

RESOURCE EXPLORATION IN THE SAHTU SETTLEMENT AREA: OPPORTUNITIES AND CHALLENGES

PREPARED FOR:

GOVERNMENT OF NORTHWEST TERRITORIES

DEPARTMENT OF INDUSTRY, TOURISM AND INVESTMENT

MAY 2013

PREPARED BY:

DPRA CANADA INC.

This page has been intentionally left blank to allow for double-sided printing.

Table of Contents

1. INTRODUCTION.....	1
1.1. Background.....	1
1.2. Objectives.....	4
1.3. Information Sources.....	4
2. EXPLORATION PROGRAMS	4
2.1. Projected Company Activities: 2012/13.....	4
2.2. Future Exploration Activities: 2012 to 2017.....	5
2.3. Employment Opportunities	6
2.4. NWT Labour Force	7
2.5. Observations	8
3. ECONOMIC PROJECTIONS	8
4. ASSUMPTIONS	11
5. ECONOMIC OPPORTUNITIES	11
5.1. Employment.....	12
5.2. Increased Household Income	12
5.3. Business Opportunities.....	12
5.3.1. Contracted Services.....	13
5.3.2. Supplies	13
5.3.3. Service Sector.....	13
5.4. Other NWT Residents and Businesses.....	13
6. CHALLENGES	13
6.1. Seasonal Programs	13
6.2. Qualified Employees.....	14
6.3. Household Income.....	15
6.4. Family Pressures	15
6.5. Housing and Other Accommodation	15
6.6. Availability of Contracted Services and Capacity of Suppliers.....	15
6.7. Sahtu Land Use Plan	16
6.8. Land Use Regulation.....	16
6.9. Hydraulic Fracturing.....	16

6.9.1.	Groundwater Contamination from Below-ground Activities.....	16
6.9.2.	Wastewater Management and Disposal from Above-ground Activities	17
6.9.3.	Chemical Additive and Fuel Handling, Transportation and Storage	17
6.9.4.	Well Blowouts	17
6.9.5.	Water Usage and Supply	17
6.9.6.	Land Consumption and Disturbance.....	18
6.9.7.	Air Quality	18
6.9.8.	Induced Earthquakes	18
6.10.	Baseline Environmental Information.....	19
6.11.	Government Programs and Services.....	19
6.11.1.	Education, Culture and Employment	19
6.11.2.	Justice	20
6.11.3.	Health and Social Services	21
6.11.4.	Environment and Natural Resources.....	22
6.11.5.	Municipal and Community Affairs.....	23
6.11.6.	Department of Transportation	24
6.11.7.	Executive	24
6.11.8.	Baseline Information.....	25
7.	CONCLUSIONS.....	25
8.	RECOMMENDATIONS	25
	Appendix One: Summary of Exploration Licences in the Central Mackenzie Valley.....	27
	Appendix Two: Overview of the Employment, Goods and Service Requirements Associated with Oil and Gas Activities	28

1. INTRODUCTION

1.1. Background

Within the Northwest Territories, the oil and gas industry has historically explored and developed conventional oil and gas deposits which are contained in relatively discrete porous reservoirs; often in limestone or sandstone. These deposits are usually less than 20 metres thick and generally uncommon. Recently, the industry has begun to explore 'unconventional' oil and gas deposits which are comprised of fine grained sandstones, siltstones and shale which are characterized by low porosity and limited permeability. By comparison, these deposits are quite common, occur over large areas, and in some cases can exceed of 300 metres in thickness.

A recent study¹ of shale hydrocarbon potential concluded that there are several good prospects in various regions of the NWT, including the Peel, Mackenzie and Great Slave Plains and the Liard Basin (Figure 1). The Canol and Hare Indian Formations, in the Sahtu Region, are known shale deposits hosting significant amounts of oil and natural gas liquids. It is estimated that these deposits could produce more than one billion barrels of crude oil over the next 15 to 30 years using horizontal drilling and multi-stage hydraulic fracturing techniques.² These estimated reserves potentially represent approximately 15 per cent of Canada's non-oil sands reserves.³

In 2011, Aboriginal Affairs and Northern Development Canada (AANDC) awarded eleven land parcels in the Sahtu Region to five companies in return for work commitments totalling \$534 million dollars (Appendix 1). In 2012, two additional parcels were awarded for work commitments exceeding \$92 million dollars.

The 13 Exploration Licences (EL) (Figure 2); consisting of two consecutive periods of five and four years (periods One and Two respectively); will be valid for up to nine years. The companies are required to expend their entire work commitment and to drill at least one exploratory or delineation well prior to the end of Period One in order to retain their EL during Period Two. Accordingly, it is expected that at least \$542 million will be spent on exploration in the Sahtu Region within the next four to five years. The projected expenditures do not include additional expenditures associated with seismic surveys or exploration work that might occur on other ELs or Significant Discovery Licences (SDL) (Appendix 1) in the Central Mackenzie region.

¹ B.J.R. Hayes, *Regional Characterization of Shale Gas and Shale Oil Potential, Northwest Territories*; Northwest Territories Geosciences Office, NWT Open File 2011-08, 2011.

² MVPPPO; *Sahtu Petroleum Exploration: Challenges and Opportunities*. August 2012

³ Canadian Association of Petroleum Producers, www.capp.ca

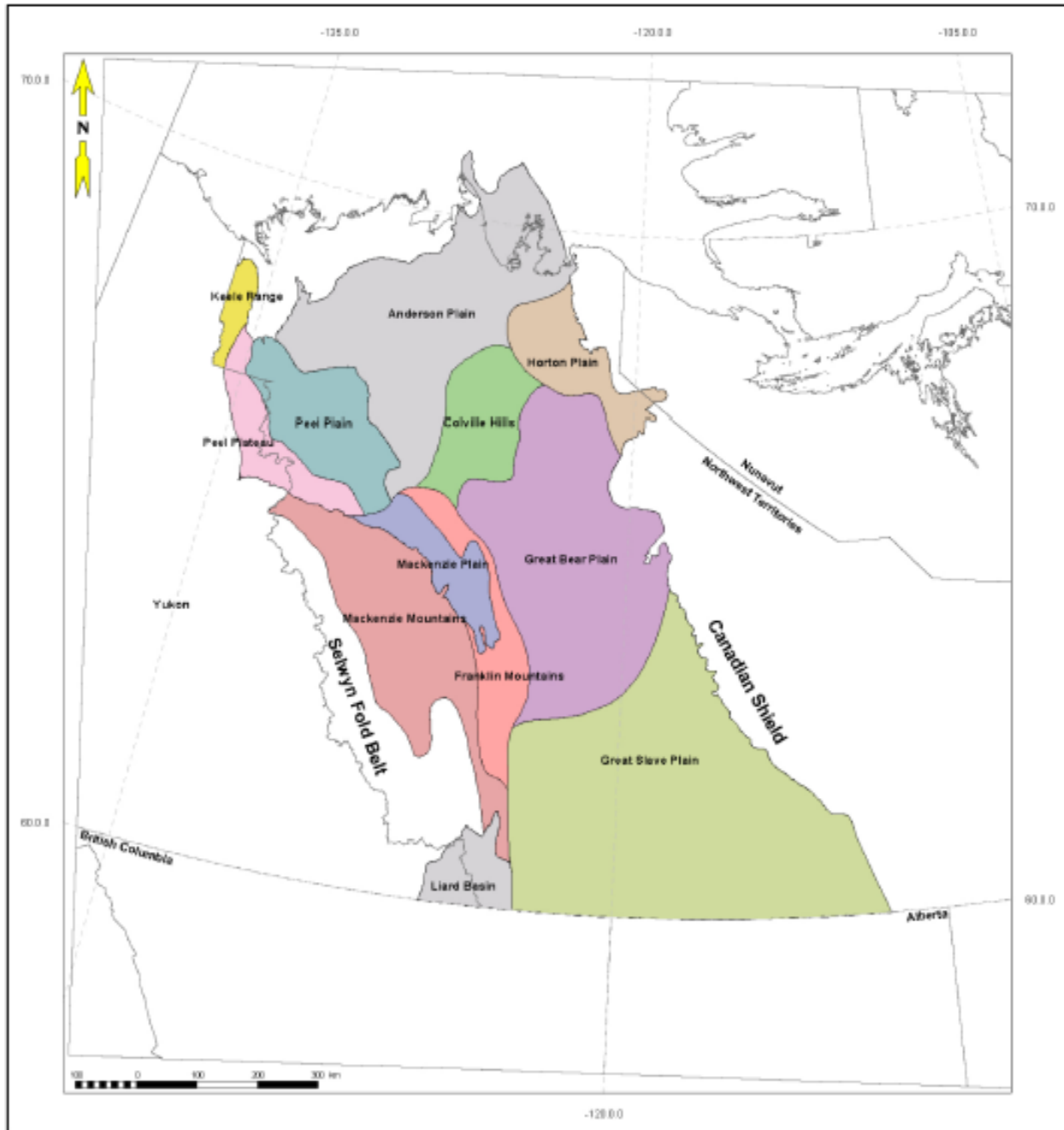


Figure 1: Exploration Regions of the Northwest Territories

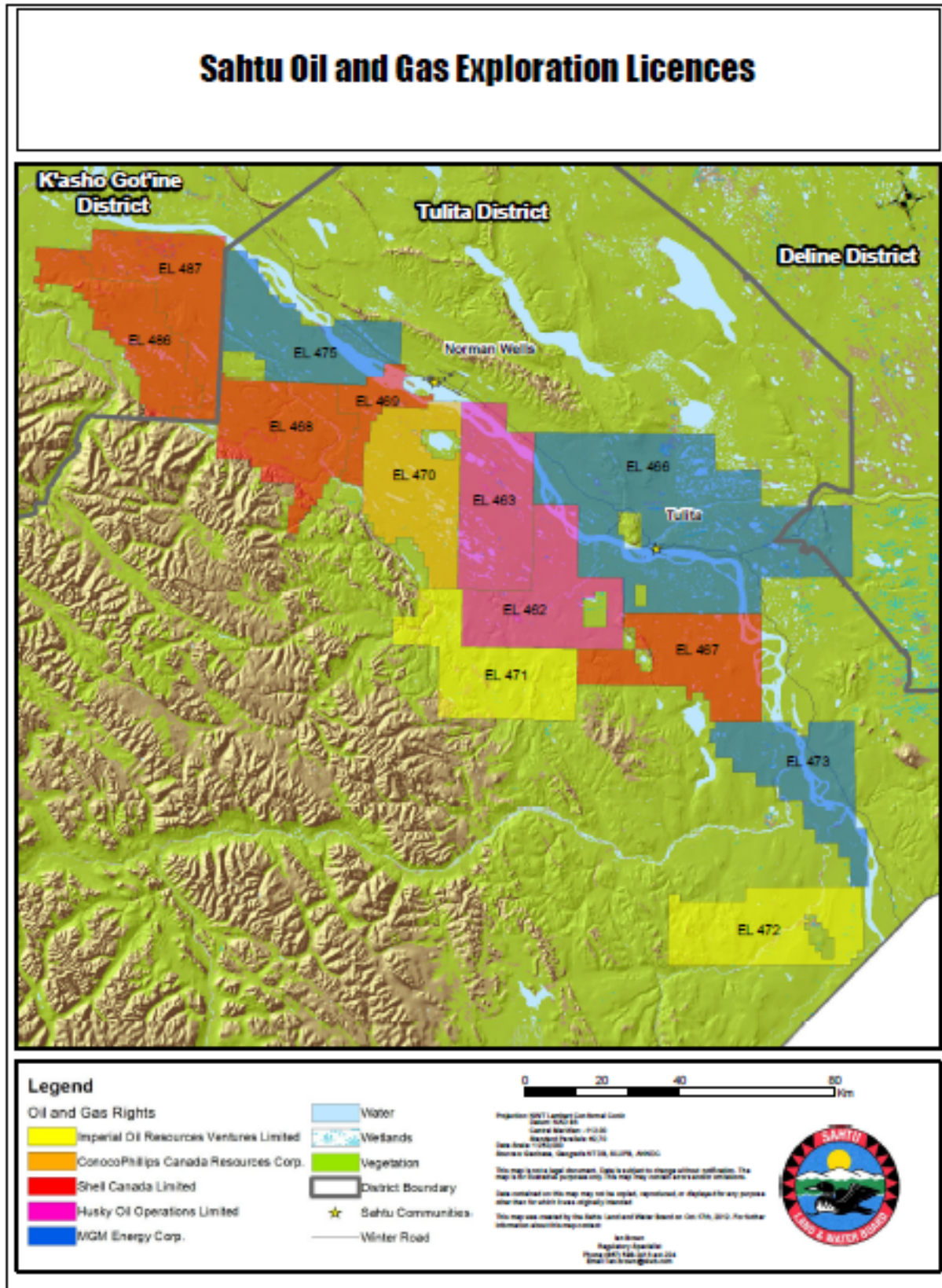


Figure 2: Location and Extent of Exploration Licences in the Sahtu Region.

The exploration activities present a significant economic opportunity for Sahtu and other NWT residents with respect to employment and the provision of goods and services. However, it is also anticipated that these activities will put additional pressures and demands on Government of the Northwest Territories (GNWT) programs and services in the region. The GNWT seeks to ensure that maximum economic benefits accrue to the residents of NWT and that potential negative socio-economic and environmental impacts are mitigated to the greatest extent possible.

1.2. Objectives

This paper is intended to:

- Succinctly describe the projected extent and duration of hydrocarbon exploration activities within the Sahtu Settlement Area over the next five years;
- Describe the potential opportunities and challenges associated with the exploration activities that will provide an informed focus for GNWT efforts and initiatives; and
- Present baseline information that will serve as a means to evaluate the effectiveness of the GNWT response to the opportunities and challenges going forward.

1.3. Information Sources

The following discussion is based on publicly available information which has been supplemented by economic modeling by the Department of Industry, Tourism and Investment (ITI), data from the Bureau of Statistics and input from government representatives. Although, this report reflects the best-available information at the time of writing, there is inherent uncertainty associated with projections of future activities and events. This report will be updated on a regular basis as details are clarified and/or circumstances change.

2. EXPLORATION PROGRAMS

2.1. Projected Company Activities: 2012/13

The scope and extent of the projected exploration activities for winter 2012/13 are summarized below.

Projected Activities and Expenditures				
Activities/Companies ⁴	Husky	Con. Phil.	MGM	Ex. Data
Seismic Surveys (km)				80
Infrastructure ⁵	x	x	x	
Exploratory Wells ⁶	2	3	1	

⁴ Con. Phil. = Conoco Phillips; Ex. Data = ExplorData

⁵ includes roads, airstrips, accommodation

⁶ Includes vertical drilling and/or testing; no horizontal drilling is planned for the current season

Projected Activities and Expenditures				
Activities/Companies ⁴	Husky	Con. Phil.	MGM	Ex. Data
Baseline Studies	x		x	
Total Employees Required	200-250	150-175	120	80
Local Employee Positions ⁷	90	25	35	35
Total Expenditures (millions)	150	60	30	5

Neither Shell Canada nor Imperial Oil Resources Ventures Limited (IORVL) plan to undertake field programs during the 2012/13 season; both companies plan to begin their field programs in 2013/14.

2.2. Future Exploration Activities: 2012 to 2017

While it is difficult to predict future levels of exploration activity (much is dependent on the results of preceding exploration activities) it can be reasonably expected that at least one well will be drilled on each of the remaining land parcels that have not yet been drilled. If a well is not drilled within the first five years, the land covered under that EL will automatically revert back to the Crown and be eligible for further nomination and bids. In addition, there are active ELs and SDLs, issued prior to 2011, that could also attract activity and expenditures. It is also possible that additional lands will be made available in future years that could further increase the forecasted levels of exploration activity and spending.

The most recent forecast⁸ with respect to oil and gas activity and expenditures in the Sahtu Region (which does not include the ELs issued in 2012) is summarized below.

Although many factors are considered when making investment decisions, it is likely that exploration activities will continue as long as the exploration yields positive results and economic projections are favourable. However, there are numerous reasons why companies may choose to not proceed with further exploration and development – the production tests may be less than favourable, there may be delays in developing the necessary infrastructure, transportation systems may require upgrading or expansion, regulatory approvals may be onerous, and product prices may not support an economic project. The collective expectations of all parties must be suitably managed in light of these sobering realities.

Forecasted Exploration Activities: 2012-2017					
	12/13	13/14	14/15	15/16	16/17
2D Seismic Programs	11	5	4	2	4
3D Seismic Programs	2		1		
Exploration Wells	1	3	6	4	4
Delineation Wells		1	1	1	1

⁷ Positions that could be filled by regional or territorial residents; information provided by companies at meeting in September, 2012. (This footnote is on the wrong page...should be on previous page)

⁸ NWT Oil and Gas Activity Forecast; October 2011 and NWT Business Opportunities Forecast; March 2012

Production Wells		1		1	
Estimated Expenditure (Millions)	73	98	148	87	136

2.3. Employment Opportunities

The primary and secondary employment opportunities associated with hydrocarbon exploration are summarized below. These are approximate numbers as the specific personnel requirements will vary from one project to another. Nevertheless, they provide a reasonable representation of the employment opportunities that are available. The approximate number and type of positions associated with a drilling operation are⁹:

Employment Type	No. of positions	Potential local employment	Expected no. of work days	Expected no. of local person-days
Camp Staff	5-10	5-10	60-90	300-800
Vacuum Truck Drivers	2-6	2-6	60-90	120-240
Rig Crew	18-24	6-10	60-90	350-400
Drilling Services	4-10	0	60-90	0
Well Site construction	6-10	6-10	30	180-300
Road Construction	8-12	8-12	60	480-720
Road Maintenance	8-12	2-4	60	120-240
Fuel Farm Attendant	1-3	1-3	60-80	60-240
Fuel Truck Driver	2-4	2-4	60-80	120-370
Environmental Monitor	2-4	2-4	60-80	120-370
Security	3-6	3-6	80	240-480
Water Truck Driver	2-4	2-4	60-80	120-320
Oilfield Tucking	2-4	2-4	25	120-320
Completion work	24	11	65	250

Additional personnel and expertise required to support primary exploration activities include:

Activities & Services	Personnel & Expertise				
Site Preparation; Road, Airstrip and Camp Construction	Site Foreman	Surveyors	Equipment Operators	Truck Drivers	Skilled & Manual Labourers
Safety Personnel	Safety Officer	First Aid Attendants			
Trades Services	Heavy Duty Mechanics	Welders	Electricians & Instrument Techs	Carpenters	Warehouse & Parts Persons
Professional Services	Biologists	Hydrologists	Geologists	Environmental Monitors	Engineers

⁹ Report prepared by ECE; 22 January, 2013

In addition to direct employment, exploration companies rely on a variety of support services which can have a substantial impact on regional and community based businesses.

Service Industry	Telecommunications	Hospitality	Food Services	Banking	Taxis	Rental Vehicles
Trucking	Mud and Chemical hauling	Fuel and Oil supply	Sewage	Garbage	Resupply	Gravel
Other Transportation	Boats & Barges	Helicopters	Aircraft	Air Cargo		

2.4. NWT Labour Force

The most recent labour statistics for NWT and its component regions (January 2012) are presented below. A further break-down of the labour force availability within the Sahtu Region is as follows:

	Population with at least a high school diploma	Population > 15 years old	Employed	Potential labour supply
Norman Wells	89.2%	649	521	29
Fort Good Hope	68.0%	453	198	78
Colville Lake	78.3%	83	36	8
Tulita	57.6%	410	171	46
Deline	62.2%	429	181	57
Totals		2024	1107	218

Bureau of Statistics; Community Profiles January 2012

As of March, 2013 there were 88 registered businesses in the Sahtu Region. Ten businesses were listed under the transportation construction category and another 15 were listed under the building construction category. There were no companies listed under the petroleum exploration service industry category. There was no explicit information on companies from elsewhere in NWT or other jurisdictions that are active in the Sahtu Region.

	NWT	Beaufort Delta	Sahtu	Dehcho	Tlicho	South Slave	Yellowknife
Population Older than 15 Years ¹⁰	33730	5409	2024	2621	2029	5702	15775
Not in Labour Force	8412	1671	699	944	957	1636	2448
Employed	22702	3053	1107	1397	822	3658	12576
Employment Rate (%)	67.3 ¹¹	56.6	54.7	53.3	40.5	64.2	79.7
Non-aboriginal	83.1	90.0	89.1	85.9	93.9	79.1	82.6
Aboriginal	49.8	43.7	41.4	47.0	36.3	50.6	69.1
Unemployed	2616	674	218	280	250	408	751

Summary of Regional Statistics; Bureau of Statistics January 2012

¹⁰ 2011 data

¹¹ 2009 data

2.5. Observations

Available information suggests that:

- Total expenditures in 2012/2013 could exceed 200 million dollars; including the potential for up to 150 million dollars of contracted goods and services from NWT-based businesses (assuming 70% of total expenditures).¹²
- Up to 550 jobs could be available through these exploration activities; including approximately 185 jobs that could be available to qualified regional or NWT residents.
- Although current information suggests that over 200 Sahtu residents are available for work, it is likely that a significant number of these persons are not employable; for a variety of reasons.
- Available anecdotal information indicates that the current demand for regional employees is not being met. Clearly, there must be a match between the skill and asset requirements of the available positions and the 'employability' of the persons available for work.
- The reasons for the mismatch between available positions and persons seeking employment must be clearly understood before the challenge can be effectively addressed.
- As Sahtu residents and businesses are not meeting all of the company requirements for employment, goods and services, there are opportunities for potential suppliers from other regions of NWT. Workers and businesses from the Beaufort Delta, Dehcho and South Slave regions are addressing some of the opportunities.
- It is likely that significant employment and business opportunities will be missed during the current exploration programs unless there is a coordinated and concerted effort to pursue the opportunities and address the apparent challenges.
- In the interim, there will be a significant influx of seasonal workers that will tax the available accommodation, supply outlets and service providers in the Sahtu communities.
- As much of the available information with respect to jobs, business opportunities, number of regional and NWT employees is anecdotal in nature; it is difficult to develop a definitive, quantitative picture of what is actually happening with respect to employment and business opportunities.

3. ECONOMIC PROJECTIONS

The Mackenzie Valley Petroleum Planning Office worked with Impact Economics to develop a model to calculate the economic impact of oil and gas exploration in the Northwest Territories. This model generates estimates for GDP, labour income, and employment.

The model was developed using a generic expenditure pattern for a vertical well drilled and completed near Tulita and the NWT Bureau of Statistics' *2008 NWT Input-Output tables*. It includes the impacts of

¹² MVPPO; *Sahtu Petroleum Exploration: Challenges and Opportunities*. August 2012

road construction, site preparation, rig transportation, and site reclamation in addition to the actual exploratory drilling activities.

To understand economic impacts, it is important to recognise how a model accounts for expenditures. Regional or territorial impacts are derived from activities that take place within that region. The purchase of goods or services outside the territory affects the economies in those regions and is treated as an import to the NWT. Most services, including labour services, take place in the territory and are therefore a part of the NWT economy, even if the labour is imported. The drill rig is treated differently. It is rented through a service provider. The oil and gas company pays the drilling company that is then responsible for moving it to the NWT and purchasing labour for operations and maintenance. The drilling company earns a return on capital, which covers depreciation, debt payments, and profits. While most of these activities take place in the NWT, a large portion of the associated dollars leaves the territory—something that economists would call “economic leakage”.

Exploration does not create a value-added product that can be included in the territory’s GDP. This is unlike mineral production that results in diamonds or oil. This means the real contribution of the industry to the current economy is employment and labour income, whether associated directly with the drilling operation or indirectly through downstream service providers. Most other expenses are directed to imports, whether directly or indirectly. But even there, a large portion of the labour is imported as well because of the need for skilled, professional, or specialised labour for a short-term basis. Research by DPRA Canada provides a list of exploration-related jobs created by drilling activities that can be filled by the regional workforce, but this does not necessarily mean that the regional workforce fills all of these positions.

A simulation was completed to determine the effects, multipliers, and intensity ratios that can be applied to other exploration programs, under the assumption that the expenditure patterns are similar. Using the generic Tulita Vertical well as the basis for the simulation, the model calculated that a \$16.4 million exploration program would cause a \$7.4 million rise in GDP, a \$5.4 million increase in labour income, and create 67 full-time equivalent jobs. These results are based on a closed model, which includes the direct, indirect, and induced effects.

From these results, it is possible to calculate the multiplier effects, which describe the total impact in relation to the direct effect. The closed-model GDP multiplier was 1.351, the labour income multiplier was 1.264, and the employment multiplier was 1.287.

The two most important caveats relate to the labour income and employment results. First, the model calculates results based on full-time equivalency. This means the model assumes the labour income generated by the project is paying for people who work full time. The idea is to determine the number of person-years of employment in order to relate the results to other labour force statistics. Because the jobs created through oil and gas exploration are seasonal, the employment results require a cautious interpretation.

Direct, Indirect, and Induced Impacts

The model calculates overall impacts by summing the direct, indirect, and induced effects from the exploration expenditures. The direct effect can be thought of as the immediate benefits to an economy. Indirect effects are all of the spinoff activities that flow from the initial expenditure. In the NWT, indirect effects are typically small because large portions of these expenditures are directed toward the purchase of supplies (goods) that are not manufactured in the territory. Even when purchased from a local retailer, the price paid is divided between the cost of the imported good from the manufacturer and a retail margin that is then divided between the cost of transporting the item to the NWT, staff, building rental, heat, utilities, advertising, etc. These purchases can spark additional activities by retailers or service providers that can affect other NWT businesses such as wholesalers or transporters, but again, a large portion of these expenditures pay for imported goods such as fuel. The value added at each stage of this transaction chain combines to produce the total indirect impact. Induced effects are the economic impacts resulting from the spending of the income earned directly or indirectly as a result of the Direct NWT Expenditure.

For example, if the impact on labour income equals \$500,000 and the average income for a particular industry equals \$100,000 a year, the model will show the total employment impact equals 5 jobs ($500,000/100,000$). For oil and gas exploration, the industry employs people on a seasonal basis, with some people working more weeks than others. In this case, it is better to interpret the 5 jobs as meaning 260 weeks of employment (52 weeks per year x 5 jobs). These weeks can then be divided between the number of workers and the average weeks worked.

Pros and Cons to Macroeconomic Modelling

The model calculates the effects from expenditures on a regional economy. Additional work is needed to determine how regional changes affect individuals. When studying simple examples such as the drilling of a single well, one might prefer to investigate its effects at a microeconomic (individual) level. In this case, it would not be difficult to identify who amongst the local population was employed and which local businesses were affected. The only real challenge would be in estimating how much income was earned, but this could be estimated using generic wage data. However, the detailed information and calculations needed to continue with this approach can become overwhelming as the industry grows and more and more wells are drilled, especially when each drilling program is different, implying different expenditure profiles. In this case, the macroeconomic approach becomes more appealing not only because it can make these calculations quickly and without much effort, but also because determining the local impacts can be calculated from the macroeconomic results *ex poste* with relative ease.

The second caveat is to recognise that a portion of the 67 full-time equivalent jobs determined by the model include labour working in the NWT but residing elsewhere. The imported income and jobs should

be subtracted from the results when discussing local impacts. The same requirement is applied to the NWT diamond industry, where it is common to see employment results separated by residency status.

The model was used to generate an initial estimate of the economic impact of oil and gas exploration over the next five years. Assuming that all of the exploration wells being considered (18 in total) were to proceed over that time frame and that each followed the same baseline expenditure profile—meaning all 18 wells were the same and included road construction, site preparation, and full reclamation—the impact on GDP would be approximately \$133 million. As more details become known regarding the anticipated exploration wells such as the use of horizontal drilling techniques, the model can be updated to incorporate that information to produce more accurate results.

4. ASSUMPTIONS

As this is a ‘forward-looking’ document, the following analysis, conclusions and recommendations are based on a number of assumptions:

- The companies will meet all of their financial and regulatory commitments and that their exploration licences will remain intact for their full term.
- Exploration activity will lead to the discovery of sufficient hydrocarbon resources to stimulate expanded (geographically and/or temporally) exploration and development activities.
- Industry will utilize regional goods and services and employees whenever possible provided that the efficiency and safety of their operations are not compromised.
- If industry needs for goods and services and employees cannot be fully met by regional suppliers, other NWT suppliers are willing to engage with the operating companies.
- NWT residents and suppliers outside of the Sahtu Region may not be fully aware of the opportunities available within the Sahtu Region with respect to hydrocarbon exploration.
- Expanded exploration and development activities will lead to increased concerns about the potential cumulative environmental and social effects of these activities.
- Good decisions require good background information. The effective evaluation of GNWT policies, programs, and initiatives requires relevant quantified information.
- As training, information gathering and other initiatives require substantive effort and time to implement, GNWT cannot wait for full certainty with respect to future exploration activities before taking appropriate action.

5. ECONOMIC OPPORTUNITIES

The projected scope of exploration activities presents significant economic opportunities for Sahtu and NWT residents. These opportunities include: direct employment by the exploration companies and their contractors, business opportunities to provide goods and services to the exploration companies, and enhanced opportunities for the regional hospitality and service sectors. A summary of common industry needs is presented in Appendix 2. Pursuant to the Sahtu Land Claim Agreement, exploration companies are required to complete an Access and Benefit Agreement with the relevant land corporation before undertaking exploration, development or production activities on any lands within the Settlement Area. These agreements generally include commitments with respect to employment and training, business opportunities, and a bilateral committee to monitor the implementation of the agreement. As specialized equipment and materials such as pipe casing and drill mud are not available in the NWT, a number of joint ventures have been established to address industry needs and support both business and capacity development in the Sahtu Region. Generally, companies have demonstrated a willingness to employ regional residents and engage regional businesses provided that company standards of service, safety and dependability are met.

5.1. Employment

The information presented in Section 2.0 indicates that approximately 185 jobs could be available to regional residents during the 2012/13 exploration season. A similar level of employment will likely be available in subsequent years if a comparable level of activity is undertaken. Clearly, there are significant employment opportunities for qualified regional and NWT residents. Although the winter work season is relatively short, the experience gained through these activities could lead to full-time employment opportunities elsewhere in the industry for persons who are prepared to work outside of the Sahtu Region.

5.2. Increased Household Income

Income derived from a season of employment can mean an increase to the annual income of a household. The typical monthly salary for persons working on a drill rig is as follows:

Position	Weekly Pay (\$)	Monthly Pay (\$) ¹³
Driller	590	12,406
Assistant Driller	532	11,173
Derrickhand	504	10,584
Motorhand	427	8,967
Floorhand	411	8,643
Leasehand	378	7,983

However, as the income is seasonal, employees may be challenged to manage the household income in a manner that provides optimal benefits throughout the remainder of the year - until the next period of employment.

5.3. Business Opportunities

The types of good and services required for an exploration program are summarized in Appendix 2.

¹³ Based on an 84-hour work week (two-week; one-week rotation) including subsistence and performance bonuses. Information provided by Akita Sahtu Drilling Ltd.

5.3.1. Contracted Services

The major contacted services relate to the construction and maintenance of winter roads, field camps, hauling fuel and industrial supplies, catering, air transportation and environmental monitoring. As a number of Sahtu-based companies currently provide many of these services for other clients, there should be opportunities to expand their current services. In other cases, it may be more effective to partner or joint-venture with other companies to address the increased demands for their goods or services. There may be less potential to provide secondary services such as surveying, safety and medical services, and tradespersons but most of these services could be available from elsewhere in the NWT.

Exploration programs will require gravel, trucking services, barging services, construction of barge landings and pipe lay down areas, winter road building services, right of way clearing, camp and catering services, medical and safety services, communications services and fuels supply services all of which can be supplied by northern companies that have the capacity available during the appropriate periods. Alternately, it may be possible for businesses to lease equipment, hire temporary workers and/or subcontract services from southern suppliers.

5.3.2. Supplies

Exploration activities require significant quantities of fuel and lubricants; drill casing, drilling mud, chemicals and cement; catering and camp supplies; and support vehicles. In some cases, significant quantities of aggregates may also be required. In some cases, local suppliers may be more economical than southern suppliers may have more product available they will have to factor in transportation costs.

5.3.3. Service Sector

The service sector includes the provision of within-community goods and services including meals and accommodation; buses and taxis; utility and fuel services; and expediting services. Many of these services are already available within the Sahtu communities but the scale of demand could exceed the current level of service delivery. There appears to be potential to grow these service businesses.

5.4. Other NWT Residents and Businesses

It is unlikely that Sahtu residents and businesses will be able to fully exploit the employment and business opportunities that will be available, particularly in the short term. Other NWT residents and businesses may be able to address some of these needs if they are made aware of the opportunities. Anecdotal information indicates that a number of persons and businesses from the South Slave, Dehcho and Beaufort Delta regions were active in the Sahtu Region during Winter 2012/13 but definitive information is not currently available.

6. CHALLENGES

6.1. Seasonal Programs

Exploration programs are limited to the relatively short (January to March) winter season when heavy equipment can operate on the frozen landscape. The lack of all-weather roads limits the season when heavy equipment can be moved into the Sahtu Region and further limits the movement of goods and equipment within the region. As a result, exploration programs are characterized by short but intense periods of activity; when there is a high demand for a limited pool of regional employees and support services; and a much longer period (before the next exploration program) of little or no employment. An all-weather road to the Sahtu Region and roads within the region would extend the exploration season, including the period of employment and business opportunities.

6.2. Qualified Employees

As jobs in the oil and gas business become more specialized, there are diminishing opportunities for unskilled persons. Employers prefer to hire persons who are at least 18 years old and have completed Grade 12. Some employers will accept persons with a Grade 10 education and work-related experience as they do not want to overlook potentially good employees. However, companies actively discourage high school students from leaving school to pursue employment and advise them that persons with a Grade 12 education get priority consideration. Companies seek to hire people that they can fully train, retain and promote to more responsible positions. When hiring, companies also consider:

- Literacy and numeracy skills
- Driver's license
- Communication skills
- Ability to travel and work independently
- Life skills
- Trade Certificates
- Experience with machinery
- Knowledge of the land

Generally, companies offer safety training and orientation at the time of hire, in addition to on-the-job learning and further training as the employee's tenure progresses. Some training may be required by the employee prior to consideration for hire. As safety is a high priority, the companies ensure that employees are well-trained to use their equipment properly and safely, and to conduct themselves appropriately on the job site. On-the-job training and training-for-hire may include:

- Safety training
- H2S Alive¹⁴
- WHMIS¹⁵
- First Aid
- Fall Arrest
- Equipment operation
- Class 7 driver's license
- Life skills
- Transportation of Dangerous Goods
- Confined Space Awareness

Persons seeking employment must demonstrate that they have the required skills and personal assets to be productive employees. In addition to the basic requirements indicated above, employers seek persons who have a positive attitude, a good work ethic, a healthy lifestyle, and a strong commitment to job-site and personal safety.

Although many applicants may have both the proper education and training, a significant number have been disqualified because they failed drug and alcohol testing or have a criminal record. (A past conviction is not necessarily a barrier to employment; it depends on the conviction, length of time that

¹⁴ Hydrogen Sulphide (H2S), also known as sour gas

¹⁵ Workplace Hazardous Materials Information System (WHMIS) is Canada's national standard for the cautionary labelling of controlled products

has passed since the conviction and the severity of the offense.) Both qualified and healthy employees are a key consideration for companies seeking to manage the risks associated with their operations. Enhanced training and assistance programs could assist some candidates to meet the requirements for employment.

6.3. Household Income

Extra disposable income may result in poor life style choices which may lead to increased gambling and/or drug and alcohol use. This might result in some employees not returning to work as originally scheduled. Money management issues may appear where individuals are unprepared for the receipt of significant paycheques and the added money-management responsibilities. The previous rent scale for public housing made employment seem futile to some persons as rents increased substantially upon employment. The new rent scale implemented in July 2012 which caps rent at a maximum 19.5% of income should be communicated to employers and potential employees so that they can make informed decisions.

6.4. Family Pressures

Family responsibilities such as young children or elderly parents can challenge those who work on rotation or away from their home community for extended periods. There is also additional pressure on the home-based partner to manage the family and other household duties on their own for extended periods of time.

6.5. Housing and Other Accommodation

Companies require short-term accommodation to house their employees during the field operations. Generally, these camps are located close the companies' base of operations, away from the community centres, and are considered to be part of the exploration program. However, more permanent accommodations will likely be required in some communities to accommodate the additional employees hired by GNWT or local companies and contractors. This demand will be dependent on the growth in regional businesses and the forced growth in GNWT programs and services. As there is a considerable time lag between the decision to expand the housing or office resource and the actual availability of such accommodation, there is an apparent need to undertake some initial planning based on a range of development scenarios.

6.6. Availability of Contracted Services and Capacity of Suppliers

Many of the services associated with exploration programs (see Appendix 2) can be contracted to regional firms, provided that they have the required capacity. However, their ability to meet contract requirements is challenged by the short exploration season when there may be a number of concurrent demands for the same service (e.g. equipment for winter road construction). Also, when the relatively short season is over, there may be an extended period when the equipment and personnel are not deployed. This introduces a significant degree of financial risk when considering the expansion of a business.

The challenge of a short, busy winter season followed by a protracted down-season is a common element of the petroleum-exploration service industry in north-eastern British Columbia and north-western Alberta. Sound business planning that includes diversification where possible; reliable,

knowledgeable, experienced and annually-returning seasonal employees; a company's reputation for quality work completed in timely fashion; and a strong work ethic are all fundamental components of successful companies meeting the needs of the petroleum exploration industry.

6.7. Sahtu Land Use Plan

Although a draft land use plan for the Sahtu Settlement Area has been completed and submitted to the territorial and federal governments, it has not yet been approved. An approved land use plan, as contemplated by the Sahtu Land Claim Agreement, will provide a regional landscape-level framework for guiding the permitting of land-based activities. This plan may go some distance toward allaying concerns over cumulative landscape impacts of exploration and development activities.

6.8. Land Use Regulation

Proponents have voiced their frustration with the current regulation of land based activities under the Mackenzie Valley Resource Management Act (MVRMA). Their concerns have focused on the length of time required to obtain permits and the perceived inconsistency in the administration of the regulatory process. Although the Minister of Aboriginal Affairs and Northern Development has indicated an intention to streamline the current regulatory process, it is likely that it will remain in place for the next few years. Under the MVRMA, due consideration must be given to public concerns about the potential impacts of exploration activities. It is likely that such concerns will focus on the cumulative effects on the landscape and the potential environmental impacts of hydraulic fracturing (fracking). A recent application to undertake a fracking program was referred to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) for further consideration but the proponent withdrew its application before the review was initiated.

6.9. Hydraulic Fracturing

Fracking is the process of using pressure (by using fluid or gas) to create cracks or open existing cracks in hydrocarbon-bearing formations. The process requires explosives to create small perforations in the well casing before forcing the fracturing fluids or gases through the perforations to create cracks in the formation. The fracking of an unconventional well will require between 10,000 and 25,000 cubic metres of water (2.2 – 5.5 million gallons) in the Canol Shale Formation. Typically, between 25 and 75 per cent of the injected fluid is returned to the surface through the well bore. These fluids must be stored, treated, and recycled or transported to appropriate facilities for disposal. There are a number of environmental impacts associated with fracking as described below.

6.9.1. Groundwater Contamination from Below-ground Activities

The greatest threat to groundwater quality occurs when fracturing fluids escape from the target formation and enter the surrounding groundwater. The route of escape may be through the creation of fractures that extend outside of the target zone and into aquifers, the intersection of induced fractures with natural fracture zones that lead to aquifers, movement of fluids upward into the wellbore and outward through improper cement seals or escape through abandoned or improperly plugged neighbouring oil and gas wells. Despite the public concerns about groundwater contamination, there is little or no definitive evidence of groundwater contamination from hydraulic fracturing of shales at

normal depth¹⁶.

6.9.2. Wastewater Management and Disposal from Above-ground Activities

The management of wastewater leaks and spills at well sites and off-site facilities is similar to conventional developments. However, horizontal drilling and hydraulic fracturing typically requires much larger volumes of water, fracturing fluids and associated chemical additives, all of which may increase the likelihood of spills and other releases. The logistics and costs associated with disposing of the substantial volume of wastewater can be significant. Efforts are currently underway to examine the conditions and processes where the wastewater may be reused in an economically viable manner. Another option is to use deep injection wells which enable the disposal of fluid wastes into underground injection zones. If on-site treatment or deep well injection facilities are not available, large volumes of drill cuttings, fracking fluids and other waste water often must be transported by truck to treatment and disposal facilities in southern Canada.

6.9.3. Chemical Additive and Fuel Handling, Transportation and Storage

The composition of fracking additives has been controversial because, until recently, manufacturing companies have insisted that the composition formulas are proprietary. In 2011, the Canadian Association of Petroleum Producers (CAPP) approved guiding principles for hydraulic fracturing including its support for the full disclosure of fracturing fluid additives. Despite this new openness, there is not yet a clear understanding of the key component chemicals or their concentration in the injected fluid¹⁷. Fracturing chemical additives may either be stored on-site in concentrated form or transported to the site and mixed immediately prior to the fracturing process. Where storage is necessary, proper advance planning will minimize the likelihood of spills and leaks occurring. Secondary containment for chemical storage, loading and unloading areas should be installed and maintained. Similar precautions and planning should be taken in regard to fuels that are stored on-site. Where wastewater, drill cuttings, chemical additives and fuels are to be transported to the drill site by truck, trucking and spill contingency plans should be developed. These plans will help to minimize the likelihood of accidents and ensure timely and proper response is taken in the event a spill does occur.

6.9.4. Well Blowouts

Most blowouts can be prevented by ensuring the integrity of the well through proper construction, operation and monitoring and use of properly operating blowout preventers. Although rare, blowouts occur when unexpected high pressures are encountered in the subsurface. These high pressures may be the result of natural occurrences or may be artificially induced in the wellbore during hydraulic fracturing. Blowouts may also be encountered underground where fluids are released from the wellbore into subsurface formations or adjacent groundwater. A major concern with underground blowouts is the limited ability for the operator to know what is happening in the subsurface.

6.9.5. Water Usage and Supply

The hydraulic fracturing of an unconventional well is contentious partly because of the volume of

¹⁶ Groat, C. G. and Grimshaw, T. W. *Fact-Based Regulation for Environmental Protection in Shale Gas Development*. Energy Institute of the University of Texas at Austin. February 2012.

¹⁷ Groat, C. G. and Grimshaw, T. W. *Fact-Based Regulation for Environmental Protection in Shale Gas Development*. Energy Institute of the University of Texas at Austin. February 2012.

water used and where it is obtained. It has been reported that a single horizontal well drilled into the Canol Shale formation would require between 10,000 and 25,000 cubic metres (between 2.2 million and 5.5 million gallons) of water¹⁸ compared to an average 190 cubic metres (50,000 gallons) needed to fracture conventional gas wells in the Western Canadian Sedimentary Basin¹⁹. Water may be obtained from several sources including surface waters (rivers and lakes), groundwater and recycled water from earlier fracturing operations. The primary concern associated with surface and groundwater withdrawal is reduced stream flow, depletion of groundwater aquifers or interference with wetlands.

6.9.6. Land Consumption and Disturbance

All oil and gas exploration and development programs require surface lands. Land is required for seismic lines, access roads and well pads which allow for the transport, operation and storage of equipment, trucks, chemicals, water and impoundment of wastewater. The horizontal drilling of unconventional formations has enabled a reduction in the overall surface footprint while providing an increase in sub-surface access. However, the development phase of unconventional oil and gas drilling requires a more dense spacing of well pads, and therefore a greater surface footprint. This is because oil and gas must rely on fractures induced through hydraulic fracturing in order to migrate through the low-porosity, low permeability sandstones, siltstones and shale. These densely spaced, producing wells must also be interconnected with gathering pipelines or access roads which enable gas or oil to be transported off-site and the periodic servicing of wells and equipment.

6.9.7. Air Quality

Air emissions originate from internal combustion engines, well testing and accidental emissions from tanks, valves and piping. Because multi-stage hydraulic fracturing and the completion of long, horizontal wells generally uses more energy than shorter vertical wells, unconventional drilling and fracturing operations produce more combustion air emissions per well than conventional drilling operations. Some of the largest emissions occur during well testing when fracking fluids, water and reservoir gases come to the surface through the wellbore at high velocity and volume. The well testing process can last from three days to 10 days at conventional wells and up to several months at unconventional wells²⁰. The application of various techniques to reduce emissions from these activities is addressed through the regulatory process.

6.9.8. Induced Earthquakes

Earthquakes are natural events that occur from time to time. There is ongoing debate on whether modern oil and gas extraction technologies are contributing to the frequency of earthquakes. According to a study released in 2012²¹, the average rate of earthquake occurrences in midcontinent US has increased since 2001. This is attributed to increased

¹⁸ Brown, D. *Hydraulic Fracturing and Water Management for Emerging Unconventional Exploration in the North*. A presentation made to the 12'th Annual Arctic Oil and Gas Symposium. March 2012

¹⁹ Sumi, L. *Environmental Concerns and Regulatory Initiatives Related to Hydraulic Fracturing in Shale Gas Formations: Potential Implications for North American Gas Supply*. A Report Prepared for the Council of Canadians. September 2010

²⁰ Brown, D. *Hydraulic Fracturing and Water Management for Emerging Unconventional Exploration in the North*. A presentation made to the 12'th Annual Arctic Oil and Gas Symposium. March 2012.

²¹ Ellsworth, W. L., Hickman, S.H., Lleons, A. L., McGarr, A., Michael, A. J., Rubinstein, J. L., *Are Seismicity Rate Changes in the Midcontinent Natural or Manmade?* April 18, 2012. United States Geological Society

seismicity in the coal bed methane fields located along the Colorado-New Mexico border. The study does not explicitly indicate that hydraulic fracturing is the source of earthquakes. Rather, injection wells dug deep into the ground to dispose of hydraulic fracturing wastewater and drilling chemicals appear to be responsible. The question of whether manmade activities are the cause of the recent increase in seismic activity in the vicinity of unconventional oil and gas formations remains controversial and the subject of significant study.

6.10. Baseline Environmental Information

As Sahtu residents value their traditional ways of life, it is likely that concerns will be raised with respect to the perceived or potential environmental impacts to the landscape and water resources. Moreover, this region has not been subjected to the scope of environmental and other baseline studies that have occurred in other areas of potentially significant hydrocarbon production. The lack of relevant baseline information may be an impediment to fully evaluating the potential impacts of exploration and development in the region. As baseline studies often require several consecutive years of data gathering, these programs should be started in a timely manner so that a true baseline is determined and that development activities are not delayed while the relevant information is being collected.

6.11. Government Programs and Services

It can be reasonably expected that with the projected level of exploration activity, the requirement for a large number of qualified workers and the seasonal influx of non-resident workers will put added demands on GNWT programs and services. However, without more detailed and quantified information it is difficult to project the nature and scope of the added pressures. The following discussion highlights some of the departments, programs and services that may be impacted by the current exploration activities. It is recognized that, if the exploration continues to expand, other departments may also be subject to forced-growth impact. These departments will be considered in subsequent updates of this report.

6.11.1. Education, Culture and Employment

The Department of Education, Culture and Employment (ECE) provides programs, services and support with regard to education, training, careers, employment, child development, languages, culture and heritage. The department also assists individuals in meeting their basic financial needs. Programs and services that could be influenced by exploration activities include:

Academic Upgrading: Aurora College and community learning centres offer upgrading courses in math, English and other subject areas as well as literacy initiatives.

Schools North Apprenticeship Program (SNAP): Students who are at least 16 years old and registered in a secondary school program are able to gain credits while participating in pre-trades training to become an apprentice in a designated trade.

Apprenticeships and Occupation Certification: Persons must be 16 years old and pass the relevant Trade Entrance Exam to attend Aurora College (Fort Smith) which offers technical training in carpentry, electrician, heavy equipment technician, plumber, housing maintainer, and oil heat system technician.

Skills Development Programs: Financial support is provided to eligible persons for short term training and educational opportunities that are not covered by student financial assistance.

Wage Subsidies: Financial support is provided to eligible persons to help them obtain the skills required for meaningful employment by providing a wage subsidy to eligible employers.

Self-Employment Assistance: Financial support is provided to eligible persons to assist during them during the planning stages of starting a new business.

From 2009 to 2012, the Sahtu Regional Service Centre trained approximately 450 persons²² in a variety of courses and programs including: class 7 driver training, environmental monitoring, accounting and hospitality. There are also 17 registered apprentices in the region including carpentry, electrician, plumber, heavy equipment technicians, gasfitter, housing maintainer, boom truck operator and other trades.

ECE carries out follow-ups with its clients to assess if the program or course was helpful and what impact it has had, on their employment, for example. Follow-ups are generally conducted at the three and twelve month mark after completion of the training although there is some variance depending on the type of program the client has participated in.²³

Clearly, the department administers a variety of programs that are intended to assist motivated persons to enhance their education, skills, and training. It is likely that greater demands will be put on these programs by persons wishing to join the labour force. However, it would be prudent to evaluate the overall effectiveness of the individual programs to determine the most appropriate allocation of any new resources that may be made available.

6.11.2. Justice

The Department of Justice is responsible for the administration of justice; including policing, court services, and corrections in a manner that encourages communities to assume increasing responsibilities for community welfare.

Policing: The Royal Canadian Mounted Police (RCMP), which is a federal agency, is responsible for policing as detailed in an agreement with the GNWT. The Government of Canada covers 30 per cent of the overall costs while the GNWT pays the remainder. Any forced growth in the demand for policing services would result in a pro-rated charge to GNWT.

Courts: There is a close association between the level of policing activity and the requirement for court services. If the level of policing activities increases, it is likely that the demand on court services will increase accordingly. Court services, which include the judge, lawyers, court reporter and other associated personnel are based in Yellowknife and travel to the Sahtu Region approximately every six weeks.

²² ECE report: *Preliminary Findings Sahtu Oil and Gas Industry Needs Assessment*; January 2012

²³ Email correspondence with Colette Perry, Coordinator – Career & Employment, Advanced Education Division, ECE, GNWT; 05 March, 2013

Corrections: Corrections facilities are located in Yellowknife and Hay River would likely not be significantly taxed any resultant increase in inmates.

It can be expected that more people in the communities and more vehicles on the roads will result in more incidents requiring police engagement. Experience has shown that an increase in disposable income often results in increased “unsociable” behaviour such as gambling, use of drugs and alcohol consumption. In Norman Wells and Tulita, there was a substantial increase in the number of reported incidents from January to May 2012, including over 100% increase²⁴ in alcohol- related call-outs. However, this increased activity could not be directly attributed to the exploration activities as it coincided with the opening of a liquor outlet in Norman Wells.

Current information suggests that that during the winter months there is an increase in calls for RCMP assistance and requests for Victim Services in response to social and behavioural issues that are linked to lifestyle choices. At this point in time, this information is only anecdotal.²⁵ Further research and analysis of information is required before a causal link can be made between resource exploration activity and the seasonal demands on these services.

6.11.3. Health and Social Services

The Sahtu Health and Social Services Authority (Sahtu HSSA) is responsible for primary community care, health promotion, home care, mental health and addictions, and social services to the people living in the Sahtu Region. Programs and services include:

Children and family services: include assistance to families in time of need, support for a disabled child, and protecting children from abuse and neglect

Mental health and addictions services: include supportive and therapeutic counselling and crisis intervention

Prevention and health promotion: includes communication and education strategies related to health and wellness such as nutrition, smoking, and mental health

Primary health care: includes home care, telehealth, and general health care services ranging from prenatal care to disease management and audiology.

Each community has a health centre, social services office, professional health care workers and support staff. Visits by physicians, dentists, physiotherapists, occupational health therapists and vision specialists follow a regular schedule. Serious medical emergencies require the patient to be evacuated by air to a hospital in either Inuvik or Yellowknife.

There is a current increase in demands during the winter months on the Sahtu HSSA when petroleum exploration and other industrial activities increase. Further increases in petroleum exploration in the Sahtu will correspondingly strain the authority further. This year, the Sahtu HSSA anticipated a busy winter season and increased their front-line health staff and social service workers accordingly. In a

²⁴ FMB submission; 08 August, 2012

²⁵ Conversations with Julie Clements, Senior Policy Analyst, Department of Justice, GNWT, February 20 2013; and Clarinda Spijkerman, Acting Manager, NWT Victim Services, February 21, 2013

conversation with a senior manager from the authority, it was noted that “they have been operating at the limits of capacity this year” due to demands on the system and that they are by no means equipped to deal with a significant emergency involving more than one or two people at any given time.

Increasing demands on the Sahtu HSSA that have been identified or are anticipated because of petroleum exploration and other industrial activities include:

- There is a direct link between increased income and alcohol consumption. When employment opportunities and wages become available to community members, alcohol consumption increases. This puts a strain on the health system due to an increase in accidents and violence, and puts further demands on the social system for matters such as child protection and care.
- Work camps can serve as incubators for the spread of contagious diseases into the communities. There have been recent scares with tuberculosis and scabies – diseases which are particularly difficult to control.
- An increase of workers into the region and / or the movement of community members due to work opportunities can result in an increase in pregnancies within the communities.
- Emergency response protocols are not necessarily observed when an industrial emergency occurs. This has resulted in injured personnel being delivered to Norman Wells by vehicle when they should have been directly evacuated by air to the hospital in Yellowknife or Inuvik.²⁶

6.11.4. Environment and Natural Resources

The Department of Environment and Natural Resources (ENR) mandate is to ensure the sustainable use and development of natural resources and to protect, conserve and enhance the NWT environment. Programs and services include:

Biodiversity and land conservation: ENR is responsible for the protection and maintenance of the territory’s wildlife, forest and water resources. Programs, strategies and legislation in place to ensure biodiversity and ecosystem health include the NWT Protected Areas Strategy, NWT Water Stewardship Strategy, Species at Risk Stewardship Program and Act, and the NWT Ecosystem Classification Program.

Climate Change: ENR oversees the GNWT Greenhouse Gas Strategy which identifies actions that can be taken to stabilize territorial greenhouse gas emissions in NWT. The strategy also identifies measures that can be taken to limit emission increases during anticipated growth in non-renewable resource development activities.

Management of hazardous waste: Hazardous waste must be handled or disposed of properly to prevent harm to human health and safety and to the environment. The department provides advice and guidance on the proper way to manage, store and dispose of hazardous wastes.

Waste reduction and recovery: The department administers programs to recover, reuse, and recycle waste products and materials.

²⁶ Conversation, March 28 2013 with Jess Fortner, Director of Quality and Risk Management, Sahtu Health and Social Services Authority

Energy conservation: The department promotes the use of environmentally sustainable energy sources and the reduced consumption of fossil fuels, energy and other utilities. Programs encourage the use of energy efficient technologies and alternative energy sources, facilitate development of community energy plans, and promote energy awareness.

Environment assessment and monitoring: ENR coordinates the inter-departmental preliminary screening, environmental impact assessment and monitoring activities for resource development projects. The department also provides advice to various screening and regulatory agencies, land and water boards and the National Energy Board.

With increased activities on the land, there will be added program demands with respect to inspections, monitoring and investigations of contaminant spills and wildlife-related incidents. In addition, there will be increased program demands relating to the review of permit applications and other management issues. The collection of comprehensive environmental baseline information will require a substantive commitment of personnel and resources by ENR and other (non-GNWT) resource management agencies. While ENR would be expected to undertake studies related to resources under its mandate, it would also be appropriate for the department to assume lead responsibility for organizing and coordinating the overall initiative.

6.11.5. Municipal and Community Affairs

The Department of Municipal and Community Affairs (MACA) works with community governments to enhance their capacity to be responsible and accountable community organizations. The department also works with local governments to promote:

Sport, recreation and youth development: MACA provides advice and assistance with respect to recreation, sport, physical activity, youth and volunteer programs and represents the GNWT in partnerships with the NWT Sport and Recreation Council and other stakeholders.

Consumer rights: MACA responds to consumer complaints and provides education and other consumer services designed to protect the public from unscrupulous business operators.

Safety standards: MACA coordinates operations relating to fire safety and territorial and community emergency management and planning. Services include the Office of the Fire Marshall and financial assistance for disaster relief and search and rescue.

Emergency Response: Effective community response plans are important to ensure the protection of people, property, the environment and the restoration of community operations. MACA assists communities to develop plans that will define the roles and responsibilities of agencies during an emergency and to establish provisions for a timely coordinated response.

Water and waste management: Community governments are responsible for the operation and maintenance of their water treatment and solid waste facilities. However, MACA is responsible for the regulation and inspection of such systems, providing training and certification, and further advice and guidance as required.

It is not likely that there will be increased demands on the department in the near term. However, that could change over the longer term if the communities grow larger and there is an increased demand on the municipal water and waste management systems. Waste management could be a challenge in some communities if industrial waste from exploration activities is added to municipal land fill sites.

6.11.6. Department of Transportation

The Department of Transportation is responsible for public transportation infrastructure including air services, docks and ferries, and the highway system.

Air services follow a typical “hub and spoke” approach. The main access point to other jurisdictions in the NWT is through the gateway hub of Yellowknife. In the Sahtu Region, the Norman Wells airport serves as the regional hub for the community airports of Colville Lake, Fort Good Hope, Deline and Tulita. The projected increase in air traffic can be accommodated at Norman Wells but may create pressures for increased servicing at some of the smaller communities.

The **Mackenzie Valley Highway** extends into the Sahtu region by way of a winter road extending north from Wrigley. There is an all-season highway between Wrigley and Fort Simpson, and points further south. The Sahtu winter road system is typically open for only the months of January, February and March. Permanent bridges have been installed at many of the more significant water crossings along the route in an effort to extend the winter road season if the weather permits. With no permanent crossing at Great Bear River, the opening of the winter road is often delayed as this spot takes the longest to freeze solidly..²⁷

The Mackenzie Valley Highway crosses the Liard River at Kilometre 43 just south of Fort Simpson and crosses the Mackenzie River at Kilometre 135 between Fort Simpson and Wrigley. Both crossings are served by ferries and seasonal ice-bridges which can support vehicles up to 64,000 kg when fully operational. Greater vehicle weights can be accommodated on the ice-bridges when the ice is appropriately thick. The river crossings are closed for a period of time in both Spring and Fall during break-up and freeze-up.

The current ferry service is adequate for the increased level of activity that is currently projected. However, the increase in exploration-related traffic will put pressure on the road system that is incomplete and not up to the standards required to support the anticipated level of traffic. Concerns include the safety of the travelling public; limited system capacity; reliability and the need for upgrades; and the increased operating and maintenance costs due to traffic volume²⁸. In Winter 2012/13, four exploration companies contributed 1.2 million dollars toward the enhanced maintenance of the winter road system²⁹.

6.11.7. Executive

The Department of the Executive, which is responsible for providing overall management and direction to the Executive Branch of the GNWT, includes the Bureau of Statistics. As noted throughout this report, there is limited quantified and documented evidence to link the past and current exploration activities to

²⁷ *Whose Highway Is It, Anyway? Carving up the Mackenzie Valley Highway, Piece by Piece.* Up Here Business, March 2013

²⁸ *Inside the Hard Drive: Status, Challenges and Current Initiatives of the Department of Transportation – GNWT 2007*

²⁹ Conversation, February 15 2013 with Suzanne Parent, Financial Planning and Budget Analyst, GNWT Department of Transportation

enhanced employment and business opportunities or increased demands on GNWT programs and services within the Sahtu Region. This does not suggest such a "cause and effect" relationship does not exist; it merely indicates that it cannot be established in a meaningful manner. The lack of such information is a significant impediment to effective planning and program evaluation. The Bureau of Statistics, in collaboration with the relevant departments, can make a key contribution to addressing this need.

6.11.8. Baseline Information

The GNWT is committed to maximizing the economic opportunities for Sahtu and NWT residents while minimizing the associated social and environmental impacts. However, good policies and programs must be based on good information. Good information is required for both for development and implementation policies and programs and their subsequent evaluation. An appropriate evaluation framework is required to identify and monitor the relevant indicators of success and to provide the basis for future policy and program adjustments as required. Planning, by necessity, often requires that decisions be made with less-than-complete information. However, enhanced quantitative information can greatly increase the probability that effective policies and programs will be developed.

7. CONCLUSIONS

The recent issuance of Exploration Licences in the Sahtu Region has generated much anticipation of the pending economic benefits that will accrue to the region and to NWT. However, the optimism should be tempered by the operating realities of the hydrocarbon industry that are highly unpredictable. There are no guarantees that the current exploration activities will result in any production in the foreseeable future. Nevertheless, GNWT should seek to maximize the economic opportunities (while limiting the social and environmental impacts) associated with the current exploration activities while preparing for further expanded exploration and development; if it should arise. GNWT must "live for today but plan for tomorrow." If GNWT wishes to maximize economic opportunities and minimize social and environmental impacts, it cannot afford to not engage in some initial planning efforts. Otherwise, the gap between the initial planning phase and the actual implementation of program and service adjustments may result in the loss of significant opportunities. The following recommendations are intended to identify more specific actions that should be pursued if GNWT wishes to realize its objectives with respect to hydrocarbon exploration and development.

8. RECOMMENDATIONS

- 1) Credible and quantified information is the foundation for effective planning and decision making. A suitable information base will enhance the determination of realistic resource requirements and allocations; development of appropriate policies and programs; and the subsequent evaluation of those policies and programs. It is recommended that GNWT develop an appropriate information gathering and management protocol that will provide the requisite information to effectively determine the opportunities and impacts associated with hydrocarbon exploration.
- 2) The economic modeling of exploration activities should enter a more detailed testing phase to ensure its accuracy, expand its capabilities, and incorporate new information. Current modeling suggests that, under existing circumstances, there is significant potential to increase the positive economic impacts flowing from the oil and gas exploration activities.

- 3) There is an apparent mismatch between the regional residents seeking employment and the requirements for the available positions. It is recommended that existing training programs focus (to the extent possible) on the prerequisites of the positions that are currently available. It is recommended that the employment status of persons who have completed the training courses be tracked for an extended period to determine if the training courses are addressing their intended goal.
- 4) An approved Sahtu Region land use plan will provide both certainty with respect to land use in various parts of the region and a clear framework for the administration of land and water permits. It is recommended that the GNWT use its best efforts to get the plan approved in a timely manner.
- 5) It is apparent that the exploration and development of unconventional hydrocarbon resources (which includes fracking) involves a number of potential environmental impacts for which the risks are not well known. The public tends to fear what is not well understood; which can result in the delayed approval of projects if they are subject to an environmental assessment. It is recommended that GNWT establish an inter-agency initiative to develop a comprehensive environmental baseline for the area that will be subject to exploration.
- 6) The potential impact from fracking is the subject of considerable uncertainty and controversy. Indeed, some Canadian jurisdictions have embargoed to the use of fracking subject to further review and analysis. It is recommended that GNWT develop a policy framework that will guide its interim input to existing regulatory processes and form the basis for a post-devolution regulatory approach.

Appendix One: Summary of Exploration Licences in the Central Mackenzie Valley.

Title	Company	Issue Date	Expiry Date	Area (Ha)
EL431	Suncor Energy Inc.			
EL436	Talisman Energy Inc.	10/05/2006	09/05/2015	84,353
EL437	Talisman Energy Inc.	10/05/2006	09/05/2015	85,993
EL438	Talisman Energy Inc.	10/05/2006	09/05/2015	87,183
EL439	Talisman Energy Inc.	10/05/2006	09/05/2015	82,820
EL440	MGM Energy Corp.	10/05/2006	09/05/2015	87,872
EL441	Husky Oil Operations Limited	10/05/2006	09/05/2015	88,452
EL442	MGM Energy Corp.	10/05/2007	09/05/2016	63,312
EL443	Husky Oil Operations Limited	10/05/2007	09/05/2016	91,116
EL444	BG International Limited	10/05/2007	09/05/2016	74,604
EL445	BG International Limited	10/05/2007	09/05/2016	79,240
EL454	MGM Energy Corp.	01/12/2008	30/11/2017	82,100
EL473	MGM Energy Corp.	05/01/2011	04/01/2020	80,240
EL474	MGM Energy Corp.	07/04/2011	06/04/2011	82,643
EL475	MGM Energy Corp.	07/04/2011	06/04/2011	86,602
EL466B	MGM Energy Corp.	07/04/2011	06/04/2011	85,288
EL467	Shell Canada Limited	07/04/2011	06/04/2011	87,948
EL468	Shell Canada Limited	07/04/2011	06/04/2011	87,117
EL4668	Shell Canada Limited	07/04/2011	06/04/2011	26,533
EL471	Imperial Oil Resource Ventures Limited	07/04/2011	06/04/2011	88,848
EL472	Imperial Oil Resource Ventures Limited	07/04/2011	06/04/2011	90,632
EL462	Husky Oil Operations Limited	07/04/2011	06/04/2011	87,748
EL463	Husky Oil Operations Limited	07/04/2011	06/04/2011	87,034
EL470	ConocoPhillips Canada Resources Corp.	07/04/2011	06/04/2011	87,495
EL486	Shell Canada Limited/MGM	06/27/2012	05/27/2021	69,649
EL487	Shell Canada Limited	06/27/2012	05/07/2021	84,504

*Financial Commitment (Millions of Dollars)

Appendix Two: Overview of the Employment, Goods and Service Requirements Associated with Oil and Gas Activities

The types of employment and commercial opportunities normally associated with oil and gas activities are as follows:

Seismic Programs

- Manual laborers are needed for pre-scouting, surveying, cutting and clearing to establish new seismic lines, seismic services, drilling, equipment supply, operation and maintenance; environmental monitoring; health and safety services; and supply of communication, lighting and electrical services;
- Portable camps and camp and catering services to support seismic crews;
- Medical and safety services;
- Winter road construction to move equipment people and supplies to the survey area;
- Supply and operation of bulldozers , graders, water trucks and other equipment;
- Winter road maintenance and heavy equipment maintenance services;
- Helicopter and land transportation services to move equipment and supplies to survey areas; and
- Fuel supply services.

Drilling Programs

It is expected that drilling will be an ongoing activity in the NWT as companies explore for and develop new oil and gas reserves. While drilling activity will vary from year to year (much less year to year variation is expected for drilling activities than is expected for seismic activity), it will still provide a basis for sustainable northern businesses. To be successful, businesses will have to be managed to cope with swings in revenue from variations in drilling activity.

Business opportunities related to drilling activities will be attractive as the local content of drilling programs can be significant:

- Drilling contract (drilling contractor supplies rig, rig transportation, drilling crew and crew transportation);
- Fracking equipment for horizontal and shale plays;
- Bit, mud, chemical and cement supply contracts (contractors generally package the material supply with the required transportation services);
- Casing supply contract;
- Trucking contract for casing transportation;
- Well-site shack supply contract (drill site office and part time accommodation for the engineer, geologist, and drilling specialists);
- Camp supply contract;
- Catering contract;
- Medical/Safety services;
- Winter road building contract (winter road building is the largest opportunity for local supply);
- In addition to the manpower required for the drilling program itself (30 to 40 people), a large amount of manpower is required for clearing and building winter roads, and for driving supply and service vehicles; supply requirement for fuels, lubricants and consumables is considerable;

- Communications equipment and services supply (secure communications are a key requirement);
- Environmental monitoring;
- Hotshot services are not generally used in regard to drilling activities in the NWT; and
- Drilling activities are generally short duration and take place during the winter construction season.

Pipeline Construction

Pipeline construction is expected to be an intermittent activity, involving large projects with several years between projects (except for a lower level of ongoing activity in the Dehcho Region).

The local content of pipeline programs can be expected to be fairly low, as the intermittent demand for pipeline construction will make it difficult to maintain the skilled workforce required (qualified welders, etc.) and will prevent large capital investments necessary from being made to maintain the inventory of specialized equipment required for pipelining.

Pipeline programs will require granular supply (borrow pit development, excavation, crushing, screening, drying and hauling), trucking services, barging services, construction of barge landings and pipe lay down areas, winter road building services, right of way clearing, camp and catering services, medical and safety services, communications services and fuels supply services all of which can be supplied by northern companies that have capacity available during periods of pipeline construction.

Large pipeline projects will generally take place during the winter construction season and occur around the same time period as facilities construction, creating large demands for labour and services, and making it difficult to take advantage of pipeline business opportunities while servicing other regular work.

Facilities Construction

Facility construction will occur only intermittently during the forecast period, with large levels of activity during periods of oil and gas production expansion, followed by long periods where no facilities are built. Most of the cost of new facilities (gas conditioning and processing facilities) will consist of the costs of prefabricated equipment and equipment modules fabricated by specialist contractors in Alberta, British Columbia, and elsewhere, which will be assembled and placed on foundations on site.

Local business opportunities will occur mainly in regard to the transportation of materials and equipment modules to site by barge and winter road, construction of winter and seasonal roads, gravel pit development and operation, gravel hauling, construction of permanent gravel pads and equipment foundations (including pile driving), drilling of production wells, installation of modular equipment, pipeline construction, provision of camp and catering services, medical/safety services, instrumentation and electrical services, welding services, fuel supply (gas, diesel and propane), methanol supply, food supply and transport, and helicopter services for personnel movement.

Construction of foundations and access roads will occur primarily in the winter. Assembly of prefabricated modules and placement and installation of equipment may take place throughout the year after winter delivery to site.

Because pipeline construction and facilities installations will generally be one time activities which will occur at infrequent intervals, they do not create the possibility of the regular revenues needed to build and maintain a local business.

However, it should be possible for northern businesses and contractors to pursue facilities construction contracts by leasing equipment, hiring temporary workers and subcontracting services from southern suppliers for the period of the project. Local companies may also be able to pursue portions of pipeline and facilities projects by joint venturing with specialist companies to draw on the capabilities, experience and equipment available from of southern suppliers (though this may remove much of the profit potential).

Goods and Service Contract Opportunities

A list of the typical types of goods and services contracted for oil and gas projects is presented below. Opportunities may exist to provide these (and other services) directly to oil and gas companies, and through their contractors and to subcontractors.

Goods and Services Required

Communications

- Telecommunications, radio, satellite and cellular phones (secure communications is a key requirement for oil and gas customers); and
- Base-speed internet and cable television.

Office Services

- Security and janitorial services; and
- Office space, supplies, furniture, computers and other equipment.

Business Support Services

- Secretarial, clerical, word processing;
- Accounting, bookkeeping and payroll services;
- Travel services; and
- Banking services.

Environmental / Geotechnical / Engineering

- Permitting;
- Regulatory Services;
- Consultation;
- Engineering;
- Lab services;
- Environmental field surveys;
- Granular resources surveys;
- Route and site surveys; and
- Environmental monitoring and mitigation.

Seismic Program

- Survey;
- Line Clearing and slashing;
- Winter road construction;
- Seismic Drilling and data recording;
- Camp services (catering, operations and maintenance);
- Medical and Safety Services;
- Freight and transport services (truck, barge, aircraft and helicopter);
- Communications equipment supply (radios, satellite phones);
- Consumables supply (drill bits, explosives and caps, magnetic tapes, recording paper, fuel and lubricants, survey lathe) ;
- Equipment supply (4 wheel drive and tracked vehicles, fuel and supply trucks, crew truck, portable camp units); and
- Equipment repair and maintenance.

Drilling Programs

- Survey;
- Winter road construction;
- Clearing and slashing;
- Site Preparation;
- Camp services (catering, operations and maintenance);
- Medical and safety services;
- Drilling rig rental;
- Equipment rental (power tongs, down hole tools, four wheel drive and tracked vehicles, fuel and supply trucks, crew truck, portable camp units);
- Equipment supply (wellhead equipment);
- Drill Shack Supply;
- Drilling Services (coring, wireline logging, mud logging, well testing);
- Freight and transport services (truck, barge, aircraft and helicopter) – moving rig to site typically involves 100 to 120 truckloads of material);
- Water trucking;
- Environmental Monitoring;
- Expediting services;
- Communications equipment (radios, satellite phones – secure communications required);
- Consumables supply (drill bits, mud/drilling fluids, cement, fuel and lubricants, casing); and
- Rig repair and maintenance services (mechanical, electrical, welding).

Construction, Materials and Fabrication

- Surveying;
- Brushing and right of way clearing;
- Building supplies, hardware, paint, lumber 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;
- Concrete, crushed rock, sand, gravel and ready-mix products supply;

- Forms, rebar, cribbing, cement finishing and masonry products;
- General contracting;
- Timber for pipeline skids and survey laths;
- Welding services, specialty welding, welding supplies, electrode, equipment, gases; and
- Instrument and electrical services.

Logistics and Transportation

- Bus and Taxi;
- Retail and wholesale grocery supply;
- Materials handling, expediting, freight transport, light delivery and courier services;
- Air transport, aircraft charters and maintenance;
- Helicopter services;
- Vehicle sales, rentals, repairs and service (skidoos, tracked vehicles, 4x4s, large trucks, cats, hoes, graders, dump trucks); and
- Barging and boat charter.

Equipment, Services and Supplies

- Industrial supplies, steam and Base-pressure water;
- Small engine repair, small equipment supply and rental;
- Heavy-duty equipment rental, repairs and service; and
- Drilling equipment for core samples.

Utility and Fuel Services

- Bulk fuel, propane, diesel fuel, aircraft fuel, gasoline, fuel oil, grease, lubricating oil, glycol, methanol, and chemicals;
- Propane and fuel storage tanks, oil and diesel fuel tanks, fuel delivery and storage;
- Water delivery;
- sewage treatment; and
- Snow removal and garbage disposal.

Accommodation and Camp Services

- Apartments, hotels and motels;
- Camps, camp catering, camp supplies;
- Laundry and dry-cleaning services; and
- Restaurants.

Safety and Medical

- Medical facilities, supplies, services;
- Air and ground ambulance;
- Dentistry, optometry and prescription drugs; and
- Safety equipment, supplies and training.