition and disposal	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no
Community ▪ effects on perceived quality of life ▪ changes in social networks or community organizations	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no
Social organization ▪ changes in distribution of power and authority ▪ changes in wealth distribution	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	____	□yes □ no	□yes □ no	□yes □ no

Table 23: Socio-economic effects framework

[19] Adapted in part from Jessica Turnley, *Social, Cultural, Economic Impact Assessments: A Literature Review,* United States Environmental Protection Agency, 2002, page 11.

The socio-economic effects framework presented above can be used as a tool for the identification of the economic and social effects potentially resulting from oil and gas activity in North Yukon. The framework is to be implemented by first confirming, based on the experience of North Yukon stakeholders, what the likely socio-economic effects of oil and gas activity in North Yukon are likely to be. For each effect so confirmed the next step is to indicate the expected timing, degree and span of each effect. To be comprehensive, the exercise should be undertaken for each of the three main phases of oil and gas activity (exploration, development and production). The results of the timing/degree/span exercise will provide a broad indication of where Yukon communities can focus their efforts in preparing for oil and gas development.

13.2 Potential community strategies to prepare for sustained and responsible oil and gas development

On the basis of the results of the timing/degree/span exercise, communities can begin to prepare a max/min strategy which maximizes (i.e., enhances) the positive socio-economic effects and minimizes the negative socio-economic effects of oil and gas development.[20] To illustrate what some of the elements of such a max/min strategy might include, this section of the paper looks at some potential approaches to community preparation including: benefit plans, human resource planning, benefit agreements and expectations management.

13.2.1 Benefit Plans

A primary benefit of oil and gas development from the perspective of public governments is the capture of economic rents from resource development in the form of royalties. In the late 1970s, the Government of Newfoundland, recognizing that resource revenues in the form of oil and gas royalties would likely be forfeited under the federal-provincial equalization program, pursued an innovative regulatory policy approach which sought to maximize direct local benefits from industry development. A primary objective of the subsequent regulations was to "…minimize negative effects on traditional industries, communities and culture and avoid 'boom/bust' effects."[21] That objective has become embodied by so-called Benefit Plans which outline in detail the developer's polices and procedures with respect to local benefits. Benefit Plans typically speak to:

- "Supplier development, including identifying potential suppliers, providing them with information about technical, commercial and other requirements, and debriefing unsuccessful bidders.
- Procurement policies, and especially bid packaging, which facilitate the opportunities for local companies.
- Training, hiring and succession planning, such that the employment of local people is encouraged, including through the timely replacement of 'expats.' This often includes requirements related to the training, hiring and retention of women and minorities.

[20] The absence of discussion here about the environmental effects of oil and gas development in North Yukon is not intended to diminish the importance of the environmental assessment process. It is fully expected that environmental assessments of the appropriate scale will be conducted under terms of the *Yukon Environmental and Socio-economic Assessment Act*.

[21] Mark Shrimpton, *Benefiting Communities: Lessons from Around the Atlantic,* Society of Petroleum Engineers, 2002, pp. 2 &3.

- Technology transfer and research and development, so as to ensure local suppliers of goods and services, and local employees, develop new capabilities related to industry requirements."[22]

An example of a completed benefits plan, submitted by Husky Oil as part of the White Rose Oilfield Development Application, may be found at: http://www.husky-oil.com/whiterose/development/.

13.2.2 Human Resource Planning

The employment of the local labour force by oil and gas companies (and their subcontractors) engaged in exploration, development and production activities in North Yukon will be a major effect of oil and gas activity in North Yukon. The scale and timing of employment opportunities was illustrated in Section 12.4.5 in Figure 24 "NYGP Estimated Direct Employment Levels."

An effective human resource plan will accurately assess the gap between the human resource requirements of oil and gas development activity in North Yukon and the available labour pools in North Yukon and Yukon-wide. A starting point to the potential human resource requirements can be found in section 5 of this paper which lists the types of jobs required for resource development, pipeline development as well as oil refining. Profiling of North Yukon and Yukon-wide labour pools can be undertaken by first defining who constitutes a resident of North Yukon and Yukon-wide regions. The definition of residents is then followed by an examination of their employability in terms of wellness, general employment skills and occupation-specific competencies.

Comparison of the human resource requirements with the labour pool profiles will yield an identification of the human resources gap. The final step in the human resource plan is the construction of a training plan designed to close the gap between industry needs and the local supply of labour.

The oil and gas industry operates on a global scale. As such, the development of North Yukon's oil and gas resources will be driven by market forces. In consequence, it is difficult to predict the exact pattern of development and the exact human resource requirements corresponding to that pattern making human resource planning challenging. Significant lead time is required by both postsecondary academic institutions and private organizations to implement education and training programs and by students to actually complete their studies. The timely solving of this human resource planning challenge is of critical importance to industry development.

An example of how to address the oil and gas industry human resource planning challenge is provided by the "Nova Scotia Offshore Labour Demand Model" developed in response to the upswing in oil and gas industry activity in Nova Scotia in the early 00's.[23] The model is not designed to provide a forecast of exploration and development activity but is instead a simulation model that can forecast the demand for competency-based human resource requirements for a series of industry development scenarios. The core-competencies (combinations of knowledge, skills, abilities, education and experience) needed to effectively

[22] Ibid, p. 5.
[23] The complete 194 page document describing the Nova Scotia model can be found at: http://www.pr-ac.ca/files/Labour_Demand_Model_-_Final_Report.pdf.

perform more than 70 industry-related occupations are specified in the model. Designed to be flexible in response to changing market conditions, new discoveries and technological advancements, the spreadsheet-based model allows users to define various development scenarios and calculate the corresponding human resource requirements. By running multiple scenarios users can identify human resource requirements common to a variety of eventualities which can then be used as a basis for the start-up of discussions with post-secondary institutions and private training organizations.

13.2.3 Benefit Agreements[24]

Benefit agreements are a commonly used tool in Canada's north to ensure that local communities realize economic benefits from resource development projects. Indeed, section 68 of the Yukon's Oil and Gas Act explicitly requires that a benefits agreement be negotiated which provides opportunities for Yukon First Nations (government and citizens) on whose settlement land oil and gas activity will be taking place, residents of communities affected by the oil and gas activity and other Yukon residents. The benefit agreement is to include opportunity provisions for:

- employment and training, and
- the supply goods and services to the developer (and subcontractors).[25]

Benefit agreements are designed to stem the leakage of economic benefits from local communities and individuals. As such, they are not an attempt to expropriate economic rent for which industry proponents have already negotiated access. To illustrate, leakage ratios for a hypothetical construction project were calculated for Canada's three northern territories.

The leakage ratios were derived using input-output multipliers[26] from Statistics Canada's 2000 Interprovincial Input-Output Model. The ratios demonstrate the percentage of wages and salaries, gross domestic product GDP) and person years of employment "lost" when a construction project is undertaken in a jurisdiction other than the benchmark jurisdiction, Ontario.[27] The ratios represent the difference, in percentage terms, between a multiplier for direct and indirect effects within a given territory and the corresponding Ontario multiplier.

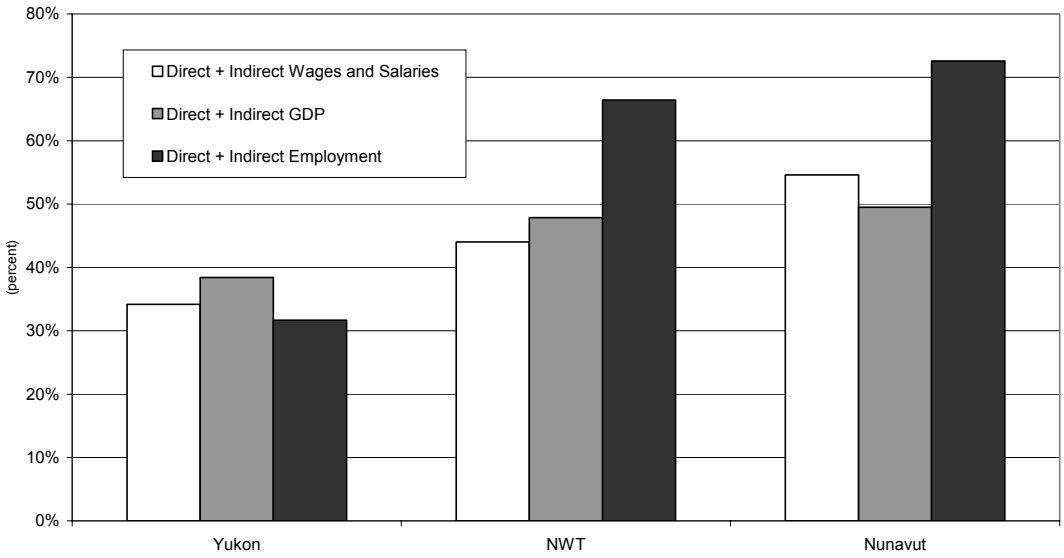
The results of the analysis are shown in the figure below. The amount of leakage associated with a given amount of construction spending is indicated by the value of the leakage ratio. For example, in the Yukon, the leakage ratio for direct and indirect multiplier effects on wages and salaries resulting from a construction spending is 34%. This means that, relative to Ontario, 34% of the direct and indirect labour income associated with a construction project in the Yukon will "leak" out of the territorial economy. For example, if $10 million were spent in Ontario on a construction project, Ontario would experience $10 million dollars

[24] Also commonly known as impact and benefit agreements.
[25] A Benefits Agreement template for exploration activities which mirrors section 68 of the Yukon *Oil and Gas Act* is available at http://www.emr.gov.yk.ca/oilandgas/exploration/default.htm#benefits.
[26] A popular approach to the measurement of the economic effects of a project is to use multipliers which derive from complex mathematical models called Input-Output (I-O) tables. Input-Output multipliers allow the tracing of changes in an economy that result from a "spending injection" such as the construction of a major project. Economic impact estimates calculated with Statistics Canada multipliers can be separated into direct and indirect components and can be limited to a provincial/territorial economy or can include impacts traced throughout the entire Canadian economy. Statistics Canada does not publish multipliers at the community level.
[27] Ontario was chosen as the benchmark jurisdiction because it is Canada's largest subnational economy and is therefore least likely to exhibit leakages.

worth of positive labour income effects. Conversely, if the same $10 million was spent in the Yukon, one third ($3,333,000) of the positive labour income effects would leak out of the territory to the benefit of other jurisdictions.

Correspondingly, 38% of the gross domestic product effects will leak away. In terms of direct and indirect employment effects, a construction project in the Yukon will result in less employment for local residents than it will for workers in other jurisdictions; 32% of jobs will leak out of the territorial economy. By way of comparison, as also shown in the figure, leakage ratios for labour income, salaries, GDP and employment for the Northwest Territories and Nunavut are higher than in the Yukon.

Leakage Ratios Relative to Ontario Benchmark
Direct and Indirect Multiplier Effects within Territory
-- Construction Industry --



Source: adapted from Statistic's Canada's 2000 Interprovincial Open Input-Output Model

As Statistics Canada multipliers are not available at the community level, the calculation of sub-territorial level leakage ratios is not possible. The dominant economic role played by Whitehorse in the Yukon economy means, however, that if community-level leakage ratios could be calculated, they would most certainly be higher than the ratios presented above.

13.2.4 Expectations Management

For a max/min oil and gas development strategy be properly executed in North Yukon – one that maximizes the positive socio-economic effects and minimizes the negative socio-economic effects – will require effective communication between local communities and industry proponents. As noted by Mark Shrimpton, large-scale industrial activity often faces several stereotypical expectations from the get-go including:

- "Most benefits will accrue to non-local corporations and their shareholders, with any local benefits being concentrated in the hands of few highly specialized and already prosperous companies and individuals.

- There will be boom-bust effects during construction activity, likely including housing shortages, traffic congestion, wage and cost of living inflation and crime and other social problems.
- There will be negative social, economic, cultural and biophysical effects during operations, as the industry's activities and culture undermine traditional industries and local lifestyles, as the scale of industry activity fluctuates in response to price cycles and through chronic and occasional accidental releases of pollution.
- The eventual cessation of activity will leave a negative social, economic, cultural and biophysical legacy."[28]

Shrimpton further notes, based on experiences in other frontier oil and gas regions, that for development to succeed according to the desires of all affected parties, a reciprocal program of public education and engagement is a critical requirement. In terms of the outcomes of the public education and engagement program, local stakeholders should have an improved understanding of the oil industry and the prospective effects of industry development as well as how industry will manage the effects. At the same time, "…it is also critical that oil industry personnel understand the local political, cultural, social and economic context, including the local values, priorities and aspirations."[29]

To prepare for oil and gas industry development, communities can:[30]

- gather information from oil and gas companies and industry associations;
- seek to learn from the experiences of others (while bearing in mind that comparative research features both merits and pitfalls[31]);
- host public workshops on the petroleum industry and the potential socio-economic effects of industry development; and
- establish multi-stakeholder committees to investigate and report on socio-economic effects issues.

For its part, industry can facilitate a positive relationship with communities "…through collaborative and cooperative approaches involving all local and industry stakeholders"[32] including:

- learning about the local context;
- educating people about the industry; and
- developing relationships and trust.

This section has described four potential approaches to community preparation for the sustained and responsible development of North Yukon oil and gas resources. While no single

[28] Mark Shrimpton, *Benefiting Communities: Lessons from Around the Atlantic,* Society of Petroleum Engineers, 2002, pp. 2-3.
[29] Ibid, p. 6.
[30] Adapted from Mark Shrimpton, *The Issue of Access: Confronting Community Expectations,* Society of Petroleum Engineers, 2004, pp. 4-5.
[31] A listing of the pitfalls of comparative may be found in *The Issue of Access: Confronting Community Expectations* at pages 4 and 5.
[32] Mark Shrimpton and Keith Storey, *Managing the Relationship Between the Offshore Oil Industry and Frontier Regions,* Society of Petroleum Engineers, 2000, pp. 3-5.

approach will be sufficient to address all of the potential socio-economic effects outlined in Table 23, combinations of approaches may be implemented. Innovative solutions reflective of the Yukon's unique nature and circumstances also remain a possibility.

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14 Constraints to Development

The intent of this section was to be a compilation of outcomes of a workshop to be conducted with the North Yukon Oil and Gas Working Group. The intent of the workshop was to conduct a risk identification and planning process with all members invited to participate in identifying both positive and negative impacts of oil and gas development in North Yukon. Major issues that form constraints to development would be prioritized and catalogued along with suggestions for working through the issues.

The results of the workshop were originally contemplated to be included in this report. It was later decided that the technical details of this report needed to be read, reviewed and discussed first. The workshop is still planned for a future time.