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May 30, 2013

Sahtu Land and Water Board
P.O. Box 1
Fort Good Hope, Northwest Territories
X0E 0H0

Via Email

Attention: Mr. Tony Morris

SUBJECT: Submission of a Discussion Paper on Canol Shale Potential Future Development and Potential Effects Considerations

Dear Mr. Morris,

ConocoPhillips Canada Resources Corp. (CPC) is providing this document *"The Canol Shale Play: Possible Outcomes of Early Stage Unconventional Resource Exploration – Discussion Paper"* to the SLWB per your request of May 21 2013. This document is not associated with CPC's SLWB application for the 2013-16 Exploration Program for EL 470.

ConocoPhillips undertook this effort after discussions with MVEIRB staff and other regulatory agencies in 2012 on potential future exploration plans on EL470. This document was produced in response to possible concerns expressed about how future development in the Canol Shale area could progress in the exploration phase.

ConocoPhillips and its consultant carefully considered the appropriate methodology and scope of the evaluation of potential future effects of unplanned and unknowable activity at this early stage of exploration. ConocoPhillips is open to discussing its inputs, methodology, learning's and outcomes of this document should SLWB or others have questions.

A few key points to consider when reading this document:

- This document is <u>not</u> meant to provide ConocoPhillips' plans for the future and is simply a look at some possibilities based on reasonable assumptions
- Exploration plans are likely to rapidly and continuously change based on a large number of internal and external factors
- Although two main drivers were considered in the scenarios development, many factors affect how the future of the Canol Shale play could progress

- ConocoPhillips has not involved other operators in the inputs to this document
- Timing and process outlined in the scenarios used here are not necessarily applicable to all Canol ELs
- This document includes information available at the time of writing

ConocoPhillips hopes this effort provides regulators and the public some insight into:

- Canol Shale background
- Possible exploration phase activities
- Key decision points, limiting factors and potential "off ramps" for future activity
- A general sense of timelines and progression for several scenarios
- A sense of the unknowns that operators have to deal with for early phase exploration in new plays
- General sense of exploration play success probabilities
- Certain management actions that may help to plan for future activities in the Canol Shale area

If you have any concerns or questions, please contact me at (403) 233-3326.

Yours truly,
ConocoPhillips Canada Resources Corp

Cyril Jenkins, P.Geol (AB)
Team Lead - Regulatory, Environment and Stakeholder Engagement

The Canol Shale Play:
Possible Outcomes of Early Stage Unconventional Resource Exploration

Discussion Paper

May 2013

Prepared by:
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In collaboration with:
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Project Number: 123511022

ConocoPhillips

K'ââlô-Stantec

This report includes forward-looking statements relating to possible future events, including a variety of project development options, strategies and other aspects of operations. Actual outcomes and results may differ materially from what is expressed in this report. These statements are not guarantees of future performance or results and involve certain risks, uncertainties and assumptions that are difficult to predict.

Summary

The Canol shale play is an area of unconventional oil and gas potential located in the Sahtu Settlement Area (SSA) of the Northwest Territories (NWT). Oil and gas are likely present in geologic formations 1 to 2 km below the surface. The hydrocarbon potential of this area has been known for some time, but only recent advances in exploration technology have made further exploration of this resource possible.

ConocoPhillips is one of five companies currently licensed to explore the resource potential of the Canol shale play. Of these five, three companies are conducting resource evaluation activities on five contiguous exploration licences (ELs) on the west side of the Mackenzie River in the Tulita District. Current evaluation activities, such as vertical well drilling, represent very early stages in the exploration of shale oil and gas. Following each season's activities, testing and evaluation of results and other factors will inform decisions about investing in future activities.

The purpose of this discussion paper is to:

- provide an informed and practical analysis of potential oil and gas activities in an area known as the Canol shale play
- discuss possible effects that these activities might have on the environment and people of the Sahtu Settlement Area (SSA)

Stakeholders in the SSA are concerned about:

- multiple companies conducting exploration activities at the same time
- the possible future activities in the area
- the cumulative effects these activities could have on the people and environment within the SSA

ConocoPhillips Canada Resources Corp.'s. (ConocoPhillips') potential future activities in Exploration Licence 470 (EL470), along with other current and planned activities in the Canol shale play, are used as examples of what the future could look like.

ConocoPhillips' programs in EL470 aim to evaluate the reservoir and fluid properties of the Canol Formation, and help determine whether further exploration is warranted. As of March 2013, only ConocoPhillips has formally proposed conducting any future activities, those being to drill, hydraulically fracture and flow test two horizontal wells between 2013 and 2016. Possible activities by ConocoPhillips in EL470 beyond 2016 to 2021 could range from ceasing exploration to conducting additional activities to appraise resources.

Oil and gas exploration is always uncertain because of unknown resource potential and the changing and uncertain market. This discussion paper describes four scenarios that represent a range of possible outcomes of ConocoPhillips' current and planned programs in EL470. One of these scenarios was selected for use in an evaluation of potential effects on the natural and human environment.

ConocoPhillips cannot publicly make assumptions about resource potential in ELs held by other companies. Nor can it make any predictions on their behalf about the location and nature of their future exploration programs, except where plans are publicly disclosed. Therefore, any activities attributed to other companies, beyond those that are publically disclosed, are hypothetical.

Companies consider many factors when progressively evaluating, appraising, production testing and producing oil and gas resources. This staged approach to resource development, which can take many years, provides periodic opportunities for companies to decide whether they will continue to invest in exploration activities. At this early stage of evaluation of the Canol shale play resource potential, the future extent of production testing and production are unknown.

Discussions with stakeholders have revealed concerns regarding potential effects on wildlife, water, community life and use of the land. Exploration activities have also generated interest in economic and social opportunities of planned and future programs. Looking at potential effects of future activities through scenario development provides insight regarding how the issues and interests might be addressed in the future.

Potential effects on wildlife were evaluated based on the amount of linear access (i.e., roads and trails) in the Canol exploration region. This paper concludes that current or future effects of exploration in the Canol shale play on wildlife should not generally be of concern. However, there might be specific areas in the core exploration region where linear disturbances could approach or exceed cautionary management thresholds for wildlife, as identified in the Sahtu Land Use Plan. These areas may require proactive attention from resource managers to prevent long-term or cumulative effects.

ConocoPhillips' future activities in EL470 will depend on:

- economic factors
- exploration results
- regulatory certainty
- community support
- waste management options
- public highway infrastructure

The speculation required for discussion in this report shall not limit ConocoPhillips' eventual plans or activities and is not based on specific knowledge of ConocoPhillips' subsurface or drilling activity or results. ConocoPhillips fully expects to change its position or plans without notice.

Water for project activities, including road construction, domestic use, drilling and hydraulic fracturing, is currently sourced from approved surface water bodies (e.g., lakes) and the Mackenzie River. Water demand might increase in the future, if more horizontal wells are drilled. However this demand might be offset by constructing all-weather roads instead of winter roads, which represent the largest use of water. The relative distribution of these water sources over several watersheds means that continued use of local water sources for water is not likely of concern.

For the people of the SSA, beneficial changes from potential future activities would include increased employment and business activities, and an overall increase in economic activity. However, rapid changes in the community's economic structure, such as increased reliance on wage income and changes in household economic dynamics, might also result in adverse social outcomes.

Permanent population changes would be moderated given that most workers will likely only be transiently employed on a fly-in, fly-out basis, and will have only limited opportunities to interact with local communities. Population increases in communities within the SSA might be expected, which would result in incremental demands for housing, and community and emergency infrastructure and services.

With additional future activities, changes to traditional land use sites and harvesting activities are possible. Access construction, well site construction and drilling have potential for interaction with species at risk, wildlife, vegetation, soils and landscape aesthetics. Construction of winter or permanent roads, can facilitate access to preferred hunting, fishing and gathering areas, thus putting additional pressure on those resources. Long-term harvest monitoring and ongoing engagement with local communities will be required to help understand these effects and to develop appropriate management actions. This would help to ensure that future activities do not affect harvested species, or the communities' ability to access harvesting areas.

It is still early in the evaluation of the Canol shale play's oil and gas potential. Currently, there are few publicly disclosed planned activities, which allows time to plan and manage potential effects on the environment and people arising from possible future activities. Various project-specific and collaborative measures can help to better understand, guide, monitor and manage effects from potential future activities in the Canol shale play.

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1 INTRODUCTION

1.1 Background: context to this discussion

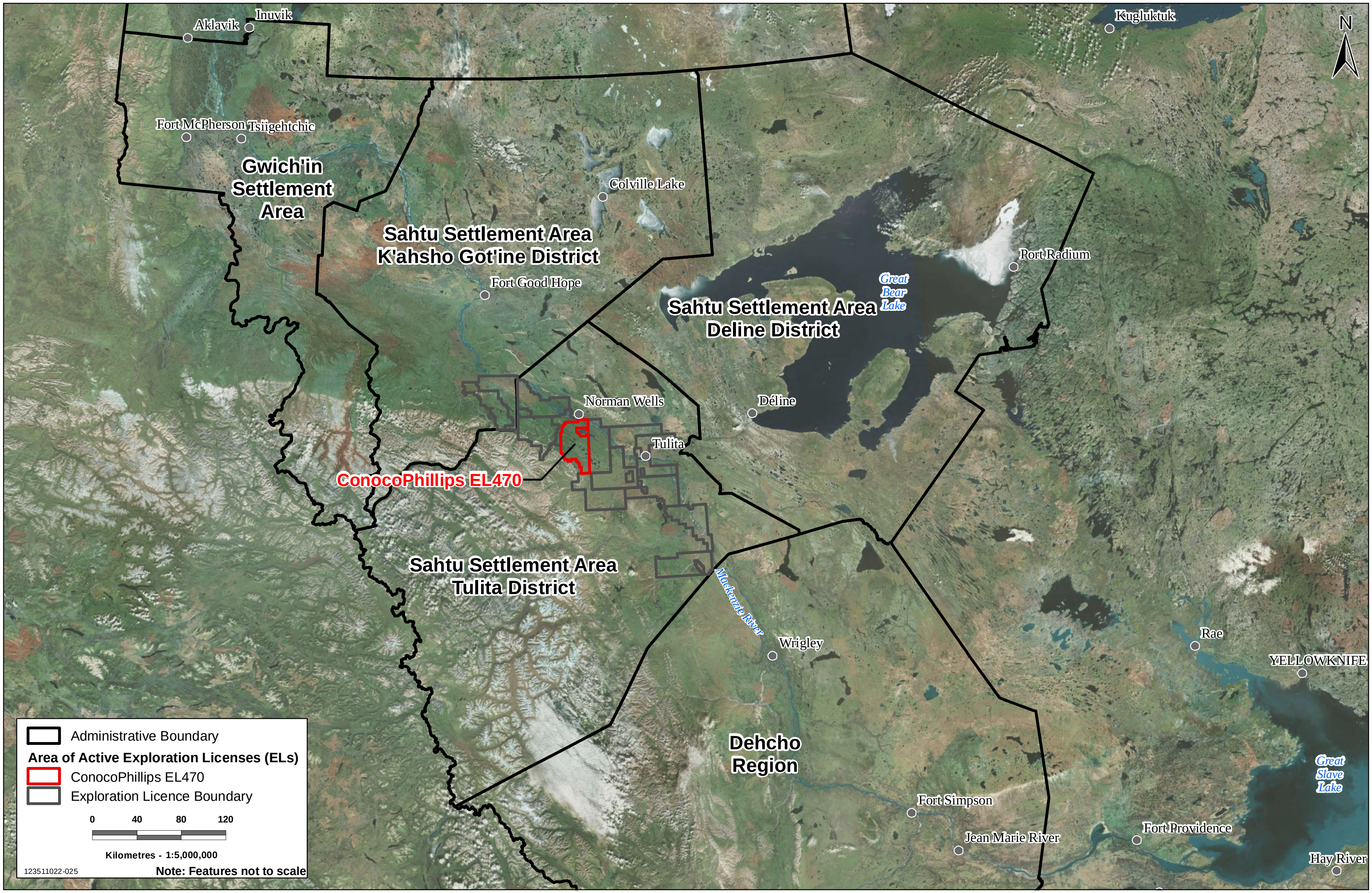
In 2011, ConocoPhillips Canada Resources Corp. (ConocoPhillips) was awarded the right to explore for oil and gas within Exploration Licence 470 (EL470), located in the Tulita District of the Sahtu Settlement Area (SSA) of the Northwest Territories (NWT). EL470 is one of 14 exploration licence blocks issued by Aboriginal Affairs and Northern Development Canada to five different companies in 2011 and 2012. As shown in Figure 1-1 these licences cover an area of about 1,052,041 ha (10,520 km^2).

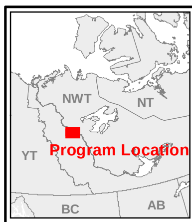
In October 2012, ConocoPhillips was granted a land use permit and water licence from the Sahtu Land and Water Board (SLWB) to conduct an exploration program within EL470, on the west side of the Mackenzie River, immediately south of the community of Norman Wells (i.e., the EL470 2012–2013 Exploration Drilling Program). This exploration program consisted of drilling two vertical wells and initiating a groundwater monitoring network.

In October 2012, ConocoPhillips met with community members and regulators to discuss plans for conducting additional exploration in EL470 beginning in winter 2013–2014. The 2013–2016 EL470 Exploration Program (the 2013–2016 Program) will involve drilling two horizontal exploration wells and testing the hydrocarbon potential of rocks deep in the ground. This requires fracturing some of the Canol shale using a water-based fluid (hydraulic fracturing) to release oil or gas. Applications for this program were submitted to the SLWB in March 2013.

During consultations for the 2012-2013 Program with communities, regulators and land claim organizations, ConocoPhillips heard common concerns about the potential for cumulative effects of multiple companies conducting exploration activities within the Tulita District. Participants were also interested in learning about what future exploration and development activities in the area might look like, and what opportunities these future activities might bring to the people of the Sahtu. These questions were reiterated to the SLWB during their review of the 2012–2013 Program, and during their review of applications for similar exploration programs, which MGM Energy Corp. (MGM) and Husky Oil Operations Ltd. (Husky) have conducted, or plan to conduct, within their respective ELs.

In response to concerns and questions raised, ConocoPhillips agreed to provide an informed and practical look at potential future activities within the Canol shale play area, and to examine the potential effects, both positive and negative, that these activities could have on the environment and people of the SSA.





ConocoPhillips Canada Resource Corp.'s EL470 in the Sahtu Region

Acknowledgements: Base Data Provided by CanVec, Imagery courtesy of ESRI

PREPARED BY
K'áálǫ-Stantec

PREPARED FOR
ConocoPhillips

FIGURE NO.
1-1

1.2 What is an early look ahead?

This discussion paper is meant to provide an informed and practical look at potential future activities within the Canol shale play – an area of oil potential within the SSA, and one of the newest areas of resource interest in North America – specifically within the Western Canada Sedimentary Basin geological region (Figure 1-2).

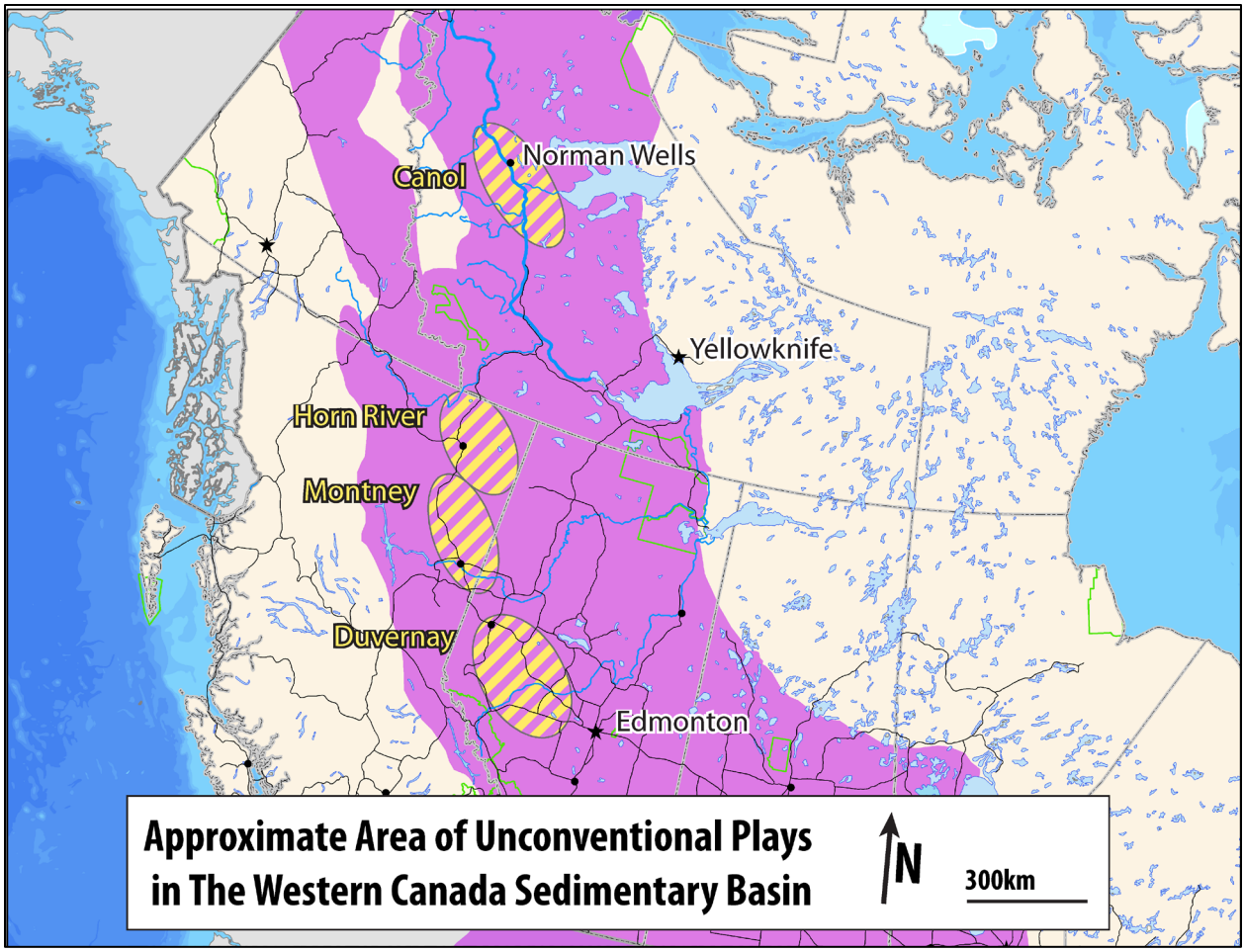


Figure 1-2 Unconventional Plays in Western Canada

Before describing potential future activities within the Canol shale area, this discussion paper provides background necessary to address these questions:

- What is the Canol shale play?
- Why does industry have an interest in exploring for hydrocarbons in this area?
- What are some of the unique characteristics of the Canol shale?
- How is technology used to evaluate its potential?

ConocoPhillips then contributes its own knowledge and experience working in areas of similar resource potential, to speculate about potential exploration activities within the Canol shale play 10 years into the future. This look ahead is based on information from very early stages of resource evaluation by ConocoPhillips.

1.3 A Modified Evaluation of Cumulative Effects

Identifying and assessing the cumulative effects of known future projects is required as part of regulatory applications for development in order to ensure that projects are assigned appropriate mitigations to minimize these effects. Speculating about the effects of undisclosed future activities however, is generally not required and may have little value if very little is known about future activities. In certain cases, considering a range of possible future activities along with the corresponding uncertainties might provide a regional context for specific regulatory applications. In this discussion paper, a description of potential future activities over the next 10 years provides a basis to evaluate the potential benefits and pressures these activities might exert on the environment and people of the SSA. This evaluation is used to make recommendations for managing effects from future activities, with suggested actions for both industry and resource managers.

Local stakeholders have expressed interest in better understanding the potential cumulative effects of future activities, and ConocoPhillips is presenting this discussion paper in response to these questions. In general discussion, the term *cumulative effects* is often used to refer to the effects that multiple industrial developments could have on culture, environment and people. To ensure a common understanding, it is important to clarify the definition of cumulative effects in the specific context of environmental assessment practice. When reviewing applications for individual projects, regulators are required to evaluate how the single project's specific predicted effects (whether positive or negative) could contribute to changes that might be caused by other projects in the same area at the same time. This assessment of project-specific cumulative effects provides regulators with information necessary to prescribe specific conditions that might be required to mitigate any negative cumulative effects from the project.

As part of its applications to the SLWB for the 2013–2016 Program, ConocoPhillips provided a cumulative effects assessment in accordance with territorial guidelines (Mackenzie Valley Environmental Impact Review Board 2004).

This discussion paper does not present information specifically correlated to any one project or regulatory application. It provides a look at potential future implications at much broader spatial scales. This discussion paper:

- compiles information about current and planned activities within the area of the Canol shale play
- speculates about ConocoPhillips' possible future activities
- projects ConocoPhillips' assumptions to a broader area of exploration interest within the Canol shale play to describe the hypothetical range of oil and gas-related activities that could take place in the future
- describes potential future activities 10 years into the future and evaluates the effects they could have on the people and environment within the region
- identifies where guidance, research or management actions might be required to manage uncertainties or effects

Such geographically far-reaching, non-project-specific evaluations are usually undertaken in support of land use planning or regional cumulative effects management initiatives, and can involve many years of studies and research to support conclusions and recommendations for predicting and managing effects of development in certain regions. Examples of such regional studies and plans include:

- Sahtu Land Use Plan (http://www.sahtulanduseplan.org/website/web-content/index.html)
- Dehcho Land Use Plan (http://www.dehcholands.org/docs_final_draft_dehcho_land_use_plan_june_02_06.htm
- Beaufort Regional Environmental Assessment (http://www.beaufortrea.ca/)
- North Yukon Regional Land Use Plan (http://www.emr.gov.yk.ca/lands/nyrlup.html)
- A Cumulative Effects Assessment and Management Framework (CEAMF) for Northeast British Columbia (http://scek.ca/projects/complete; AXYS et al. 2003; Salmo et. al. 2003)

Development of these plans and frameworks requires multi-stakeholder input and a reasonable understanding of the regional environment, values and future drivers of change. Since industry's interest in the Canol shale play is relatively new, predicting activities as well as the play's ultimate success, will remain uncertain for quite some time. This paper provides a more appropriate evaluation of potential future effects which is neither project-specific nor regional in scope.

2 THE CANOL SHALE PLAY: EVALUATING THE RESOURCE

2.1 Why the Canol Shale?

ConocoPhillips began exploration activities within EL470 to evaluate the hydrocarbon potential of the Devonian-aged organic-rich shales of the Canol Formation (Figure 2-1). Geochemical methods show that the Canol Formation is the source rock for the oil found within the Kee Scarp reef in the Norman Wells oil field. This is one of Canada's largest conventional oil fields (Snowdon et al.1987), and is the source of oil that is produced in and around Norman Wells. Geological studies and information from historical wells also show that there might be a secondary resource potential in the underlying Devonian-aged shales of the Bluefish Member of the Hare Indian Formation.

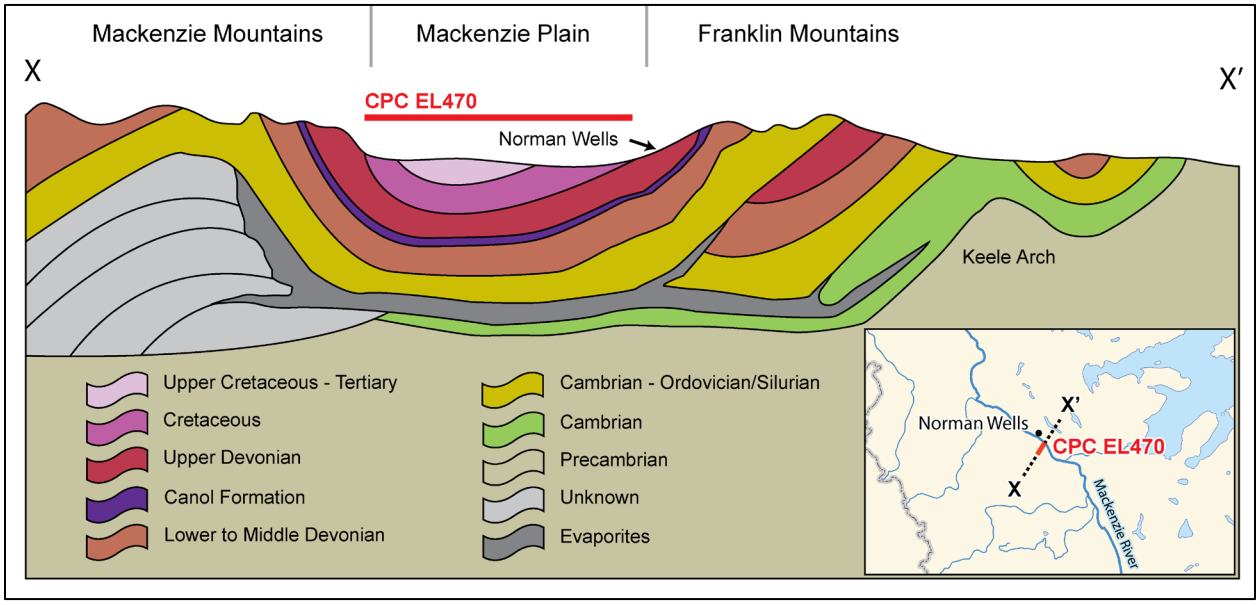


Figure 2-1 Stratigraphic Location of the Canol Shale Formation[1]

While the hydrocarbon potential of the Canol Formation has been known for some time, its prospectivity as a development target has only recently become feasible because of advances in exploration technology. The Canol shale is considered an *unconventional* resource play. Any oil or gas within the shales one to two km below the surface of EL470 is expected to be found within tiny pores with low permeability, relative to a *conventional* reservoir. As result of its low permeability, any oil or gas the Canol shale contains is not likely to flow easily. Technologies to increase the permeability of *unconventional* shales, such as horizontal drilling and multi-stage hydraulic fracturing, are needed and have only become feasible in the last 10 to 15 years.

[1] Figure modified from Indian and Northern Affairs Canada, Northern Oil and Gas Branch 1995

The key uncertainties which can only be tested during drilling, are:

- What are the characteristics of the hydrocarbons in the shales of the Canol Formation?
- Can hydrocarbons flow from these shales?
- How well do hydrocarbons flow?

Oil is generated within a limited range of pressure and temperature and can only be formed from specific types of organic matter. Depending on conditions, gas, condensate or water could also exist. The rocks within the prospective formations might contain various proportions of oil, gas condensate or water, or contain no hydrocarbons at all.

ConocoPhillips' main interest at this time is oil. Predicting what type and proportions of hydrocarbons might be found within the rocks under EL470 is key information ConocoPhillips requires to further evaluate the prospective resource. While publically available data from existing wells and outcrops throughout the region broadly indicate that much of the Canol Formation in the Mackenzie Valley could contain oil (Pyle 2011), the amounts and proportions are expected to vary over a broad area. The purpose of ConocoPhillips' current and planned exploration programs is to use well drilling and testing to obtain critical information necessary to predict the types and amounts hydrocarbons (if any) to be found in the Canol Formation.

2.2 The Evolution of Unconventional Oil

Unconventional shale resources are typically more expensive and technically challenging to develop than conventional resources. Different technologies are used for different situations, but the most common methods used are horizontal drilling and multi-stage hydraulic fracturing. Horizontal drilling is a procedure where the wellbore is drilled vertically to a certain depth above the target formation and then angled through a wide 90-degree arc so that a large portion of the well itself extends horizontally through the target formation (Figure 2-2). Fracturing the reservoir by pumping fluids, such as water, mixed with a propping agent, usually sand, into the reservoir at high pressure, creates or opens pathways by which the oil can flow to the wellbore.

In *conventional* oil and gas reservoirs, hydrocarbons are trapped within porous rock formations, such as carbonates, sandstones and siltstones, called reservoir rocks. The size and interconnectivity of the pores within these reservoirs makes the hydrocarbons relatively easy to extract (i.e., produce). Most of the world's hydrocarbon production comes from conventional reservoirs.

In *unconventional* reservoirs, hydrocarbons are found within rocks such as oil or gas-rich shale, tight sandstone or coal seams that have very small, unconnected pores. These rocks consequently have much lower permeability (ability for fluid to flow through them) relative to a conventional reservoir. Extracting the hydrocarbons requires application of advanced technologies such as horizontal drilling and multi-stage fracturing.

As conventional resources decline, it is expected that unconventional resources will contribute to a growing proportion of the world's oil and gas supply.

Hydraulic fracturing is the process of cracking the reservoir rock using sand and fluids under pressure to improve the rock's permeability.

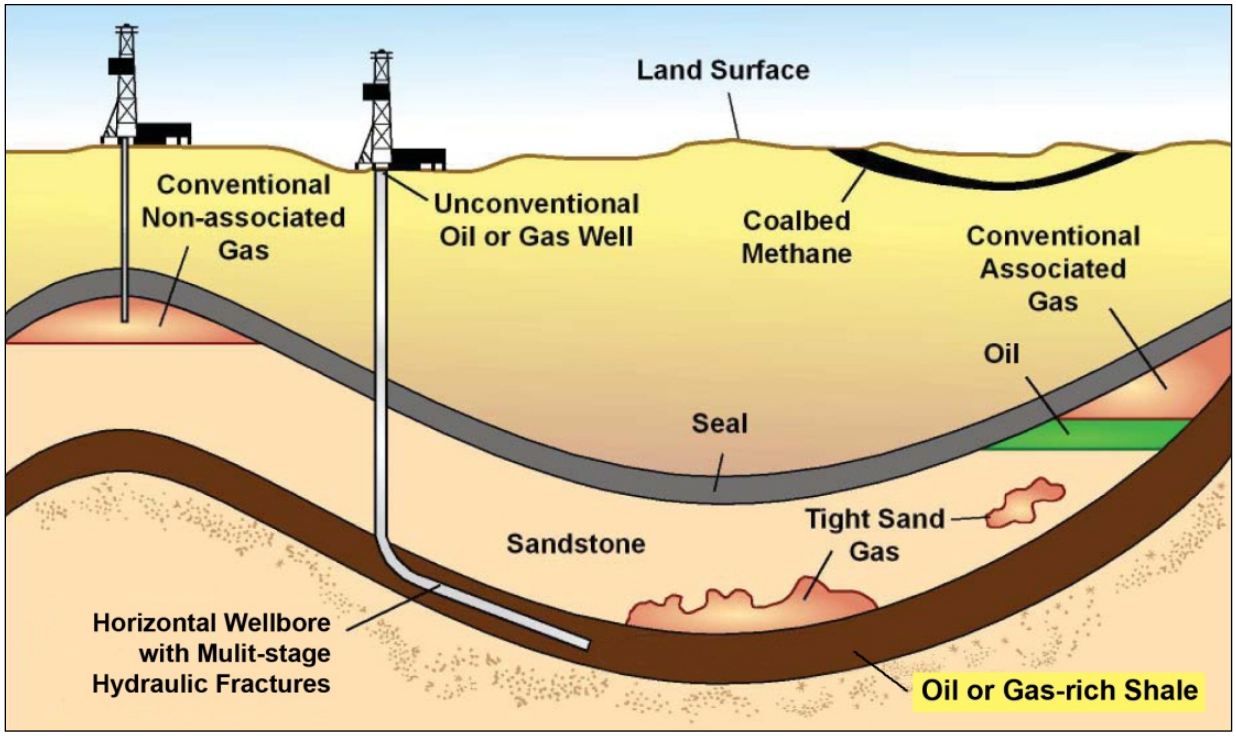


Figure 2-2 Geology of Conventional and Unconventional Oil and Gas[2]

Multi-stage fracturing is the process of carrying out multiple fracture stimulations of the reservoir using a single horizontally-drilled well. Horizontal drilling and multi-stage fracturing significantly reduces the land surface disturbance and poses fewer safety and environmental risks, because one well pad can be used to drill multiple horizontal wells. Vertical wells require multiple pads for the same purpose. Once the oil has been unlocked from the tight reservoir and is able to flow to the wellbore, conventional technologies are used to produce the well.

Development of conventional oil and gas reserves follows a relatively predicable course of activities from exploration, to appraisal, to development and production. Progressively, these activities help companies:

- delineate the resource
- evaluate its economic viability
- assess overall risks
- decide whether and how to proceed with production

[2] Figure modified from *America's New Energy Future: The Unconventional Oil and Gas Revolution and the US Economy*; Volume1: National Economic Contributions, accessed at http://www.energyxxi.org/sites/default/files/pdf/americas_new_energy_future-unconventional_oil_and_gas.pdf

The progression of activities for unconventional resources is not as easily defined. In order to fully understand the economic viability of the resource generally requires more testing and evaluation of the resource over a longer period of time. The resource can remain conceptual for quite some time while various resource parameters are tested.

The Canadian Society for Unconventional Resources (CSUR) has developed a time chart and description for the various stages of unconventional resource development based on the premise that certain activities required for resource appraisal, occur at specific stages in project development (Canadian Society for Unconventional Resources 2013). The description of CSUR's stages has been modified to reflect more realistic timelines for the potential stages of development of the Canol shale play (Figure 2-3). However, these are still approximate and might vary depending on a variety of technical and economic factors. Continuation of the project from one stage to the next is dependent on positive evaluation of results from previous activities, and a positive economic and investment environment. A project may terminate after any stage and would be followed by reclamation.

2.3 Early Stage Evaluation of the Canol Shale Play

2.3.1 Current Activities in EL470: 2013

There are currently three companies with resource evaluation programs underway within five ELs in the Canol shale play (Figure 2-4):

- MGM
- Husky
- ConocoPhillips

The specific activities that have been completed, or are permitted to be undertaken, by these explorers in the area outlined in Figure 2-4 as of March 31, 2013, include the following:

- MGM has completed one vertical well within EL466B and has constructed a winter access road and storage and staging areas.
- Husky has completed two vertical wells in EL462 and EL463 and has also constructed winter access and supporting facilities.
- ConocoPhillips has completed two vertical wells in EL470 and has also constructed winter access and other supporting facilities.
- Husky has completed a 3-D seismic program.
- MGM and ConocoPhillips have acquired 2-D seismic data within their licence areas.
- In total, over 20 groundwater monitoring wells have been completed by the three companies.
- Husky has started construction of an all-weather access road, helipad, airstrip, camp and staging area.

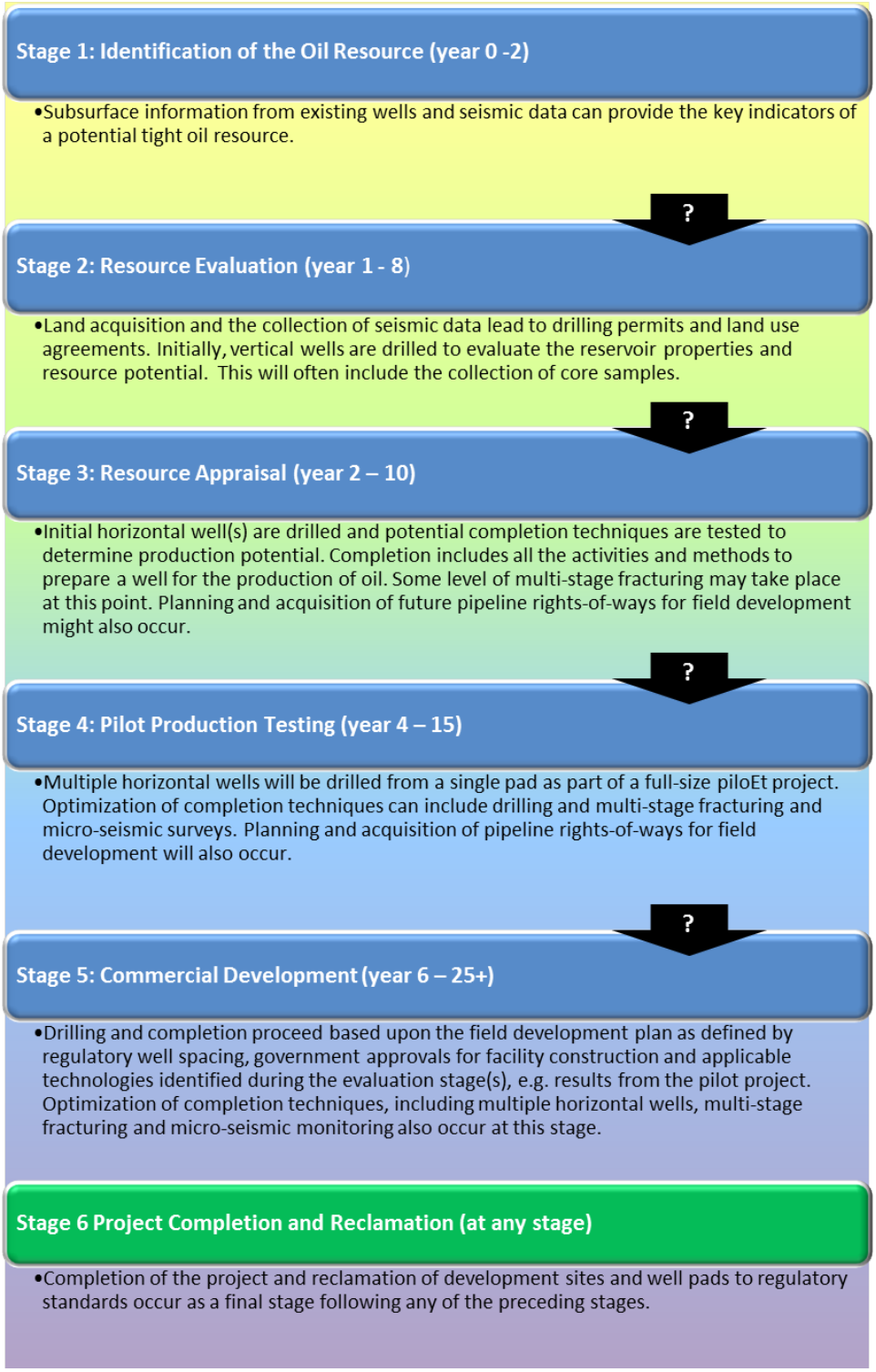
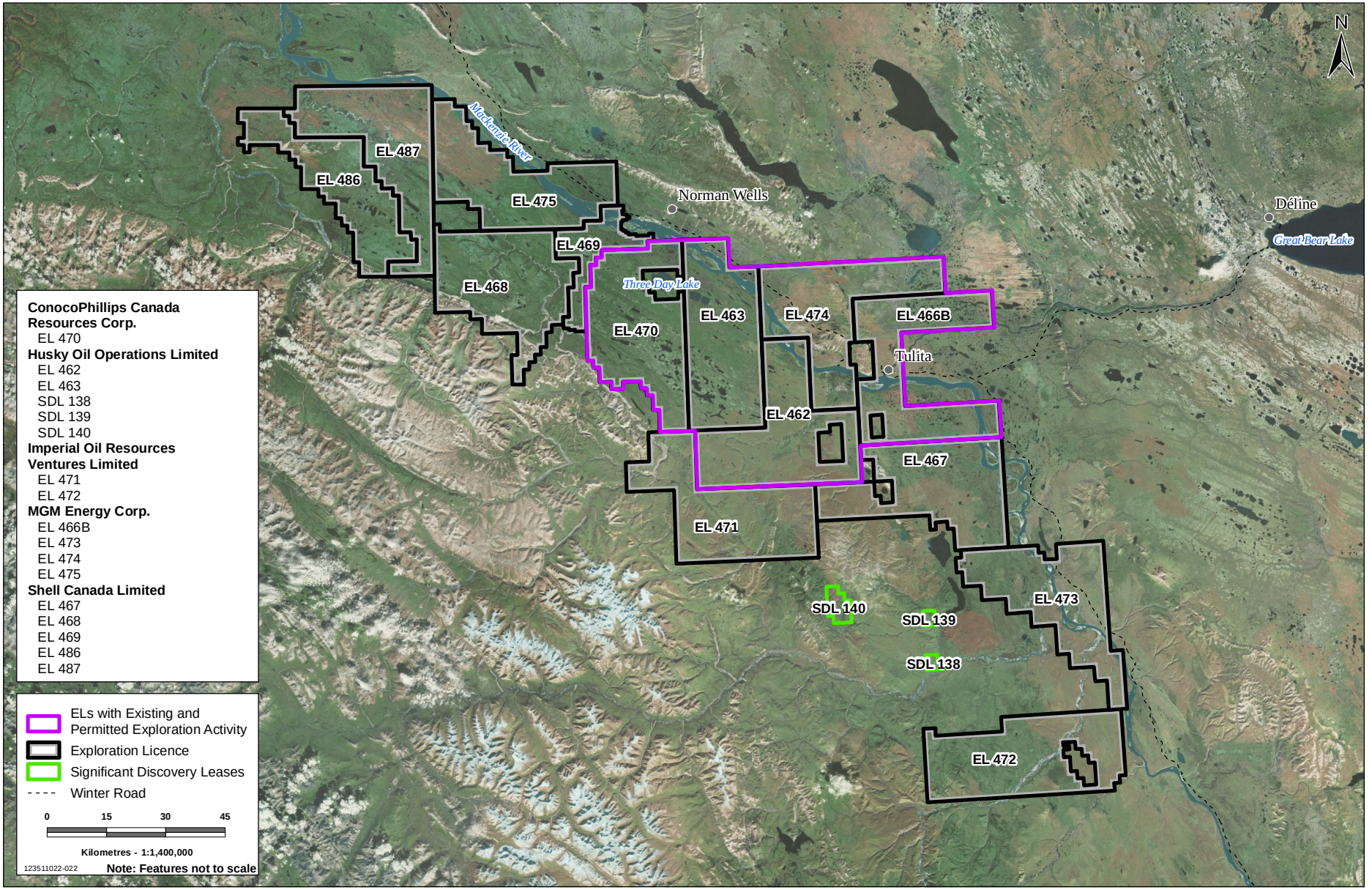


Figure 2-3 Staged Development of Unconventional Oil adapted to Canol Shale Play



Exploration Licences with Current Activity

Acknowledgements: Base Data Provided by CanVec, Imagery courtesy of ESRI

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PREPARED FOR ConocoPhillips

FIGURE NO. **2-4**

The listed activities completed, or permitted to be undertaken, within these five licence blocks are shown in Figure 2-5 and are considered evaluation activities in the progression of staged development, as previously described in Figure 2-3. Activities conducted during this early stage of exploration, and in particular drilling of vertical wells, will enable a preliminary evaluation of the rock and fluid properties of the targeted geological formations. Evaluation of results at this stage will allow companies to determine whether to proceed with further investment in the resource. Regulatory applications are often made in advance of final results to ensure that the next phase of exploration activities, if conducted, can proceed in a timely manner. Active exploration programs are conducted under ELs issued by Aboriginal Affairs and Northern Development Canada, and other approvals granted by the SLWB and National Energy Board (NEB).

2.3.2 Proposed Activities: 2013–2016

As of March 2013, ConocoPhillips is the only explorer having applied to the SLWB for approval for additional activities within the Canol shale play. Other explorers have not publicly disclosed their plans for any new or additional activities either within the area of current resource evaluation activity, or within the larger Canol shale region. ConocoPhillips has submitted applications to conduct further activity within EL470, to the SLWB and plans to submit to the NEB around June 2013.

2.3.2.1 ConocoPhillips Activities

ConocoPhillips' proposed activities between 2013 and 2016 are shown in Figure 2-6 and include:

- completing two horizontal wells
- conducting multi-stage hydraulic fracturing
- expanding existing staging and storage areas

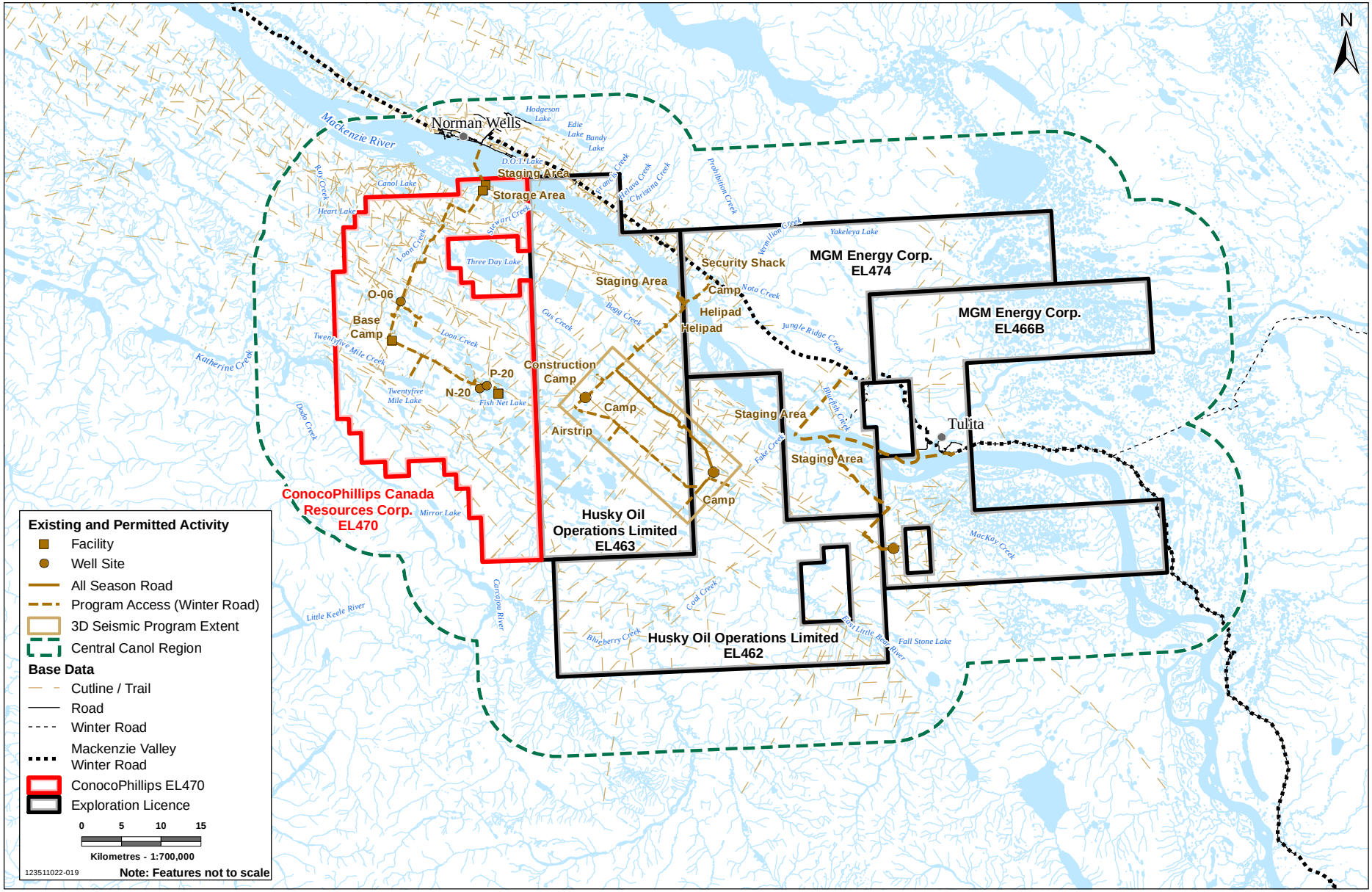
The purpose of ConocoPhillips' proposed 2013–2016 Program is to further evaluate the rock and fluid properties of the Canol Formation. ConocoPhillips plans to:

- evaluate data from vertical wells
- drill its first horizontal wells
- conduct hydraulic fracturing to enable testing of geological and geo-mechanical properties of the reservoir
- test other parameters of the Canol Formation, such as flow rate

2.3.2.2 Other Developments

Activities proposed by other developers within the region that are not related to the Canol shale play are also shown in Figure 2-6. These include:

- continued production activities within the Norman Wells Proven Area
- construction of the Mackenzie Valley Highway



Existing and Permitted Canol Shale Activities, March 2013

Acknowledgements: Base Data Provided by CanVec

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PREPARED FOR ConocoPhillips

FIGURE NO. 2-5

MGM, Husky and ConocoPhillips have all drilled vertical wells. It will not be until testing and evaluation of results from multiple horizontal wells is complete, that operators will be able to determine whether this unconventional play may be successful. It will be necessary to drill and test wells over several years to allow for interim analysis and evaluation of results. To date, no horizontal well programs have been drilled. Therefore, it makes it difficult at this time to predict future activities beyond those underway, or proposed. It is also impossible to predict the ultimate resource potential of the Canol shale play at this early stage of exploration. In ConocoPhillips' case, further evaluation or appraisal activities within EL470 will depend on:

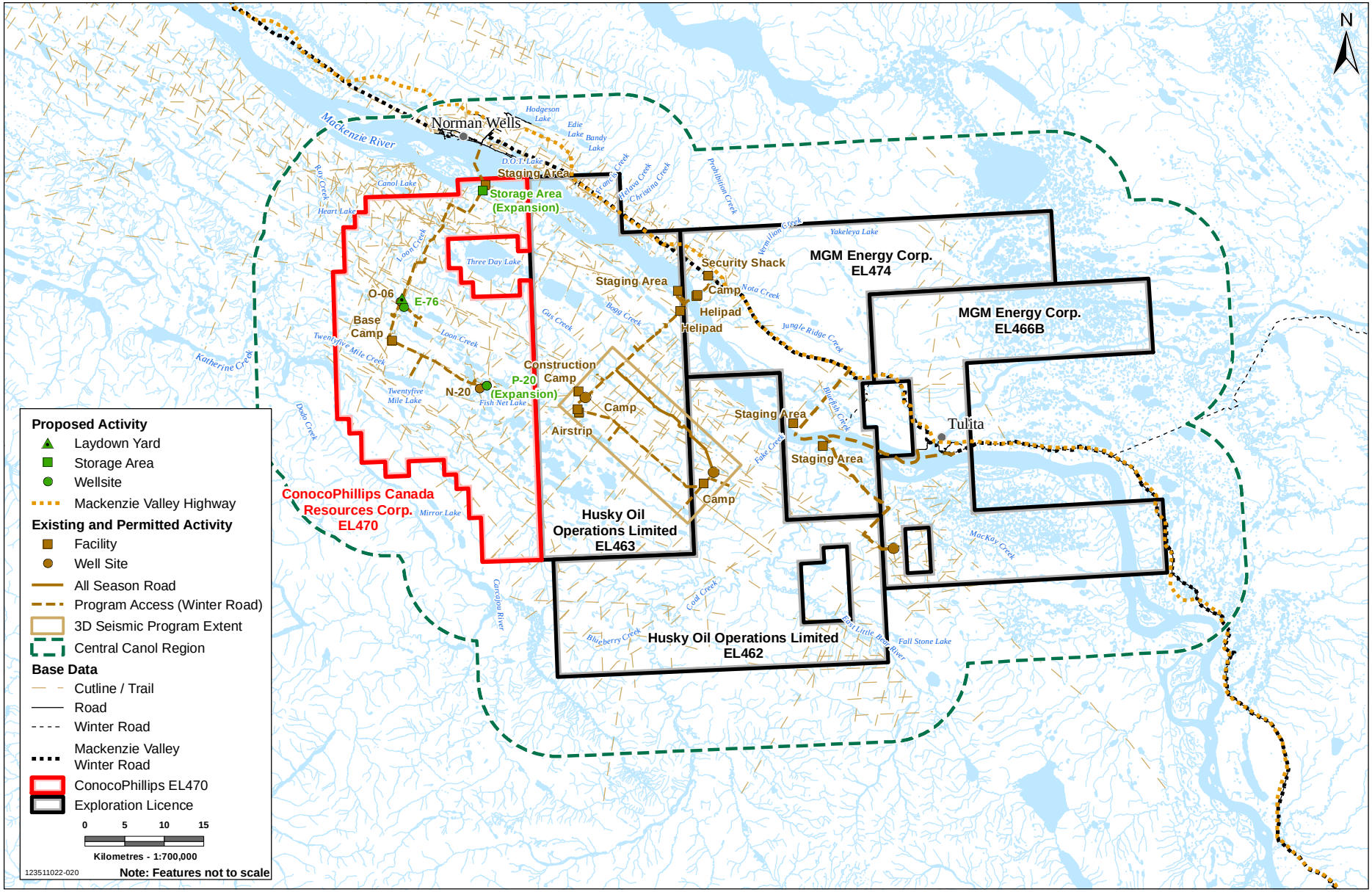
- results of previous programs
- commodity value
- regulatory certainty
- community support
- assessment of waste management options
- internal investment decisions

2.3.3 Possible Future Activities: 2013–2021

2.3.3.1 Companies other than ConocoPhillips

At this time, none of the other four explorers have disclosed any plans for next steps or further activity, beyond those that are already approved. Shell and Imperial have not yet proposed activities within their ELs. They may try to meet their first term exploration commitments, which requires drilling at least one well in each of the ELs during the first 5 years of the licence. Even this activity is based on speculation, given many factors that can influence when, where and how exploration-type activity is conducted in the SSA or how multi-lease management occurs. Other explorers have not disclosed future plans, and ConocoPhillips will not speculate about their potential future programs.

All companies are currently within the first 5 years of their ELs. Once a well is drilled on a lease, the leaseholder has an additional 4 years to evaluate whether the interest is to be held or relinquished.



Proposed Canol Shale Activities, March 2013

Acknowledgements: Base Data Provided by CanVec

PREPARED BY
K'áálô-Stantec

PREPARED FOR
ConocoPhillips

FIGURE NO.
2-6

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2.3.3.2 ConocoPhillips' Activities

ConocoPhillips is considering a range of possible options for future activity in EL470 within the next 8 to 10 years. A description of these possibilities supports a discussion of potential effects on the environment and people of the SSA from these potential future activities. Four scenarios are used as the basis for predicting what might occur in EL470 by 2021 (during the remaining 7 years of the licence). These scenarios are shown on Figure 2-7.

The context for these scenarios is based on the purpose and process for ConocoPhillips' activities. The purpose of ConocoPhillips' current 2012–2013 (two vertical wells), and planned 2013–2016 (two horizontal wells) exploration programs in EL470 are to:

ConocoPhillips is in a very early stage of evaluating the resource potential of the Canol Formation underlying EL470.

After completing each planned program ConocoPhillips will evaluate the findings to determine whether to proceed with further investment in the resource.

- evaluate the reservoir and fluid properties of the Canol Formation below EL470
- evaluate whether further exploration activity within EL470 is warranted

Depending on results, commodity value and internal investment considerations, ConocoPhillips' evaluation of reservoir properties and whether future activities within EL470 are warranted, will result in formulation of options. Future activities within EL470 could range from no activity to various activities associated with additional resource appraisal within EL470 such as well drilling. The description of these potential future activities can be used to support cumulative effects assessments required for possible future project applications, but such a discussion also provides an important context to evaluating the effects of future activities which could occur within the broader area of the Canol shale play.

FOUR SCENARIOS IN EL470

ConocoPhillips' four possible future scenarios within EL470, are summarize and are based on four combinations of commodity value and results at the time, as illustrated in Figure 2-7.

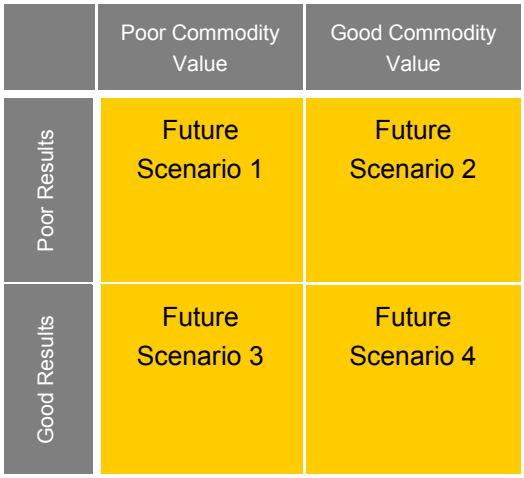


Figure 2-7 Four Possible Future Scenarios in EL470

Commodity value is used in the four scenarios in Figure 2-7 to summarize non-reservoir-related economic factors, such as:

- predicted future commodity price
- predicted future access to markets
- construction capital
- operating costs
- mobilization and equipment costs
- costs related to project approvals
- access and benefits agreements

As illustrated in Figure 2-7, a *poor commodity value* generally represents a predicted low or negative net value of a barrel of oil in light of these economic factors. *Good commodity value* means that the expected net value is such that the expected project profits and timing result in earnings that are greater than those that could be earned on other ConocoPhillips projects or investments.

During resource evaluation and appraisal, *results* comprises the range of reservoir-related factors on which the potential resource is initially evaluated, such as resource type, quantity, quality, expected recovery rates and the predicted ease of recovery. In Figure 2-7, *poor results* and *good results* might be based on evaluations of reservoir pressure, flow rate, the gas-to-oil ratio and each well's rate of decline.

The basis of ConocoPhillips' four possible scenarios in EL470 is illustrated in Figure 2-8. Three of these scenarios unfold following ConocoPhillips' currently proposed activities, while one scenario sees activities terminate in 2013. Each of the scenarios result in different activities by ConocoPhillips, based on the outcome of its evaluation of results and commodity value at the time.

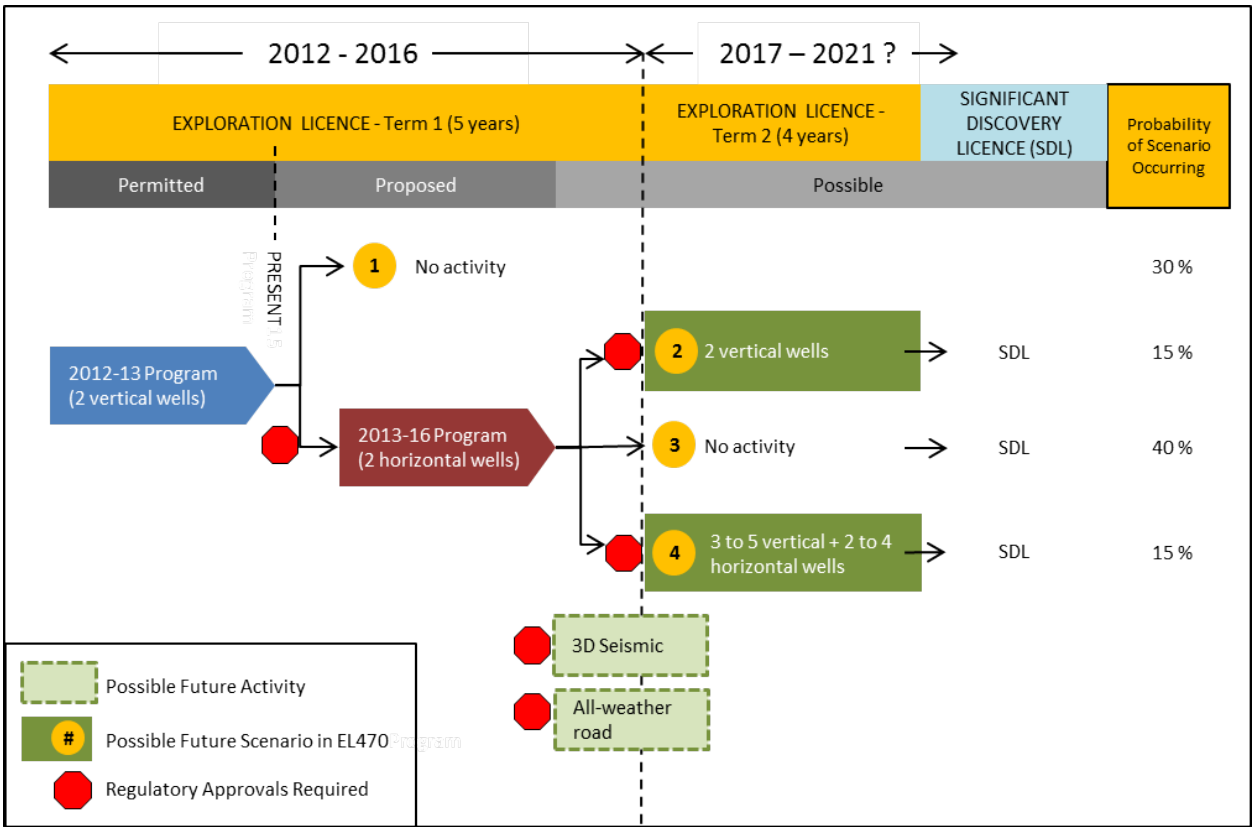
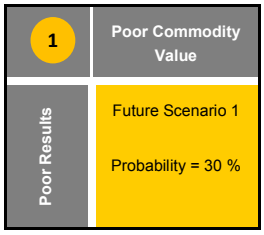


Figure 2-8 Evolution of Potential Future Scenarios in EL470

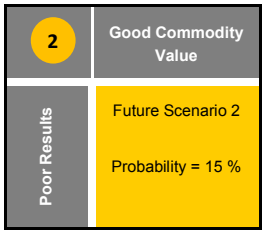
POTENTIAL FUTURE SCENARIO 1: POOR COMMODITY VALUE/POOR RESULTS



After drilling and evaluating its first two approved vertical wells in 2013, ConocoPhillips might cease activities in EL470, if the projected commodity value and results are deemed *poor*. Although further activities such as the 2013–2016 Program might be approved or planned, it is possible that ConocoPhillips might relinquish its interest in EL470.

This scenario comprises less activity than is currently being proposed by ConocoPhillips and, consequently, would not contribute to additional effects to the environment or people, although further economic opportunities would cease. The probability of ConocoPhillips ceasing further activity after 2013 is estimated at 30%.

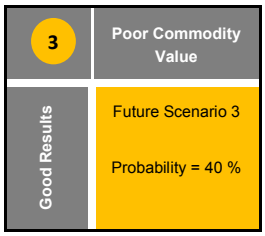
POTENTIAL FUTURE SCENARIO 2: GOOD COMMODITY VALUE/POOR RESULTS



If the commodity value is projected to be *good*, but the data results of the 2012–2013 and 2013–2016 programs are *marginal* or *poor*, ConocoPhillips might plan to conduct some additional winter drilling to further evaluate the resource potential. In this situation, ConocoPhillips might drill two additional vertical wells before the end of the licence term in 2021, but hold its interest in the area if it already had information sufficient to obtain a significant discovery licence (SDL).

The additional incremental effects of this scenario on the environment would be less than those of the 2012–2013 Program, since much of the infrastructure to undertake this additional drilling activity would already be in place. The probability of this outcome following the 2013–2016 Program is estimated at 15%.

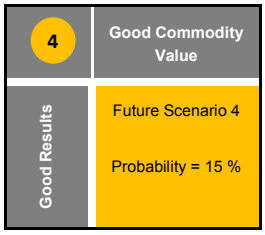
POTENTIAL FUTURE SCENARIO 3: POOR COMMODITY VALUE/GOOD RESULTS



If the 2012–2013 and 2014–2016 programs show *good* results, but the projected commodity value is *poor*, ConocoPhillips may not conduct any further evaluation or appraisal activities beyond the 2013–2016 Program, until such time as commodity values improve. ConocoPhillips might have sufficient results at this point to acquire an SDL, which would allow ConocoPhillips to hold the rights into the future and develop the resources once commodity values improve.

Because this scenario represents a cessation of activities, there would be no additional effects to the environment and people beyond those predicted for the 2013–2016 Program. The probability of ConocoPhillips not conducting further activities beyond those of the 2013–2016 Program is estimated at 40%.

POTENTIAL FUTURE SCENARIO 4: GOOD COMMODITY VALUE/GOOD RESULTS



If project results and commodity value are favourable after completing the 2013–2016 Program, ConocoPhillips might plan to conduct additional exploration and early production testing activities to further evaluate the resource. In this scenario, ConocoPhillips might plan to:

- drill three to five additional vertical wells and drill two to four horizontal wells during the winters of 2017-2018 and 2018-2019
- conduct multi-stage fracturing and possibly limited production testing of each horizontal well

The activities conducted during this scenario would contribute incrementally to effects on the environment and people. It is these activities that have been used to complete a project-specific cumulative effects assessment for the 2013–2016 Program's regulatory applications. While the activities represented by Scenario 4 represent a best case for ConocoPhillips, as they are a possible precursor to further appraisal and testing activities, the probability of realizing this scenario is estimated at only 15%.

A *Significant Discovery Licence* (SDL) gives operators flexibility to hold leases for a time to further evaluate the resource against other opportunities.

Other possible future activities that ConocoPhillips may wish to conduct within EL470 is more flexible within the scenarios, including:

- acquire 3-D seismic data on a portion of EL470
- construct an all-weather access road and supporting facilities

Seismic data would be acquired to assist with and supplement resource evaluation and to optimize placement of possible future wells. An all-weather road would facilitate future project logistics by extending the project operations season and facilitating on-site mobilization of equipment and personnel.

ConocoPhillips's possible future activities within EL470, based on Scenario 4 (the best case), as well as a potential 3-D seismic program and all-weather road have been added to the activities currently permitted and proposed within the active region of the Canol shale play in Figure 2-9.

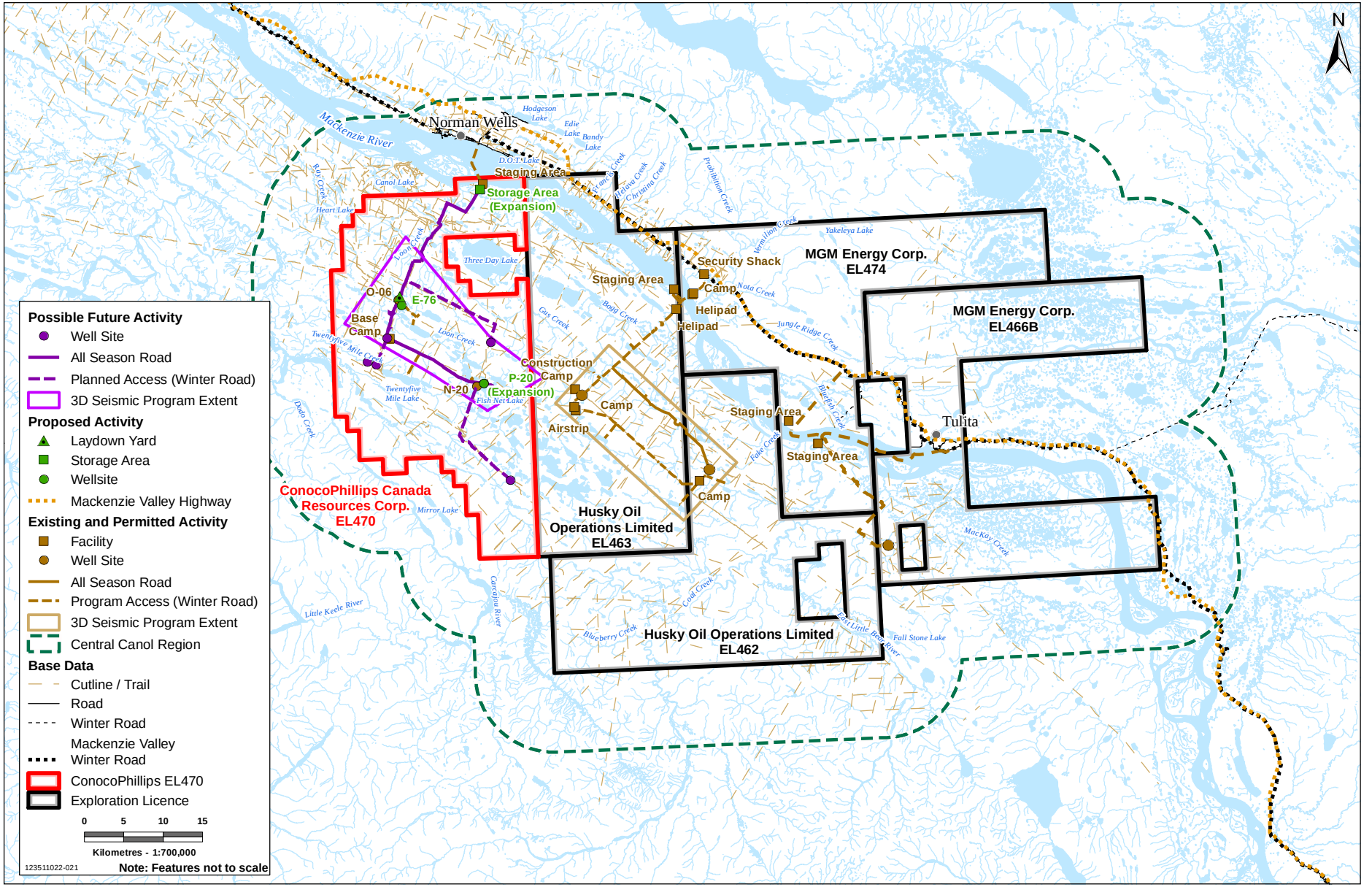
Although ConocoPhillips can describe what its future appraisal activities might look like, based on this predictive four-scenario approach, it is not possible, nor appropriate for ConocoPhillips to speculate about the factors that other companies might consider in decisions concerning future activities in the Canol shale play.

2.4 Hypothetical Future Activities in the Canol Shale Play

Hypothetical activities include those that are speculative at this time. That is, there is very little or no information upon which to presume what or when something may take place. So, although it may be possible to make some informed guesses about future activity based on precedence and conjecture, whether or not these activities actually take place remains essentially unknown.

However, to provide information that might be useful to local residents, resource managers and regulators, ConocoPhillips is providing a description of these uncertain and hypothetical future activities within the Canol shale play using two future time frames:

- hypothetical future activities from 2013 to 2021
- hypothetical future activities from 2021 and beyond



Possible Future Activity, Canol Shale (CPC Scenario 4): 2017-2021

Acknowledgements: Base Data Provided by CanVec

PREPARED BY K'áálò-Stantec

PREPARED FOR ConocoPhillips

FIGURE NO. 2-9

2.4.1 Hypothetical Future Activities: 2013–2021

Speculation about other explorers' activities must begin at the point when their publicly disclosed plans end. Any activities by Shell Canada Ltd. (Shell) and Imperial Oil Resource Ventures Ltd. (IORVL) are at this moment considered as hypothetical, and activities by MGM and Husky beginning at the end of their currently approved programs in 2016 are also considered hypothetical.

ConocoPhillips will not make assumptions about resource potential in ELs held by other companies. Nor can it can make any predictions on their behalf about the location and nature of their future exploration programs, except where plans are publicly disclosed. Speculation about hypothetical future activities is based on ConocoPhillips' current interpretation of available geologic information, and experience with other potentially similar shale and tight oil and gas plays in North America. It is not based on information from the other explorers in the Canol shale play.

These limitations preclude the development of a visual depiction of the location of specific activities on the landscape (i.e., "lines and dots" on a map).

The following assumptions must be considered for the purposes of hypothetical future activities within the Canol shale play:

- The resource of interest is assumed to be the Canol Formation (although other explorers may have interest in other strata, such as the Bluefish Member of the Hare Indian Formation, e.g., MGM, 2012).
- The depth, areal extent and geological characteristics of the Canol Formation likely vary considerably across the play (Pyle et al., 2011; Lemiski et al., 2011; Gal et al., 2009).
- Access to every EL block might not be physically possible since there are several major rivers and steep terrain bisecting a number of ELs.
- Access and benefits agreements have been concluded, as appropriate.
- The existing Enbridge Norman Wells Pipeline has available capacity that could enable oil to be shipped out of the NWT during production testing. However, no tie-in from the west side of the Mackenzie River is currently planned.
- There are no local waste or wastewater disposal options, such as disposal wells.
- The regulatory regime will continue to be robust and provide certainty of process.

Any of the other four explorers in the central Mackenzie Valley could follow a similar progression of evaluation and appraisal activities as ConocoPhillips within any one of the other 13 ELs, This could occur before, concurrent with, or at some time after ConocoPhillips. Although operators could opt to complete no work on their licence and pay a penalty to the Crown. ConocoPhillips assumes that some level of exploration will have been conducted within most of the ELs by 2021. The range of activities could reasonably be those as described by ConocoPhillips' Exploration Phase Scenarios 1 through 4. Having invested in construction of an all-weather road, Husky might be planning to conduct additional appraisal activities. All-weather access facilitates movement of supplies, water and equipment, and reduces

program uncertainties and logistics planning because activities can now be conducted outside of the typical three-month winter season.

2.4.2 Hypothetical Future Activities: Beyond 2021

ConocoPhillips will use its experience from other jurisdictions, and real examples from other active unconventional plays in Canada, to describe the phases of resource development that could follow successful resource evaluation and appraisal by 2021.

Based on the scenarios outlined in Section 2.3.3 and factors that strengthen the predictions leading to any one of these scenarios, ConocoPhillips expects that, by 2016, it might know whether it is proceeding to conduct further appraisal activities. Furthermore, by 2021, ConocoPhillips will have completed sufficient appraisal activities to acquire an SDL and decide whether to proceed with pilot and production testing. If successful, ConocoPhillips will have made a significant discovery declaration to the NEB and acquired an SDL from Aboriginal Affairs and Northern Development Canada. This might result in a pause in activity to consider, in additional to resource evaluation, other risk factors such as commodity value and regulatory certainty before making a decision about a pilot production testing phase. Figure 2-10 shows the evolution from potential future evaluation and appraisal activities into hypothetical pilot production testing activities, beginning in 2021.

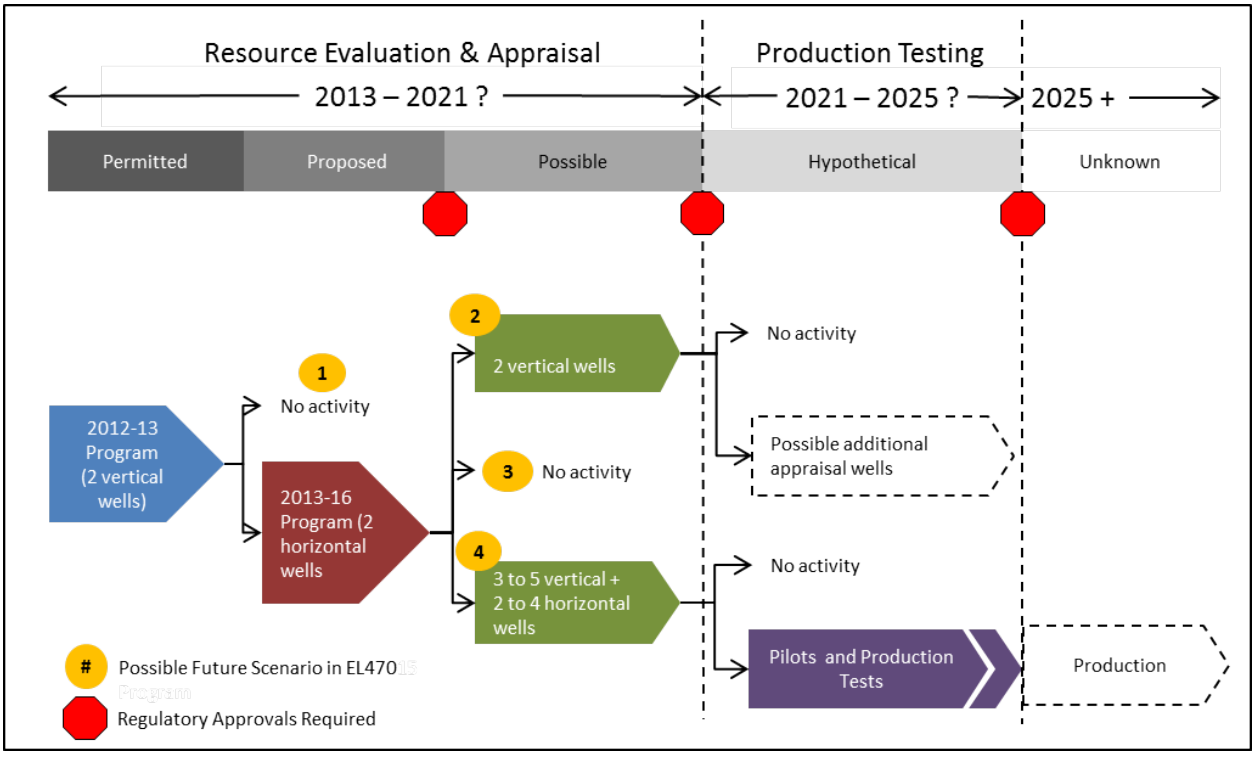


Figure 2-10 Evolution of Exploration Activities Beyond 2021

For ConocoPhillips, further stages of testing the resource might involve more intensive drilling and testing activities over a more defined, and smaller area, to evaluate the potential long-term production performance and to obtain information necessary to optimize production project design. Even if the Canol shale can flow liquid hydrocarbons, there would still be uncertainty about the long-term well performance and ultimate recovery, until the evaluation of years of pilot production testing. ConocoPhillips could decide to proceed to full development depending on a number of factors, including:

- production rates
- fluid quality
- commodity price and projected profit margin
- regulatory certainty
- capital and operating costs
- infrastructure capacity

Speculating becomes increasingly uncertain beyond 2021. However, it is useful for the purpose of describing what these activities could potentially look like, and for introducing the wide range of factors that will need to be evaluated before proceeding from appraisal activities to production testing activities. These factors include, among other things:

- results and commodity value
- waste management options (e.g., a disposal well)
- community support
- regulatory certainty
- availability of certain supporting infrastructure (e.g., roads, pipelines)

These decision points and factors are summarized in Figure 2-11. The red arrow indicates the current stage of ConocoPhillips' evaluation activities.

If ConocoPhillips proceeds to production evaluation activities, it would have collected sufficient information to evaluate and delineate the resource beneath EL470 to obtain an SDL and will have obtained the necessary regulatory approvals to proceed. For the purpose of describing hypothetical activities during production evaluation, this smaller area within EL470 will be referred to as a fictitious SDL470. The size of this fictitious SDL470 area will depend on the evaluation of appraisal activities and could be different than the area of EL470.

The purpose of production testing is to evaluate well production over a term of one to two years to get detailed information about the reservoir characteristics. This information is required to optimize facility design and layout to support commercial development during an even more distant future production phase. For ConocoPhillips, the decision to proceed to a production evaluation would indicate significant interest in the resource within the fictitious SDL470, and a commitment to expend significant resources on associated activities and infrastructure.

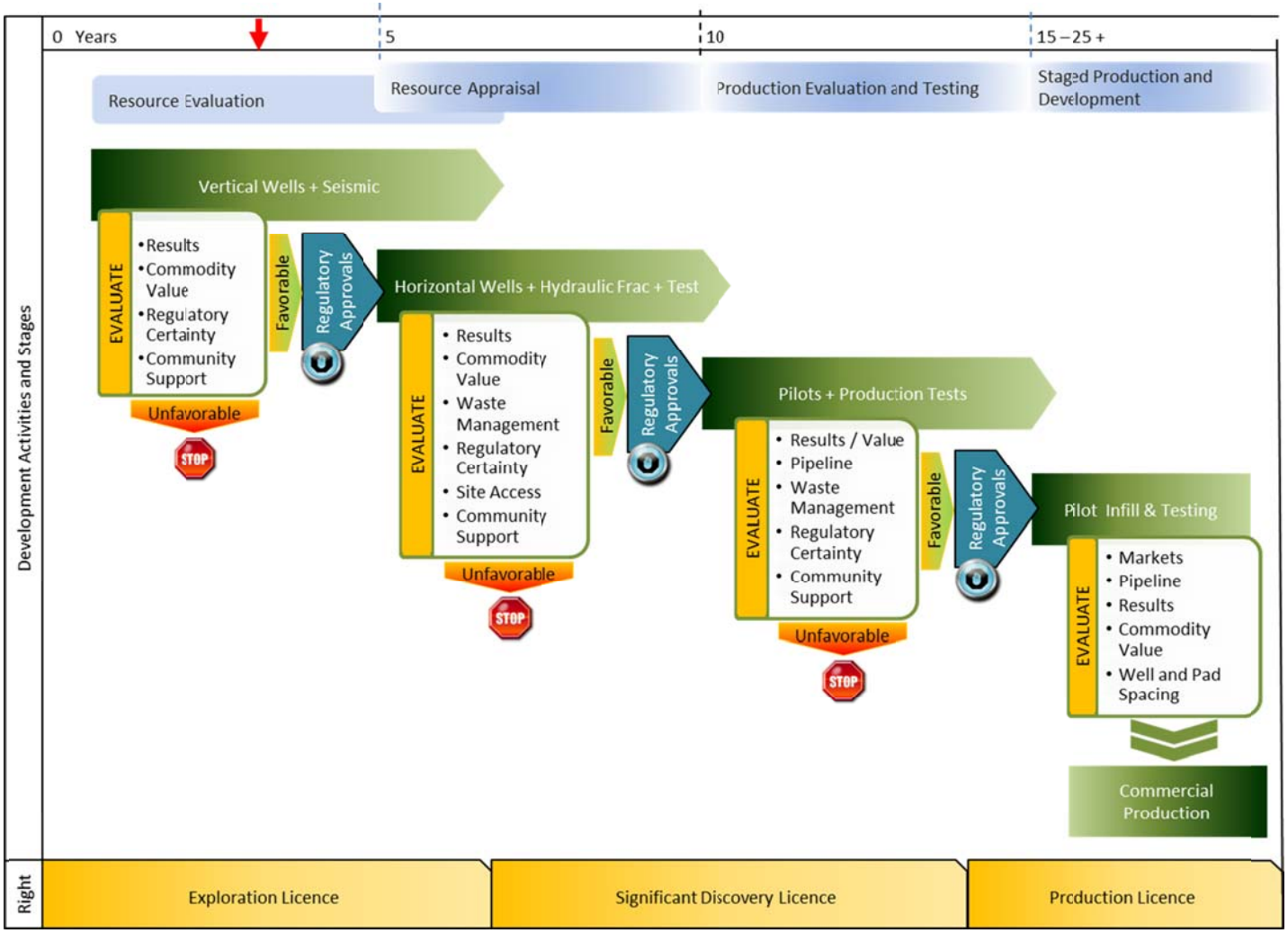


Figure 2-11 Decision Points for Appraisal and Production Testing Activities

The kinds of activities ConocoPhillips would undertake during a hypothetical production testing phase within the fictitious SDL470 between 2021 and 2025 are based on other North American shale plays, such as Bakken, Eagle Ford, Duvernay, Montney and Horn River, which are each in various stages of appraisal, production testing or production.

ConocoPhillips suggests that activities comprising production testing could be undertaken between 2021 and 2025, but would be predicated on the availability of certain third-party infrastructure, including:

- pipeline capacity for oil produced during testing
- disposal wells
- an all-weather highway to the south

Subject to regulatory approvals, ConocoPhillips might hypothetically construct the following infrastructure sometime beyond 2021:

- permanent fuel, oil and wastewater storage facilities
- permanent well pads upon which wells, pumps, processing facilities and small tanks would be located
- all-weather access roads to each well pad
- a barge landing and staging area
- gathering pipelines to transport oil, gas and liquids from well sites to a pipeline connecting to the Enbridge Norman Wells Pipeline
- fresh water pipelines to transport water from the Mackenzie River to well pads
- quarry pits or borrow sources for sand and gravel

ConocoPhillips might conduct the following activities:

- drill and complete 8 to 16 horizontal wells per well pad
- well stimulation (fracturing) and production
- oil production
- separate and process produced oil, gas and liquids
- transport oil by pipeline to the existing Enbridge Norman Wells Pipeline
- remove gas and liquids to third-party facilities
- flare waste gas
- dispose of wastewater by downhole injection
- operate a 150-person all-season camp
- develop one or several quarries or borrow pits

ConocoPhillips understands that these activities and infrastructure could have effects on land, water, air, wildlife resources, culture and economy. ConocoPhillips presents an assessment of the environmental effects of production testing activities as part of its regulatory applications. ConocoPhillips would also continue to work with stakeholders to proactively prepare for, and manage, these effects in expectation that it might conduct production testing activities in the future. By the time ConocoPhillips might make a decision to proceed with such activities, it would know the program details necessary to conduct a thorough assessment of potential environmental and social effects and to propose corresponding mitigations.

While production testing could allow for some production to get out to market (assuming pipeline capacity is available), ConocoPhillips would not be able to proceed to full commercial production until additional pipeline capacity was available. Given the uncertainty and number of variables, commercial production, which is likely more than 15 years away, can be considered to be unknown at this early evaluation stage of the Canol shale resource.

For illustrative purposes only, ConocoPhillips is providing an example of a small area within the Horn River Basin play in northeast British Columbia showing some early production activities underway. Figure 2-12 depicts a 7.5 km x 7.5 km area showing the interconnection and layout of infrastructure and disturbances caused by activities. In particular, the figure shows:

- winter access and winter well pads
- all-weather access and permanent well pads
- 2-D and 3-D seismic lines
- pipelines
- borrow areas

In this figure, it appears that a number of techniques have been used to reduce environmental effects, for example:

- access roads have been constructed along existing disturbances
- multiple operators are sharing infrastructure such as access roads
- 3-D seismic lines are low-impact meandering lines as opposed to the higher-impact straight lines
- old well sites have been reclaimed

These mitigation measures are also required, or commonly applied to programs in the NWT.

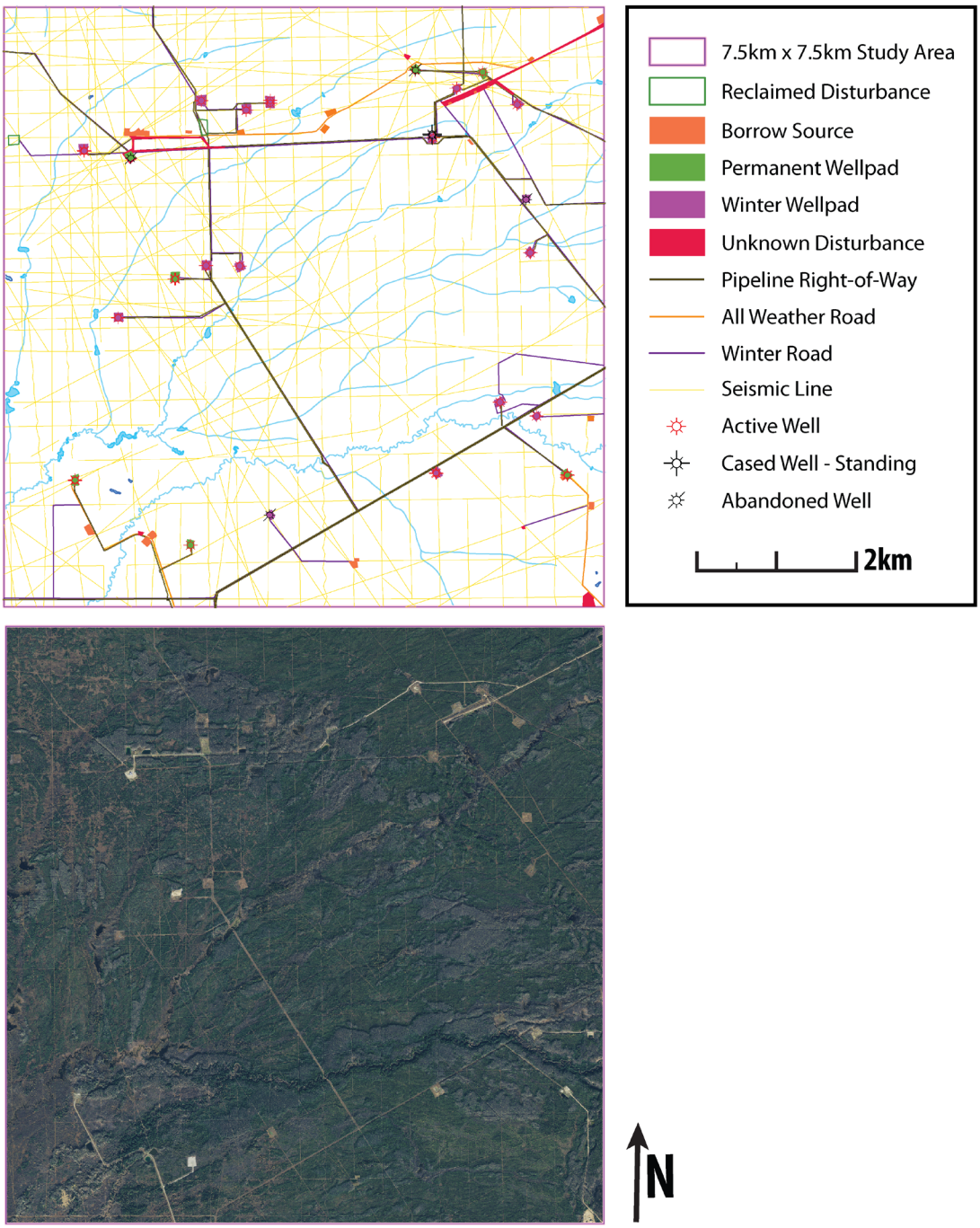


Figure 2-12 Area Undergoing Appraisal and Early Production Testing Activities

2.5 Current, Proposed and Future Programs in the Canol Shale Play

There are 14 active ELs within the Canol shale play area. Three companies have conducted some initial drilling and testing activities to evaluate the resource potential of the play.

To date, ConocoPhillips., Husky and MGM have:

- completed winter drilling programs consisting of one to two vertical wells each
- constructed winter access roads
- constructed and operated seasonal supporting facilities (e.g., camps, staging areas)
- acquired 2-D and 3-D seismic data over some portions of their ELs

During the period of 2013 to 2016, ConocoPhillips proposes to:

- complete drilling of two horizontal wells
- conduct multi-stage hydraulic fracturing on each well
- complete production test on each well
- operate seasonal supporting facilities, such as winter roads and camp

After 2016, ConocoPhillips might conduct a range of possible activities, depending on the evaluation of results from completed programs. ConocoPhillips' future activities could range from doing nothing, to one where additional vertical and horizontal wells are completed. Additionally, 3-D seismic data may be acquired, and all-weather access could be constructed at some time after 2014. The likelihood of ConocoPhillips proceeding with further activity beyond 2016 is estimated at 30%.

No other explorers have provided plans for future activities within their ELs. However, it is reasonable to assume that some drilling could take place within currently inactive ELs, at least to meet the exploration licence requirements. Activities beyond those proposed or disclosed as possible by ConocoPhillips are hypothetical.

3 CANOL SHALE: POTENTIAL EFFECTS OF ACTIVITIES

3.1 Introduction

The people of the Sahtu Settlement Area (SSA) are watching over changes in their land. One source of those changes arises from oil and gas activity. While such activity has occurred for many years, principally in the immediate Norman Wells area, more recent activity has occurred that is associated with exploration for new unconventional (shale) resources.

Section 2 described what those new activities are and what they could be. That section provided details on how unconventional resource projects progress in terms of their physical project design and the process involved in making decisions on how to proceed in the development of that resource.

Section 3 now looks at some possible implications of these activities to the natural environment and people in the SSA, and more specifically in the Canol shale play. To do this, Section 3 provides a regional study that examines potential effects on many human actions across a broad landscape over time.

This study is not a conventional cumulative effects assessment (CEA) of a single project nor is it required for regulatory approvals. Specifically, this is not a conventional cumulative effects assessment (CEA) as would be done for an oil and gas exploratory drilling program. This study does, however, follow some aspects of the evolving practice of looking at cumulative effects in a more general way. Assisting land and resource managers of the SSA in identifying appropriate regional effects management measures is viewed as one of the most important and useful outcomes of this study.

The study involved:

- identifying issues
- identifying values
- defining study areas
- developing assessment scenarios

These aspects are discussed in further detail below in Section 3.2.

3.2 Approach

The study approach is primarily a qualitative discussion, supplemented with some numerical analysis of mapped information. The qualitative discussion relies on professional judgment and experience to interpret effects.

3.2.1 Issues and Interests

People of the SSA have expressed concerns about potential effects of oil and gas projects, which recently have involved hydraulic fracturing. They have also asked to learn more about the potential positive and negative effects of multiple companies doing activities at the same time, and how the people and landscape of the SSA might change if the current level of oil and gas activity in the Canol shale play continues.

The following issues and interests have been identified, reflecting common questions and concerns raised during ConocoPhillips' consultations for its current and proposed drilling programs:

- increased road traffic
- increased water use
- loss of wildlife habitat
- waste management
- degradation of the natural landscape aesthetic
- access to renewable resources for harvesting
- change in community life
- access to employment and business opportunities

3.2.2 Values

Values were chosen for this study to collectively represent the issues and interests mentioned above. They are typical of values used in regulatory assessments for oil and gas projects, in part because they:

- provide insight about an effect and how it might be managed through measurable change
- can be assessed based on available information
- are broad enough to use in assessments of large areas
- provide insight about associated issues (e.g., traffic effects are considered when examining effects on wildlife).

The following values were selected for review in this study:

- wildlife
- water
- change in community life
- land use

Values represent features in the natural and human environment that are important to people because they represent something that is desired for use by people or its presence amongst us is valued.

They provide insight or a window to understanding of an effect and how it might be managed. Such values also must be broad enough to look over large areas and be based on available information

The only issue not represented by a value is waste management, because this issue is managed through comprehensive and mandatory measures for industrial projects. Most waste is currently transported by truck out of the SSA, and other waste is managed on site according to license criteria. This approach to waste management is expected to continue in the future. Further information on waste management can be found in the project-specific applications for industrial projects.

3.2.3 Study Area

3.2.3.1 Overview

Unconventional shale resource development has the potential to contribute to cumulative effects in the SSA. When selecting a study area, the area that could generate cumulative effects forms the spatial focus for the study. Study areas start where such impacts would occur and then expand outward to cover an area large enough to provide a basis for improved understanding of industrial activity, and of the natural and human environment possibly affected. This understanding arises from new information from a regional or cumulative effects point of view. This offers insights and measurements that aid the understanding of cumulative effects in the future.

Three study areas were selected for this study. The largest study area is the SSA, used for the study of effects on people. The two other smaller study areas are used for the study of effects on the natural environment and are discussed below.

The large study area for the natural environment covers the Canol shale play and its immediate surroundings and is referred to as the Canol Region. The Canol Region reflects the large spatial extent and its correlation to the sub-surface resource. The small study area covers the ELs for which there are current and future activities planned. The small study area is referred to as the Central Canol Region.

Two study areas provide an opportunity to look at cumulative effects on two spatial scales, each providing its own insight. The large study area provides a regional context, while the small study area provides more detail about specific oil and gas exploration activity. The large study area reflects the full spatial extent of the resource play that might, depending on the many factors discussed in Section 2, undergo change because of future oil and gas exploration. The small study area clearly shows one example of how such activities look on the land.

3.2.3.2 Canol Region

The Canol Region is focused on the geographic area of the Canol shale play because that region is a candidate for future industrial activity in the SSA. It is this type of activity, in this region, about which local communities and regulators have expressed concerns regarding potential cumulative effects. Furthermore, the Canol Region might be the greatest potential driver of change in the SSA.

The Canol Region encompasses the current ELs and SDLs within the Canol shale play. Figure 3-1 shows the location of the Canol Region in the SSA. Figure 3-2 shows the Canol Region in more detail, including the boundaries of the ELs and SDLs. The area of the Canol Region is 22,741 km^2, which is 8% of the area of the SSA (284,142 km^2).

Most of the Canol Region consists of a 10-km buffer around the outermost boundary of the ELs (the ELs form a continuous block of land). There are two relatively small exceptions to this buffer, one being a best-fit boundary southwest of the SDLs (best-fit because the SDLs do not occur right next to an EL) and the other being the extreme southeast corner of the Canol Region, where the boundary was stopped so as to not extend outside of the SSA and into the Dehcho Region.

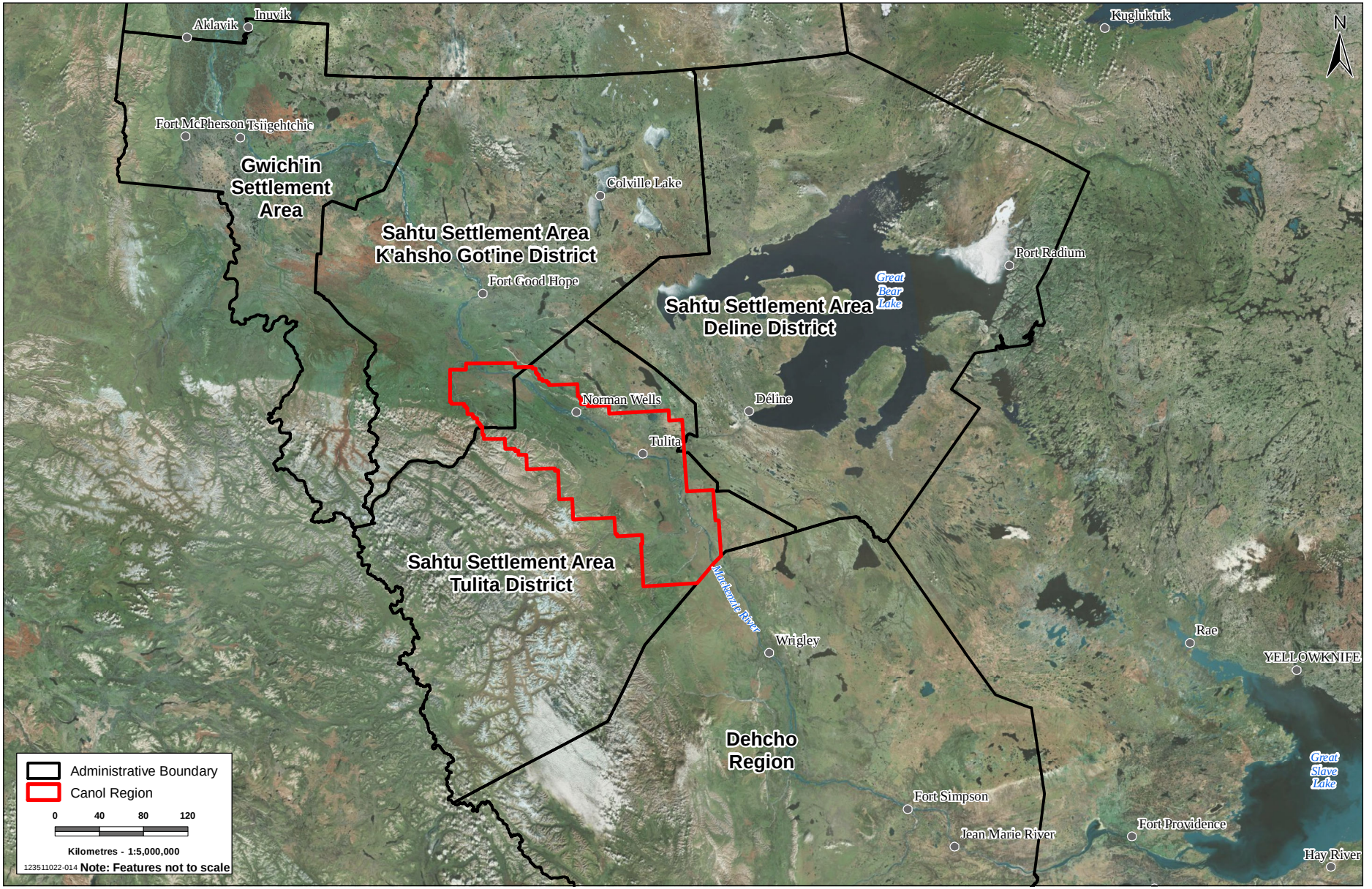
The Canol Region does not encompass the entire SSA because, based on available information, a larger area is not necessary to provide the insight needed. A regional study area where potential cumulative effects are to be studied, needs only to be large enough to be representative of these potential cumulative effects.

The Canol Region excludes other known human effects in the SSA (e.g., past oil and gas exploration around Colville Lake and Fort Good Hope). Although this does not diminish the value of this study, it is possible that further evolution of this study, or other similar studies, might cover a larger area and be supported by additional map and field-based information. These types of studies might be undertaken as part of land use planning, conservation or cumulative effects management initiatives.

3.2.3.3 Central Canol Region

The Central Canol Region is shown in Figure 3-2. The study area boundary is based on a 10-km buffer surrounding five ELs, one for ConocoPhillips, two for Husky, and two for MGM. Within these leases are typical components of exploration programs, including winter roads, drilling pads, seismic programs and camps. The Central Canol Region is entirely contained within the Canol Region. The area of the Central Canol Region is 8,366 km^2, which is 37% the area of the Canol Region and 3% of the area of the SSA.

This smaller study area better illustrates actual project footprints on the land. The type and extent of these programs are a typical example of what exploration programs look like (as discussed in Section 2.4.2 and illustrated in Figure 2-13).



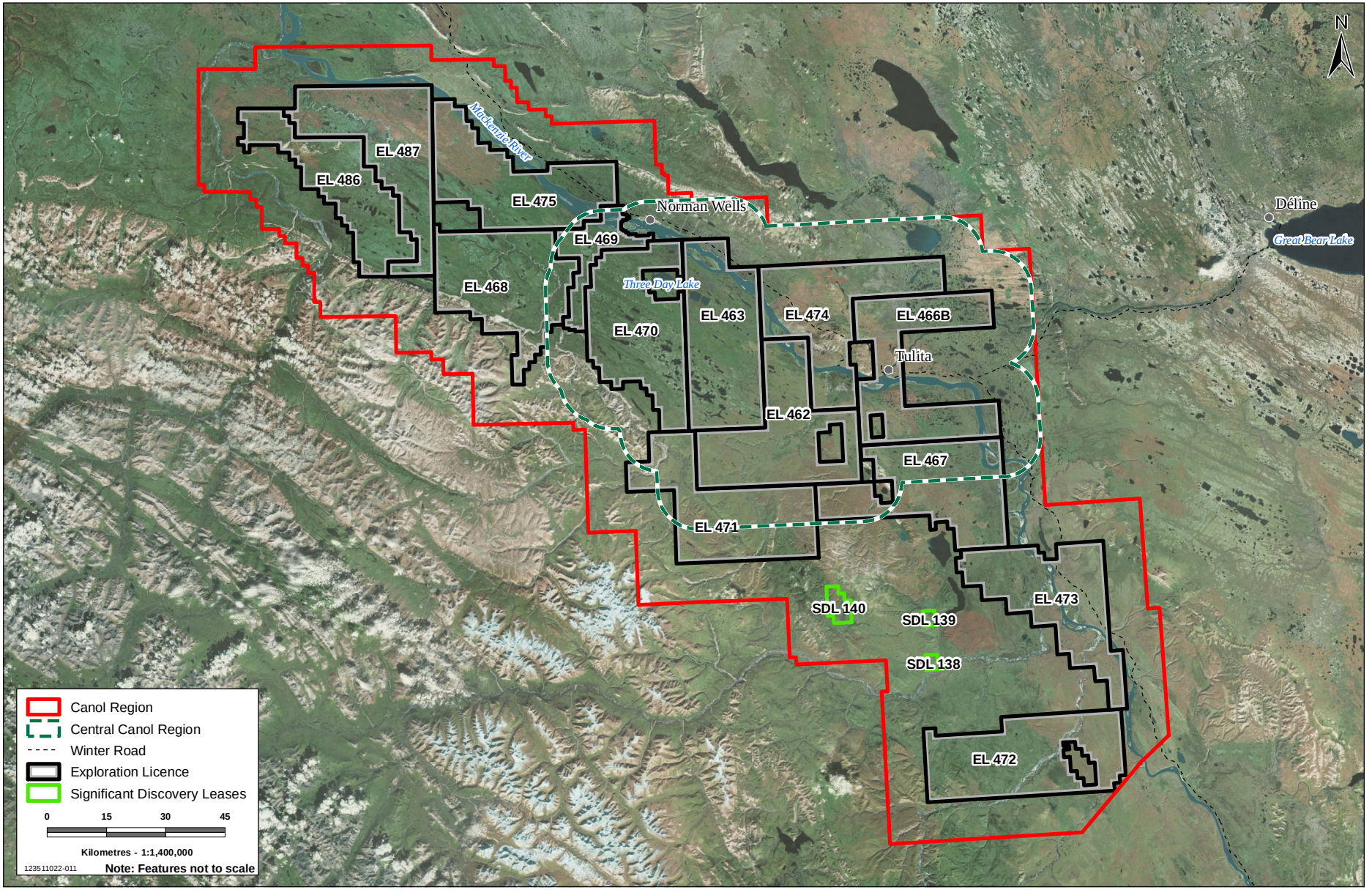
Canol Region in the Sahtu Settlement Area

Acknowledgements: Base Data Provided by CanVec, Imagery courtesy of ESRI

PREPARED BY K'áálò-Stantec

PREPARED FOR ConocoPhillips

FIGURE NO. **3-1**



Canol Region and Central Canol Region Detail

Acknowledgements: Base Data Provided by CanVec, Imagery courtesy of ESRI

PREPARED BY K'áálò-Stantec

PREPARED FOR ConocoPhillips

FIGURE NO. **3-2**

3.2.4 Scenarios

The study uses three scenarios for the assessment of potential effects, each representing a snapshot or point in time and a certain level of human activity (i.e., impacts) on the landscape. Information from these scenarios establishes a temporal view of change over time, which is just as important as looking at spatial change when examining regional effects.

The first point in time is 2010, referred to as the *Past* Scenario, an approximate and early date to represent land disturbances in the study areas prior to the shale oil and gas activities. The second point in time is 2013, referred to as the *Current* Scenario. The third point in time is the year 2021, at which time there could be some more shale exploration and other non-oil and gas activity, referred to as the *Future* Scenario. The Future Scenario represents a relatively early level of evaluation activities in the ELs.

The use of these scenarios is most apparent in the discussion potential effects on wildlife, in which each of these scenarios are used to quantify change over time. The discussion of potential effects on water, change in community life and land use take into consideration selected information for the current and future scenario.

3.2.4.1 Past Scenario

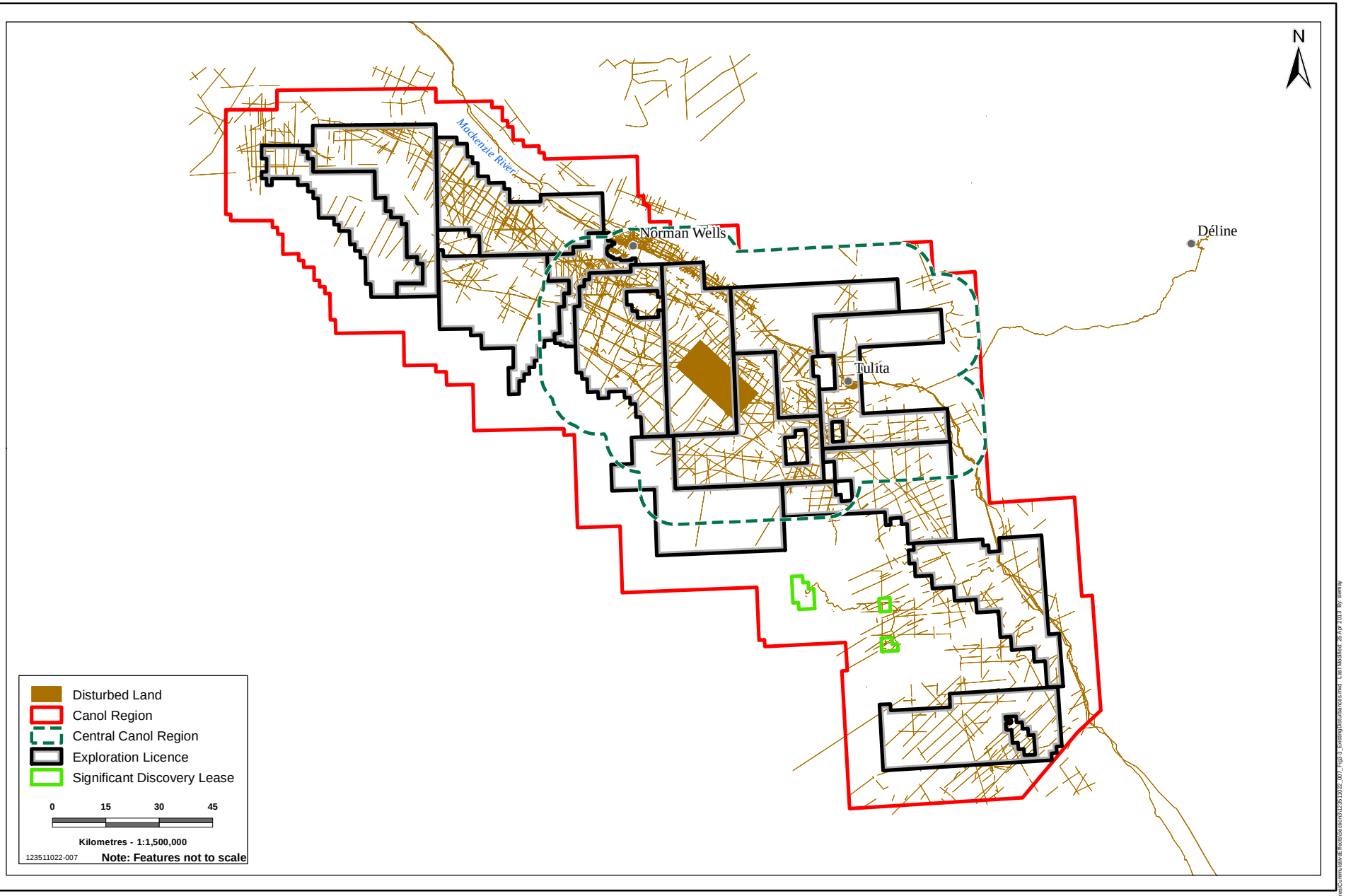
The Past scenario includes historical land disturbances (e.g., trails, seismic lines, roads, settlement) prior to exploration activities associated with current ELs in the Canol shale play. As such, it excludes the recent programs by ConocoPhillips, Husky and MGM.

3.2.4.2 Current Scenario

The Current Scenario includes all land use disturbances shown in available maps, which includes past human actions to the extent that they remain visible and can be mapped. This scenario, depicted in Figure 3-3 shows oil and gas activity to date in the Canol Region.

Table 3-1 lists the general types of surface disturbances that were mapped. The table also indicates if each disturbance is principally localized to a site, or narrowly extends over some distance as a linear feature. Whether a feature is site-specific, or linear, it has implications to some types of effects. All features involve some form of clearing or physical surface coverage, and so contribute to the cumulative effects of gradual displacement, permanently or temporarily, of what was there originally. Linear features can facilitate foot or vehicle traffic (and possibly movement by some wildlife species), although they can also create a barrier to movement. Both types of disturbances can contribute to cumulative effects anywhere they occur.

Some of these disturbances are specific to certain oil and gas related activities, including activities by ConocoPhillips, MGM and Husky, as described previously in Section 2.3.1 and shown in Figure 2-4.



Current Disturbances in Canol Region

Acknowledgements: Base Data Provided by CanVec

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FIGURE NO.
3-3

Table 3-1 General Mapped Disturbance Features

Feature	Type	
	Site	Linear
Aggregate (gravel/sand/fill)	X	
Airstrip	X	
All-season road		X
Camp	X	
Clearcut	X	
Cutline		X
Firebreak	X	
Helipad	X	
Pipeline		X
Recreation area	X	
Security shack	X	
Seismic line (2-D and 3-D)		X
Settlement	X	
Staging area	X	
Storage area	X	
Trail		X
Well	X	
Winter road		X

The table and discussion above describes physical human actions that are apparent as built structures or clearings. There are also impacts through certain activities associated with these particular features - vehicle traffic (along trails or roads of any type) currently being the activity of greatest interest from a cumulative effects point of view. Traffic adds to the physical disturbance of people across a landscape. However, traffic is not directly mapped, although it is certain it occurs along some access routes and implied along other routes.

Mapped representations of human caused disturbances on the land require explanation to ensure the size of each feature is not misinterpreted. Many mapped features in this study are shown with an exaggerated size at the scales necessary to fit a map onto one page. As such, features are shown symbolically so that their presence is visible. However, by doing this, their actual size appears larger than they really are. For example, the lines in Figure 3-3 representing seismic lines are many times wider on that map than the actual width of less than 5 m. This may give a false impression of the extent of land disturbance, especially in areas with extensive historical seismic based oil and gas exploration.

Linear and area disturbances are useful indicators for evaluating cumulative effects as each additional linear disturbance can change the movements of people and animals across the land.

Mapped representations of disturbances should be interpreted carefully as the size can be misleading.

Another possible reason for misinterpretation is that some features from the past may, if not used for many years (such as old seismic lines), have partially or fully re-grown due to natural succession. In some cases, a line may appear on a map even if the feature may no longer be visible from the air or on the ground and as such is effectively no longer acting as an unnatural feature or disturbance. Only a complete ground truthing can determine the extent to which this might have happened.

Figure 3-4 provides an illustration of a few typical exploration program components (road, pad, seismic, trail) drawn to scale relative to one another. This gives a true representation of "how large" these features are relative to one another, a representation that for the reasons mentioned above is not possible in the maps in this study.

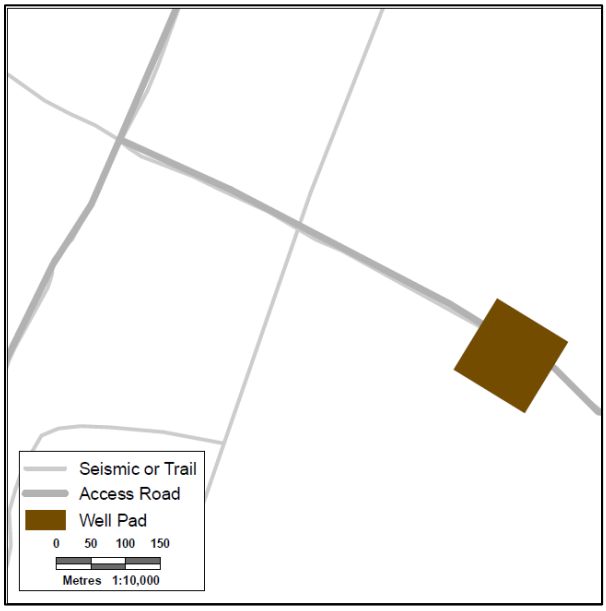


Figure 3-4 Scale Diagram of Surface Disturbances

3.2.4.3 Future Scenario

The Future Scenario adds proposed and potential activities to the Current Scenario. The assumed range of years covered by this scenario is 2014 to 2021, based on the possible start of some of the activities in 2014 and possible future activity by ConocoPhillips in EL470 concluding in 2021.The proposed activities were described in Section 2.3.2 and shown in Figure 2-7. These include ConocoPhillips' proposed 2013–2016 Program, construction of the Mackenzie Valley Highway and continued production activities within the Norman Wells Proven Area. Two other proposed projects do not have mappable footprints (i.e., Four Mile Creek and Prohibition Creek bridge replacements).

Possible additional future activities were described in Section 2.3.3 and shown in Figure 2-10 as ConocoPhillips' Future Scenario 4, which spans the years 2017 to 2021.

3.3 Potential Effects on Values

3.3.1 Wildlife

The analysis of potential effects on wildlife calculates disturbed area, and the length and density of linear features in the two study regions for each scenario. Most importantly, this section paints a picture of change or trend over time. It does not rely on complex forecasting models or additional detailed spatial analysis (i.e., no mapping and analysis of changes to ecological land units such as those used in project-specific cumulative effects assessments). The lack of such modelling is not a deficiency, but rather a different approach to accomplish the same objective of providing insight into what may happen and what can be done to manage any effects, as discussed in Section 4.

Human actions can affect wildlife in many ways within a broad landscape. Each species with any residency in a given region will have different physical and physiological responses to stimuli, and will behave and move based on that stimuli and physical changes in its habitat. These changes cause effects that commonly are referred to as:

- habitat loss
- sensory alienation
- obstruction of movement
- energetic loss
- direct mortality

These multiple responses introduce considerable complexity when attempting to portray what could happen to wildlife, unless habitat mapping is done, followed by detailed spatial analysis. To do that requires a lengthy process, starting with an ecological land classification of a region. Habitat suitability analysis is species-specific, which on one hand can be very informative of potential changes to a given species, while on the other hand does not offer a view of possible effects by human activities in general for all wildlife for the purpose of long-term forecasting, planning and land and resource use management over large areas.

The challenges, time and cost involved in a habitat based approach have led to a different approach of looking at regional (cumulative) effects on wildlife. This different approach is based on use of a type of human disturbance that is historically important, and a dominant type of human activity contributing to cumulative effects - namely roads and similar features. Road use by many hundreds of trucks, required to support concurrent multiple exploration programs, represents an important contributor to potential effects on various values. Roads (also referred to as linear access, linear corridors or rights-of-way) might occur as unimproved roads, winter roads and trails, but in all cases will facilitate movement of motorized vehicles, people and certain predator species.

The approach to this study is not to take a detailed look at each specific type of effect that could occur on wildlife (e.g., assessed mortality risk associated with traffic and changes to habitat). These effects are typically assessed in environmental assessments for regulatory project applications, such as those done

in support of oil and gas exploration activity in the Canol shale. However, the approach in this study uses regional thresholds as an alternative way to evaluate potential future effects over a large area, when habitat suitability maps are not available.

3.3.1.1 Linear Density Thresholds

Scientific studies, corroborated by traditional knowledge, have observed and quantified the relationship between the amount of access and effects on wildlife (i.e., more roads often means less wildlife). This relationship matches a level of linear density with a likelihood of effect on wildlife generally, or for a particular species. Linear density, expressed as km/km^2, is a convenient measurable indicator because it can be mapped using available maps that cover the study region.

Although this approach means that niche habitat requirements by some species are not accounted for (e.g., wetlands, eskers), the concept remains useful as long as any loss in precision is superseded by the ease and efficiency with which this landscape mapping shows change over time.

When employing these land-use-based, or anthropogenic, thresholds, the real value is in their ability to establish an early warning system to assist land and resource decision makers in performing oversight and identifying and implementing appropriate management response (see Section 4 for further detail). This technique is limited in that these thresholds indirectly reflect, through implication and in a highly general way, that overall effects on certain wildlife may worsen as more development occurs in the form of access.

A *threshold* is a point at which a resource undergoes an unacceptable change or reaches an unacceptable level, either from an ecological or social perspective (AXYS 2001).

Access roads, trails or other rights-of-way can be readily mapped and measured, and they are known to cause effects on wildlife. Furthermore, thresholds for the linear density of these features have been established or proposed in certain areas over regional scales, offering a *one window* approach to the range of possible tolerable effects on wildlife. Thresholds, when appropriate, can be used to guide land and resource management, along with the many other available management opportunities (as discussed in Section 4).

Linear density thresholds can be customized to apply to a specific species (e.g., woodland caribou) or be generalized for many species. Thresholds can also be customized to specific land use zones in recognition that an area with a land use management objective that includes resource development can have a higher threshold (i.e., allow more) of disturbance. This reflects a land management compromise of development but remaining within ecological limits of change.

3.3.1.2 A Threshold for the Canol

The Sahtu Land Use Plan does not include thresholds, although it recognizes (in section 4.2 *Action #1 - Sahtu Land Use Working Group*) their possible use (referred to as "landscape targets") as part of a cumulative effects and monitoring program. Implementation of thresholds is included in the North Yukon and draft Dehcho plans. The results of scientific research over many years has provided insights into possible thresholds of various types and numerical values, with their gradual incorporation into land use and species recovery plans. Although more research and operational planning is always beneficial to overcome uncertainties and improve confidence for formal incorporation in the Sahtu Land Use Plan, some thresholds are currently available to at least help one forecast possible long-term and regional changes.

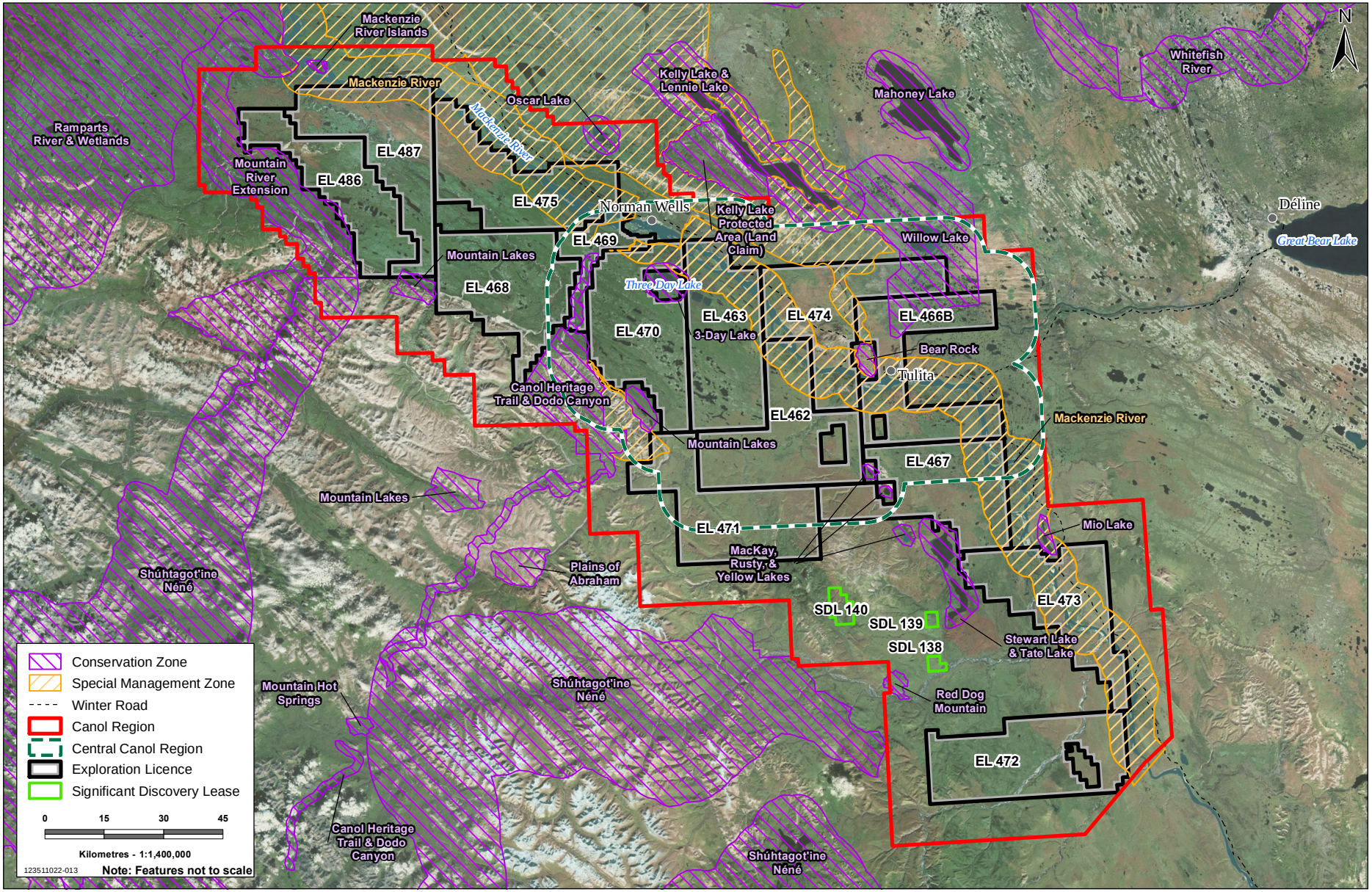
Generally, the Canol Region is an area for which resource development is allowed, subject to conformity requirements (CRs) of the land use plan and the various regulatory provisions in the SSA and NWT. The most appropriate thresholds therefore are those intended for zones of general resource/industrial use.

The Canol Region is mostly zoned as general use zone (GUZ; 66%) based on the land use designations of the Sahtu Land Use Plan, with 11% of remaining zones as conservation zone (CZ) and 23% as special management zone (SMZ). Most of the SMZ in the Canol Region is the Mackenzie River SMZ (Zone 3), which goes through the entire Canol Region. No CZs however overlap an EL or SDL, although some are in close proximity. As such, the substantially more stringent thresholds that would apply in CZs would not apply to the ELs, within which at least project (disturbance) footprints are contained. As to SMZs, any operator would need to conform to the CRs for such zones within their leases. Figure 3-5 shows the overlap of these zones in the Canol Region.

While the numbers are varied, a pattern emerges from a review of science based literature with a focus on northern Canada (AXYS Environmental Consulting Ltd. 2001; Applied Ecosystem Management, 2002; Salmo Consulting and Diversified Environmental, 2003; Salmo Consulting, 2004; Dillon Consulting and Salmo Consulting, 2005; Dehcho Land Use Planning Committee, 2006; ALCES Group, 2009; North Yukon Regional Planning Commission, 2009)[3]. These references suggest an appropriate generalized linear density threshold for areas zoned for resource development of 0.8 to 1 km/km^2.

In general, linear densities *of less than 0.8 to 1 km/km^2* indicate a relatively acceptable degree of certain land use. Additional management may be required where densities exceed 1 km/km^2.

[3] Note that Environment Canada's recent *Recovery Strategy for the Woodland Caribou* (2012) uses a different threshold of 35% disturbed habitat based on effects of fire and buffering of all anthropogenic land disturbances by 500 m. This was not used in this Canol region study as this threshold is based on one species and the data regarding fire effects is not currently available.



Sahtu Land Use Plan Zones in Canol Region

Acknowledgements: Base Data Provided by CanVec, Imagery courtesy of ESRI

PREPARED BY K'áálò-Stantec

PREPARED FOR ConocoPhillips

FIGURE NO. 3-5

The meaning of this threshold (adopted from ALCES Group. 2009) from a land and resource management point of view is that:

- levels of disturbance below threshold indicates conditions with likely no or negligible effect on wildlife
- levels of disturbance at threshold are likely acceptable and considered adequate from a social or ecological perspective
- levels of disturbance above threshold are of concern where the status of wildlife may not achieve social or ecological objectives

Most important to the above is that appropriate and available management responses are implemented as levels of disturbance increase.

3.3.1.3 Mapping Linear Density

The following provides technical details on how the linear densities were determined using a Geographic Information System (GIS):

1. A 5 km square grid was created in ArcGIS 10 using bounding coordinates of the region. A total of 999 grid squares were required to completely cover the region.
2. Current scenario disturbances were obtained from various sources, including:
    a. ConocoPhillips (2013–2016 Program plans, Natural Resources Canada base data provided through Challenger Geomatics)
    b. CanVec transportation data (shapefile format)
    c. SLWB (shapefile format) for Husky and MGM permitted data
    d. digitized data (CentralMackenzie_Regional SeismicCoverage.jpg by ConocoPhillips, Landsat (2008) and QuickBird (2011) imagery, MVLWB Applications)
3. All baseline disturbance line work was merged into a single linear disturbance file, taking into account overlapping features. Linear disturbances were intersected with the grid, then dissolved based on the grid ID field to provide a single length of linear features in each grid square. The length (km) was divided by the area of each square (25 km^2) to provide an average density per square. The density values were joined to the grid based on grid ID to geographically display the linear density of the entire grid.
4. The linear density in each grid was categorized within one of six levels (evenly numbered) of threshold based on a range from zero to 2 km/km^2 and above[4], with each range depicted on the linear density maps on a graduated colour scale. The result of this is a map and derived numbers for the current scenario.
5. Land disturbances were subtracted to the numbers for the Past scenario and added to the map and numbers for the Future Scenario.

[4] Two is the maximum even whole number of linear access density from the various literature references.

Linear densities for the Central Canol Region were also calculated as one number for the entire area. While the 5 X 5 km^2 grids remain, a single number for the leases in the Central Canol Region is also useful to provide insight into change on the land.

Numerical results are conservative (reflect a greater effect than would truly be the case) because they do not include habitat recovery following reclamation and natural recovery. The basis of reflecting this in any such analysis is complex and requires more information than is currently available.

3.3.1.4 Results

Table 3-2 summarizes the numerical results from the map-based analysis of change between scenarios. Figure 3-6 shows the map of the analysis for the Current Scenario, and Figure 3-7 shows the map of the analysis for the Future Scenario. These two figures are considered of most interest and value for depicting change by showing what is there now and what may come. Figure 3-8 graphically illustrates these changes relative to threshold.

SUMMARY OF TABLE NUMBERS

Within the Canol Region, the Future Scenario results in a 19% increase in the length of linear disturbance and linear density, and a 27% increase in area disturbed (project footprint) relative to the Current Scenario. Regarding the correlation to wildlife thresholds, currently at 0.53 km/km^2 the Canol Region is well below threshold. The Future Scenario could result in an increase of 0.1 km/km^2 to a future density of 0.64 km/km^2 that is still below threshold.

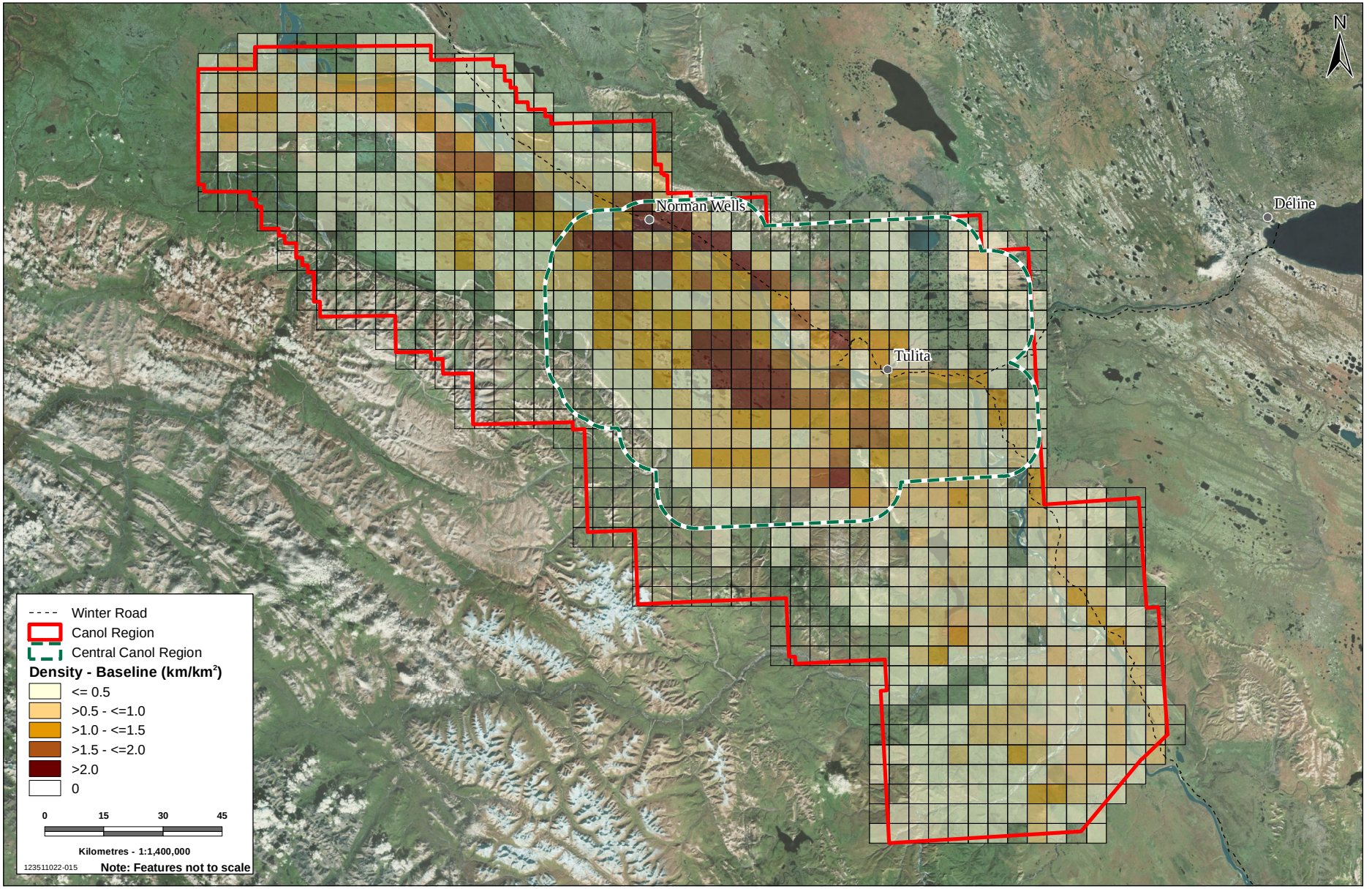
Within the Central Canol Region, the addition of the Future Scenario results in a 29% increase in the length of linear disturbance and linear density, and a 26% increase in area disturbed relative to the Current Scenario. The current density in the Central Canol Region is 0.9 km/km^2, just below the management threshold (1 km/km^2). The Future Scenario results in an increase of 0.27 km/km^2. This will put the linear density in the Central Canol Region above this threshold to 1.17 km/km^2.

A slightly longer-term historical perspective is provided by the changes between the Past and Future scenarios. Within the Canol Region, there may be a linear density increase of 49% (0.43 to 0.64 km/km^2) with possible future activities. Within the Central Canol Region, linear density may possibly increase 83% (0.64 to 1.17 km/km^2).

Table 3-2 Comparison of Results between Scenarios

Measurable Parameter	Scenario			Changes over Time					
				Past to Current		Current to Future		Past to Future	
	Past	Current	Future	Difference	% Change	Difference	% Change	Difference	% Change
Canol Region									
Length of Linear Disturbance (km)	9,869	12,140	14,490	2,270	23	2,530	19	4,621	47%
Area disturbance (km^2)	69	89	114	21	30	24	27	45	65%
Linear Density (km/km^2)	0.43	0.53	0.64	0.1	23	0.1	19	0.2	49%
Central Canol Region									
Length of Linear Disturbance (km)	5,352	7,537	9,755	2,185	41	2,219	29	4,403	82%
Area disturbance (km^2)	44	62	78	18	42	16	26	34	77%
Linear Density (km/km^2)	0.64	0.9	1.17	0.26	41	0.27	29	0.5	83%

NOTE:
Some numbers are approximate due to rounding.



Current Linear Density in Canol Region

Acknowledgements: Base Data Provided by CanVec, Imagery courtesy of ESRI

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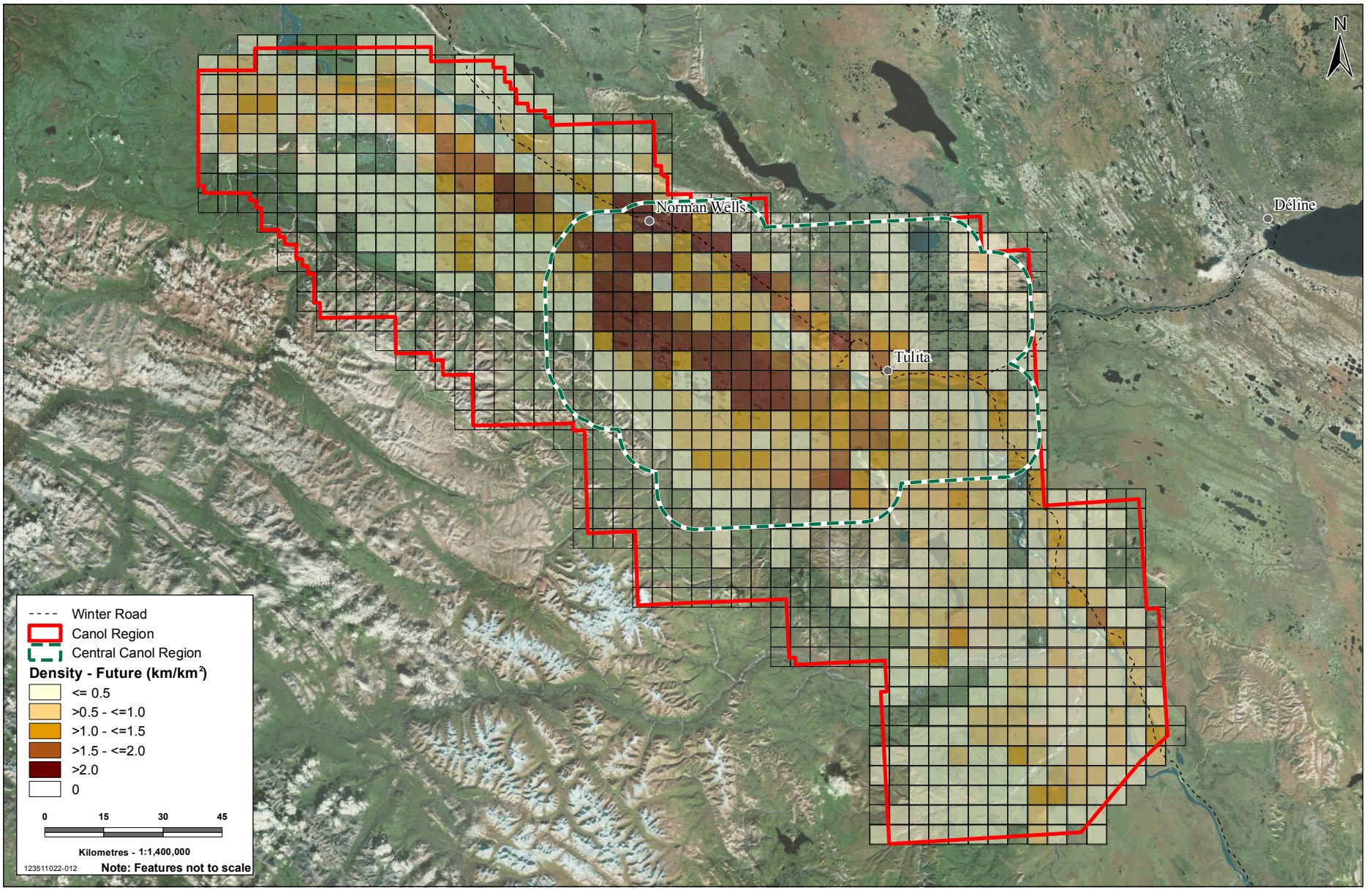
PREPARED FOR
ConocoPhillips

FIGURE NO.
3-6



Potential Future Linear Density in Canol Region

Acknowledgements: Base Data Provided by CanVec

PREPARED BY: K'áálò-Stantec

PREPARED FOR: ConocoPhillips

FIGURE NO. 3-7

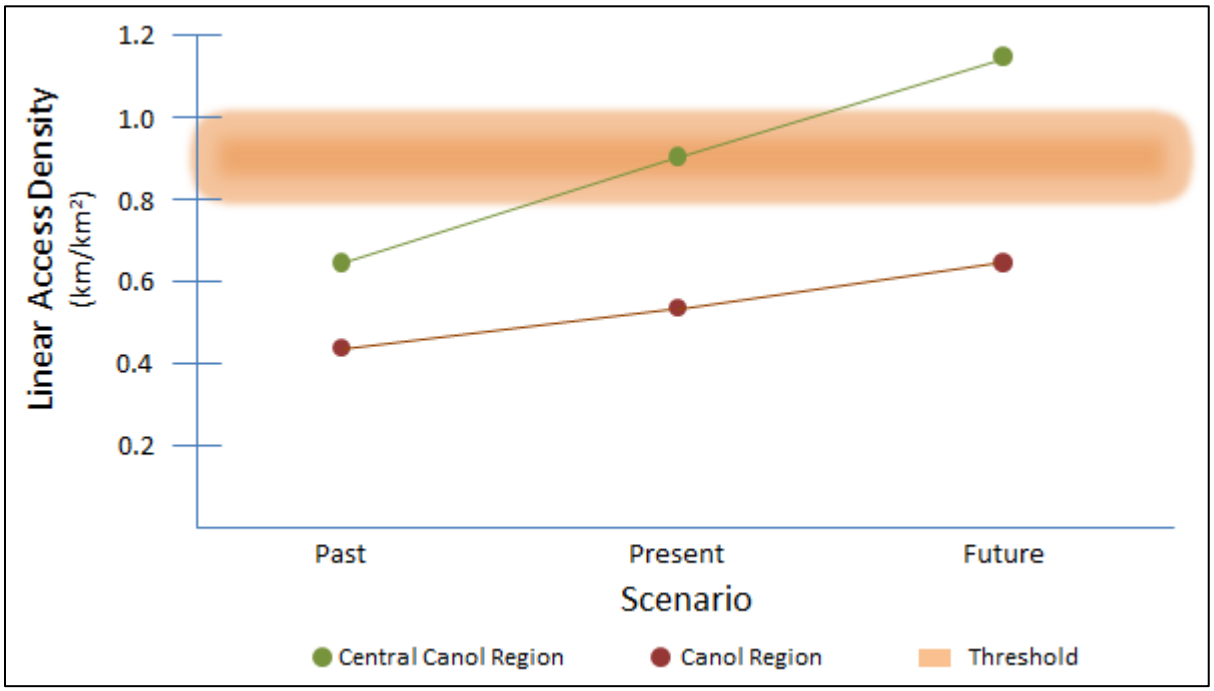


Figure 3-8 Changes in Linear Density

INTERPRETING THE MAPS

These maps showing linear density offer a useful visualization of each scenario from which some observations can be made over time. These maps show a common outward growth pattern of human development, even at relatively modest levels of activity. In all scenarios a large portion of the Canol Region remains at very low (less than 0.5 km/km^2) linear densities, and the overall average linear density of the Canol Region remains well below threshold. However, there is a noticeable area of higher densities in the middle of the Canol region, which is to be expected given the current focus of exploration and the adjacency of ELs with current activity. Some of the densities within individual 5 X 5 km grid cells currently exceed threshold. The map of the Future Scenario reveals how the geographic extent of that area expands slightly relative to the Current scenario.

It is important to remember that the Canol Region provides “the big picture view”; it is more meaningful to apply these thresholds to this larger region than is the Central Canol Region. The thresholds were not intended to be used to test relatively small areas, where small would be substantially less than the diurnal movement patterns of wide-ranging species such as caribou or moose. Wide-ranging terrestrial wildlife species are most appropriately analyzed at broad spatial scales that might better reflect effects arising from the many possible interactions with human activities.

Therefore, a single 5 X 5 km square with a high level of disturbance is not necessarily an immediate matter of management concern. However, such results can be used to indicate candidate areas for future

monitoring. This study relies on interpreting an overall average over a much larger area, as opposed to focusing on outliers that may occur within.

WHAT THE RESULTS MEAN TO WILDLIFE

In summary, the map results mean that current levels of land use disturbance should not be of management concern for wildlife, and that possible future development may require a considered management response. It may be appropriate to plan additional management response now to accommodate and manage possible future appraisal programs beyond such a minimal level of current activity. It is possible that more intensive levels of hypothetical future development, such as pilot production testing, could result in the Central Canol Region exceeding threshold.

3.3.2 Water

Water use is one of the most important issues associated with developing unconventional resource using horizontal drilling and multi-stage fracturing. Stakeholders have expressed concerns about the volumes of water typically required for hydraulic fracturing and the nature of potential effects on local hydrology and surface water if this water is sourced from local water bodies.

Water use in the SSA is regulated by the SLWB under the *Northwest Territories Water Act*, and is subject to review and advice provided by Fisheries and Oceans Canada. Currently, operators are allowed to withdraw up to 10% of the free available volume (unfrozen water) of water bodies of sufficient depth (Fisheries and Oceans Canada, 2005). ConocoPhillips has previously received approvals to withdraw water for its operations from several local surface water sources and the Mackenzie River. Permits are required and tracked for use of prescribed water volumes from the Mackenzie River.

Water requirements for some aspects of the Canol shale program operations are similar to those for other winter exploration drilling programs in other areas of the NWT. It is only for wells requiring hydraulic fracturing that water requirements are greater. Water for winter program operations is used for:

- building winter roads
- constructing ice pads for camps, staging areas and well sites
- camps

Linear densities in the Central Canol Region are higher than the Canol Region because they have not been averaged out over as large an area. The results indicate that the Central Canol Region is currently approaching threshold, and that possible future projects may bring this region above that threshold. This implies that current exploratory activity should not be a concern for wildlife from a land and resource use management point of view. However, possible future increases suggest the need for planning and preparing management options now.

- drilling
- well stimulation (hydraulic fracturing)

For example, in EL470 during the 2013–2016 Program, ConocoPhillips expects to need about 104,500 m^3 of water during each winter drilling season (December – March), summarized in Table 3-3. ConocoPhillips plans to source about half of this water from the Mackenzie River, and the other half from three nearby lakes (two of which are part of the much smaller Carcajou River watershed, connected to the Mackenzie River).

Table 3-3 ConocoPhillips' Proposed Annual Winter Water Use: 2013–2016 Program

Project Component	Water Volume (m^3)
Winter roads	70,000
Ice pads for facilities	15,000
Camp use	9,000
Drilling	2,500
Hydraulic fracturing (one well)	8,000
Total water use per season	**104,500**

The numbers in Table 3-4 are representative of a program in the Canol shale play consisting of drilling one horizontal well per year. If a larger program or several smaller programs were undertaken at the same time during any given winter, water use would increase. As an example of increased water demand, in the possible future Scenario 4, ConocoPhillips could drill up to three vertical and two horizontal wells in a single season, supported by an all-weather main access road and permanent camp facilities. The corresponding water requirements of Scenario 4 are summarized in Table 3-4.

Table 3-4 ConocoPhillips' Scenario 4 Potential Future Annual Winter Water Use

Project Component	Water Volume (m^3)
Winter roads	20,000
Ice pads for facilities	17,500
Camp use	9,000
Drilling	12,500
Hydraulic fracturing (two wells)	16,000
Total	**75,000**

NOTES:
[1] Assume 20 km of new winter roads (1,000 m^3/km of road)
[2] Based on five 120 x 120 m average well pad
[3] Based on drilling five wells in single season
[4] Based on hydraulically fracturing two horizontal wells

By constructing an all-weather (gravel) main access road to the site, ConocoPhillips' annual water use requirements would likely decrease substantially, as winter road construction is currently the single biggest user of water in the program area.

It is not possible to predict what other explorers' future plans for drilling programs might be, nor what their water requirements might be. A reasonable assumption is that water requirements would be similar to those of ConocoPhillips for similar activities. The amount of water needed per year would be depend on, the number of explorers active in the Canol shale play in any given season and their specific activities (e.g., the length of winter roads constructed, the number of wells drilled and the number of wells to be hydraulically fractured).

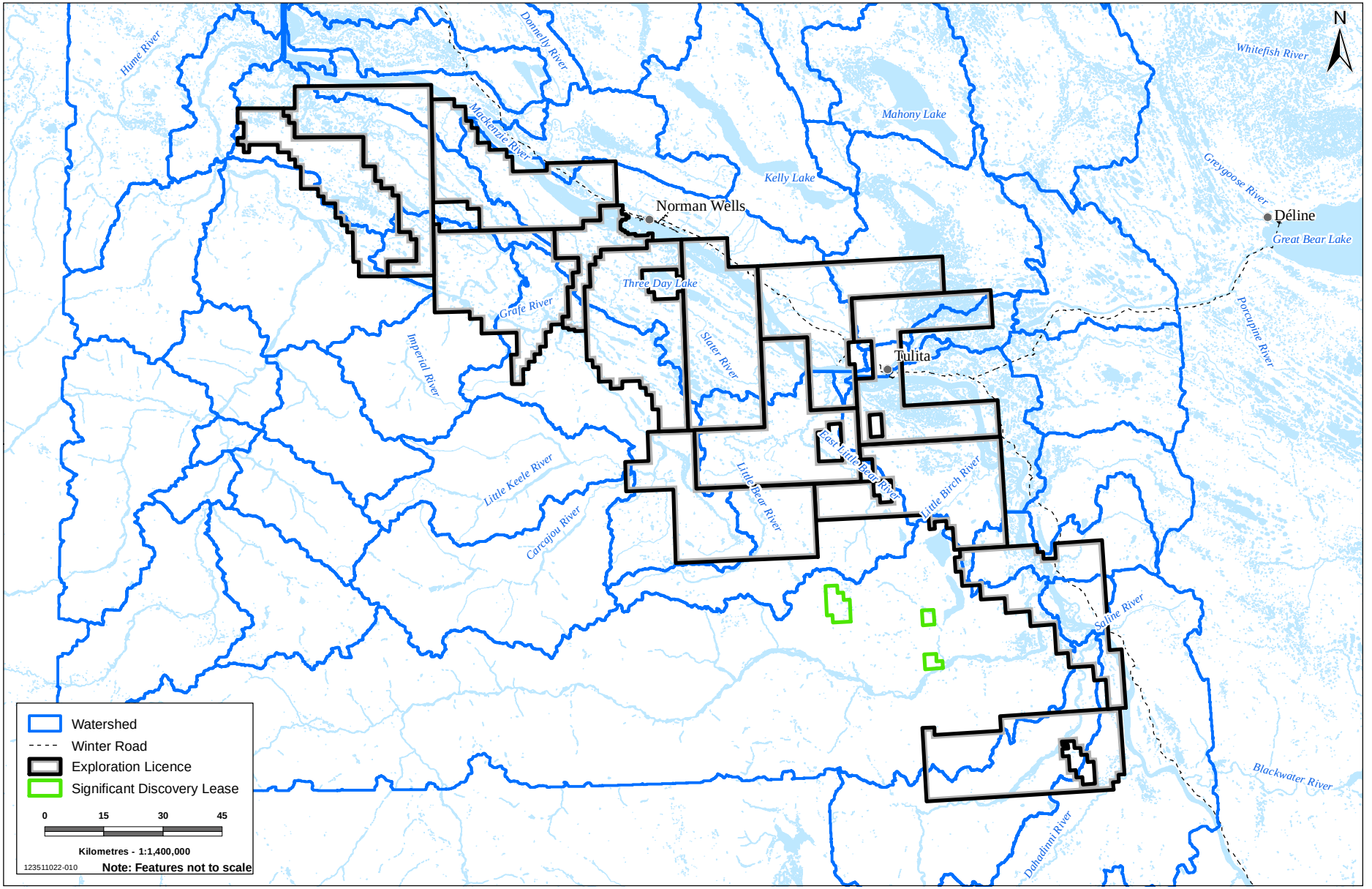
It is not possible to predict the future water requirements of other explorers. The amount of water needed for exploration in the Canol shale play each year would be depend on the number of active operators in any given season and their specific activities such as:

- the length of winter roads constructed
- the number of wells drilled
- the number of wells to be hydraulically fractured

Water for ConocoPhillips' operations is sourced from approved water sources and from the Mackenzie River. At the moment, no other viable water sources have been identified (groundwater could be an option). This is the case for other explorer's as well. During their 2012 drilling programs, Husky used water from six approved lake sources and the Mackenzie River and MGM withdrew water from the Mackenzie River. Currently, the Mackenzie River is the only common water source available to all explorers. ConocoPhillips' proposed program would use less than 2% of the available volume of the approved lake water sources each year. Currently, insufficient information is available to correlate water usage from Canol shale activities to potential effects on water quantity, and no information is available regarding possible thresholds of use.

Figure 3-9 shows the watersheds that overlap the Canol shale play. The Mackenzie River flows through 27 such watersheds. ConocoPhillips' water is sourced from two separate watersheds, and Husky and MGM's water was sourced from different watersheds. This compartmentalization (separation) of affected water bodies throughout the Canol region means that ConocoPhillips' water use is not likely to be consequential, and that cumulative effects are not likely to be of concern because each drainage basin has full or partial independence of water recharge.

While potential future water use for evaluation and appraisal activities to 2021 is unlikely to be of concern on this basis, it is useful to compare this information from ConocoPhillips' water use requirements to data and analysis from other jurisdictions, where more intense activity and greater water use requirements have led to stricter reporting and the initiation of water management initiatives. Table 3-5 summarizes water requirements for hydraulically fracturing wells in three different plays in Alberta and British Columbia, which are at more advanced stages of resource development.



Watersheds in the Canol Region

Acknowledgements: Base Data Provided by CanVec

PREPARED BY
K'áálò-Stantec

PREPARED FOR
ConocoPhillips

FIGURE NO.
3-9

Table 3-5 Water Use Requirements in other Unconventional Shale Plays

Unconventional Play	Resource Stage	Water Volume per Well (m^3)	No. Stages Hydraulic Fracturing	No. Horizontal Wells per year (2012)	Source Water
Duvernay (gas)	Production Testing	10,000 – 60,000	8 - 14	~ 50	Surface
Montney (gas/oil)	Production Testing	8,000 – 30,000	8 - 14	unknown	Surface water Shallow groundwater Deep groundwater (non-potable)
Horn River Basin (gas)	Production	30,000 – 100,000	10 - 20	~ 500	Surface water Shallow groundwater Deep groundwater (non-potable)
Canol Shale Play	Early Appraisal	8,000 (estimated)	8 - 10	1	Surface water
NOTE: Data compiled from: BC Oil and Gas Commission (2011, 2012a, 2012b, 2012c); Trican 2013; Hayes 2013					

The British Columbia Oil and Gas Commission issues short-term water approvals for oil and gas operations, and publishes quarterly reports of water use within the province's major and sub-basin watersheds. In 2012, water volumes withdrawn from each watershed ranged from 0 m^3 to a maximum of 1.5 million m^3 in the Petitot River watershed, representing 0.12% of the mean annual runoff for the watershed. In most other cases, surface water withdrawal represented less than 0.05% of the mean annual runoff for the watershed (BC Oil and Gas Commission 2011, 2012).

The Horn River Producers Group, a consortium of operators in the Horn River Basin, recognized that ensuring local sustainable use of water is an important consideration, even though water within the whole watershed may be abundant, since operators' water needs are often very localized in the watershed (Horn River Basin Producers Group 2011). In several regions, current operators are exploring the availability of other sources of water for use in production operations involving hydraulic fracturing, particularly non-potable groundwater.

In the Horn Basin, Apache and Encana commissioned the Debolt Water Treatment Plant, which treats and recycles saline (i.e., non-potable) groundwater from the Debolt Formation (500 to 800 m below surface) for use in their fracturing operations, thus greatly reducing their requirements for surface water during production operations[5].

Explorers within the Canol shale play are at a much earlier stage of play evaluation that precludes investment in such a facility. However, current explorers are investigating alternatives to surface water that could alleviate the need to transport large volumes of water along winter roads to program operations. As part of their groundwater investigation program, MGM has reported preliminary flow results

[5] See http://www.encana.com/news-stories/our-stories/environment-debolt-facility.html

from groundwater wells drilled into the Little Bear Formation that could suggest that groundwater might be a suitable source for water (Hogg 2013).

Water availability and water quantity are not expected to be of concern for current and potential future evaluation and appraisal activities in the Canol shale play. No changes in water quality are expected, as described in recent hydraulic fracturing applications in the region. This reflects the substantial project design mitigation measures, operational practices and depth of fracturing. These applications also include groundwater monitoring, which would benefit by a regionally coordinated approach to data collection and analysis.

Water use and effects on regional watersheds might need to be examined once the future uses of water are known. This would include water needed during currently unknown and hypothetical production testing or production activities.

3.3.3 Change in Community Life

3.3.3.1 Current

The following issues and concerns have been identified in SSA through public consultation:

- employment, training and business opportunities
- effects on public infrastructure (e.g., waste disposal, health services, air and road transport)
- public safety
- access to camps and worker access to communities
- food security (i.e., an increase in store bought foods)
- disturbances to harvesting practices
- increase in availability of alcohol and drugs

The SSA accounts for 6% of NWT's population and 5% of its income (GNWT ITI 2006). In 2011, the population of the region was reported at 2,693 people, of which about 74% were aboriginal (GNWT Bureau of Statistics, 2012).

The SSA does not have all-year land-based transportation to the rest of NWT (or other parts of Canada). A winter road is constructed each year, connecting communities in the terminus of the Mackenzie Highway at Wrigley. All communities receive scheduled all-year air service with Norman Wells as the regional air hub (GNWT ITI 2006). In the summer months, Tulita, Norman Wells and Fort Good Hope are resupplied by barges travelling along the Mackenzie River GNWT ITI 2006).

Electricity is provided by community diesel-powered generating plants, with the exception of Norman Wells where electricity is generated by natural gas recovered from Imperial Oil's production facilities. Trucked water delivery and sewage removal is the primary service delivery method in the region. Municipal solid waste and wastewater disposal and treatment facilities are licenced by the SLWB.

Education and primary health services are available in each community, however, residents must travel to larger centres, such as Yellowknife, for specialized medical services. Telephone and Internet communications are available in all communities.

The oil and gas industry is the major economic driver in the SSA. The region has the territory's only producing oil field and exports over $500 million in oil per year via the Norman Wells-Zama Pipeline (GNWT ITI 2006). Imperial Oil currently produces oil and natural gas at its operations in Norman Wells for shipment through the pipeline (GNWT ITI 2012). The other oil and gas companies currently conducting activities in the SSA are Husky and MGM (GNWT ITI 2012). Husky has indicated plans to spend about $100 million in 2013 on major infrastructure projects, including the construction of a permanent 150-person camp, construction of 35 km of permanent roads, barge landing sites and a 2,500 m permanent runway (GNWT ITI 2012). MGM has several leases in the SSA, including ELs near Tulita, Norman Wells and Colville Lake (MGM 2012). There is also mineral resource development potential in the SSA, including tungsten, lead, zinc, copper and diamonds (AMEC 2011). Currently there are no operating mines in the SSA and mineral exploration is limited. The SSA is a popular tourist destination with over 40 licenced tourism operators, including outfitters and outpost camps (GNWT ITI 2006).

3.3.3.2 Future

Potential drivers for change in community life might include:

- temporary and permanent changes in population and demographics
- local procurement and purchasing
- increased industrial activity, including truck transportation
- increased demands placed on community infrastructure and services

Since an available workforce within the SSA will be insufficient to fulfill the needs of the possible Future Scenario, transient workers from other regions might be required. This will cause population and demographic changes over the life of the projects. Transient workers include those that are hired from southern communities, and individuals who migrate from within the SSA or elsewhere in the NWT to local points of hire looking for work. For possible programs in the next 10 years, much of the population change will be temporary, and will likely have low to moderate effects on the population and demographic structure of local communities. The workforce would peak during the winter exploration season (i.e., December to March), with considerably fewer workers employed at other times of the year. It is expected that explorers will seek to maximize local and Aboriginal employment during all phases of activity. Other workers might migrate to Tulita and Norman Wells seeking jobs created indirectly by explorers procuring locally or induced by a general increase in economic activity in the SSA.

It is expected that during operations most of the workforce will be accommodated at seasonal work camps. Workers would likely be transported from the point of hire locations via aircraft to Norman Wells, or the site, and then transported by truck or bus to the work camps. Workers from southern points of hire will not likely affect the population and demographic structure of local communities because the majority

of their time within the SSA will likely be spent in remotely located work camps and drill sites, or in transit. The population and demographic structure of local communities might be affected if job seekers take up residence at point of hire communities hoping to land a position with either one of the explorers or a contracting firm.

As exploration activities wind down at the end of each season, the part of the population within local communities that was economically attached to those activities might move elsewhere. Those workers with few local ties could be expected to move back to their home communities, or elsewhere in search of work. Also, workers who have developed portable skills might seek oil and gas jobs elsewhere in Canada. The extent of such out-migration will depend on the availability of local employment opportunities, which will partly depend on the sustainability of oil field development within the SSA.

Through a combination of community benefits agreements and local procurement policies, explorers could be expected to make substantial economic contributions to SSA communities. For example, ConocoPhillips spent an estimated $37.5 million locally on its 2013 Program over the 2012–2013 period, and estimates that local procurement will be $17.8 to $46.4 million each year over the 2013–2016 period. Continuing exploration from 2016 to 2021, ConocoPhillips could be expected to procure local economic benefits of similar magnitude. Spending by other oil field developers should also be similar, assuming similar exploration programs. Recycling of capital injected into local communities would magnify the effects on the local economy.

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Employment and economic effects could result in both positive and negative community outcomes. In the United States, where unconventional oil and gas development has been operational for close to 20 years, studies have shown that local residents perceive economic and service-related issues, such as poverty, local police protection, quality of schools, fire protection services, medical and health care services, and availability of good jobs, as improving with development (Theodori 2009; Brabant and Gramling 1997; Brasier et al. 2011). Other benefits might include: improved wage income and lower costs of living while on shift enabling workers to make lifestyle improvements for themselves and their families; set blocks of time (between shifts) allowing workers to spend quality time with their family and friends, pursue traditional land use activities, or undertake volunteer, recreational or leisure activities (ACELG 2012). Assuming that hiring policies and housing strategies for construction and operation workers are based largely on the fly-in, fly-out model, an increased demand for community and emergency services is not expected to affect the viability of these services.

Residents within the SSA have mixed views about the pace of development and the ensuing employment and local procurement opportunities (December Consultation, 2012). Previous experience with resource extraction industries has given local populations the impression that the good jobs that could potentially raise their standard of living went to outsiders first (Christensen 2012; Ford and Beaumier 2011; Mason et al 2010; Angell and Parkins 2010; Johnson 1990).Resource extractive development in the area have given locals the impression that development brought with it increased alcohol and drug use, violence (i.e., fighting, homicide and family violence), sexual activity, unwanted pregnancies, and resulting family disruption. Social impact assessments conducted in the SSA for industry have reported increased rates of substance abuse, gambling, sexual transmitted infections, violent crimes and income disparity (Imperial Oil 2004).

Tackling negative social changes resulting from population and demographic changes, the influx of new money into households, and other potential psycho-social strategies, would likely require cooperation and planning between numerous groups, including government, industry and local community organizations.

Community agreements and local hiring and procurement strategies could help offset some of the negative perceptions held by local communities concerning employment in the oil and gas industry. For example, to counteract the erosion of culture and community well-being, benefits under ConocoPhillips community investment program include: training programs, computer donations, sponsored events and scholarships and awards for individuals and communities within the Sahtu. As well, programs to foster cultural education targeted at youth are underway in Tulita. It is reasonably anticipated that other oilfield developers operating in the SSA would develop similar social investment programs.

Oilfield developers would also likely implement policies and practices to reduce or avoid direct negative social outcomes associated with their operations. For example, at ConocoPhillips worksites no drugs or alcohol would be permitted and, all staff and contractors would be screened at the airport to ensure such substances are not brought into the area.

ConocoPhillips' December 2012 consultation revealed that Elders are concerned that multiple stressors, such as the prospect of employment opportunities, an increasing dependency on non-traditional sources of income and little training on financial matters will create familial disturbances in their communities. Studies in the SSA have identified the complexities of employment and participation in cash economies limits the amount of time that people can spend on the land and, for the youth in particular, their ability to acquire land-based skills (Dokis 2010). On the other hand, the same study identified that participation in the cash economy also facilitates a traditional lifestyle, by providing the funds needed to buy equipment and supplies required to engage in this lifestyle.

In the future, further development of the cash economy, and increased employment opportunities, could result in further erosion of traditional economic activities in the SSA. While most of the field workers associated with possible future appraisal activities would likely be accommodated at remote work camps, their incremental demands on community infrastructure and services would likely be low. Seasonal increases in populations of some community centres, such as Norman Wells and Tulita, would be expected, resulting in a moderate increase in demand for housing, community infrastructure, community and emergency services. Community leaders have expressed the need for upgraded infrastructure to

accommodate future increases in population due to industrial development (GNWT ITI 2012). In 2012, the Sahtu Exploration Readiness Session brought together stakeholders from the communities, and the oil and gas industry to discuss future needs. One of the major recommendations from the session was the need to establish a fund with federal support to invest in infrastructure and address socio-economic issues in the SSA (GNWT ITI 2012).

An increase in industrial activity in the SSA would also bring changes to the community in the form of increased ground traffic volume that potentially could affect the viability of road infrastructure, increasing the number of traffic collisions, increasing dust and noise, and potentially affecting wildlife migratory routes. In the United States, in studies concerning areas where unconventional oil and gas development has taken place, the noise coming from large truck traffic is considered a major annoyance and a safety issue for local populations (Wiseman 2009; Theodori 2009; Bramley 2011; Cooley and Donnely 2012; Brasier et al 2011; Olyench et al 2011).

A moderate increase in truck traffic over existing levels might be expected in the future. Most traffic would involve wastewater backhaul, and the mobilization and demobilization of exploration rigs, worker camps and other facilities. Based on ConocoPhillips' estimated 220 truck trips (one-way) per year for mobilization and demobilization of exploration activities (2013 and 2014 estimates), over 660 annual truck trips could be expected for similar activities if other explorers (assuming two other lease holders in the immediate area, estimating 220 truck trips per lease holder) also pursue exploration programs during the same time period.

Without proximal waste disposal facilities, waste hauling activities are anticipated to add an estimated maximum of 400 truck trips during the 2013–2014 program season, and 340 truck trips during the 2014–2015 program season. These approximations include an estimated maximum of 330 truck trips for wastewater backhaul over the course of 30 days of operation of winter road, effectively increasing traffic volumes on local/public roads by 11 trucks per day during this period. Other waste hauling activities involving domestic waste, recycling and drilling waste will comprise the remaining estimated 70 truck trips during the 2013–2014 season, and 26 truck trips during the 2014–2015 season. Truck volumes associated with waste hauling activities during the 2015–2016 season are expected to decrease significantly to a total of approximately 32 truck trips, as no wastewater backhaul is anticipated to be necessary. Assuming that similar waste hauling truck estimates are to be anticipated for other lease holders conducting exploration activities during the same period, a maximum of over 1,200 trucks during the 2013–2014 program season; 1,020 trucks during the 2014–2015 season; and 96 trucks could be expected during the 2015–2016 season. Monthly traffic could potentially decrease with development of an all-weather road, although the total number of trucks would not.

Approximately 19 truck trips will be required for fuel transport for the duration of each program season. An estimated maximum of 60 truck trips are anticipated for fuel transport activities if other lease holders conduct exploration activities during the same period.

It should be noted that based on the fluctuations in estimated anticipated truck trips per program season, the total truck trip numbers presented above are maximum estimates based on the assumption that all

lease holders in the area will be conducting the same activities at the same scale during concurrent exploration seasons.

These numbers will affect the annual average traffic count, given mobilization, demobilization and the 30-day wastewater backhaul activities. The increase in traffic volumes could result in adverse outcomes, including winter road degradation, congestion, noise, vehicle collisions and wildlife interactions.

The Future Scenario is predicted to result in moderate changes to community life within the SSA. Beneficial changes would include increased employment, business activities and overall economic activity. However, changes in the community's economic structure, such as increased reliance on wage income, and change in household economic dynamics might also result in adverse social outcomes, as has been documented elsewhere in Canada (Dana 2008; Christensen 2012; FRBC 2012; Christensen 2011; Samson 2003). A low to moderate increase in the population of some community centres within the SSA is expected, which would result in incremental demands placed on housing, and community and emergency infrastructure and services. However, population changes would be moderated by the fact that most oil and gas workers will likely be transiently employed on a fly-in, fly-out basis, and would thus have limited opportunities to interact with local communities.

3.3.4 Use of the Land

3.3.4.1 Current

In addition to the traditional knowledge studies, the results of ConocoPhillips' initial public consultation program identified potential direct and indirect effects on land use and harvesting. Indirect effects are often communicated through issues and concerns raised regarding other biophysical components, such as wildlife, vegetation and groundwater. With respect to the use of land and water resources, the following issues have been identified:

- effects on traditionally harvested species
- effects on traditional use areas
- effects to land and water quality
- effects on non-traditional land use

It is expected that these issues will also be of concern in regards to future exploratory activities within the SSA.

Hunting, fishing and country foods are important food sources for residents of the SSA. Country foods make up more than half of the food consumed for 60.9% of households (NWT Bureau of Statistics 2012). The number of households where country foods make up more than half of the food consumed differs considerably among communities within the SSA. Norman Wells has the fewest number of households that rely on country foods for half or more of their diet (29.3%). A similar proportion of the households in Deline (77.0%), Fort Good Hope (76.9%) and Tulita (78.5%) had diets made up of 50% or more from country foods (NWT Bureau of Statistics 2012). The cost of living in the SSA is the highest compared to

other assessment areas in the Mackenzie Basin region (Imperial Oil 2004: 2-28). Therefore, participation in subsistence activities is not merely a lifestyle choice but an economically rational decision (Dana (no date); GNWT 2012; Ford & Beaumier 2011; Angell & Parkins 2010; Dokis 2010; Mason et al 2010; Brook et al 2009; Antoniuk et al 2009; Nuttal 2008; Johnson 1990).

Ungulate species traditionally harvested within the SSA include moose, deer, elk and caribou. Because of the perceived precarious state of the caribou populations, many Sahtu do not specifically target caribou, but will harvest them opportunistically (SRRB 2010). Other large mammals harvested by Sahtu members include Dall sheep, mountain goat, black bear and grizzly bear (TRRC 2012; SHPSJWG 2000). Trapping is practiced throughout the SSA by Sahtu members, with target species, including beaver, otter, mink, marten, weasel, muskrat, porcupine, hare, snowshoe hare, squirrel, wolverine, lynx, fox and wolf (TRRC 2012). Fish are harvested throughout the year species such as , Arctic grayling (Taa), herring, whitefish (Klu Dekale), northern pike, pickerel, sucker, red suckers, coney (inconnu; Siho), loche (burbot) and lake trout (NWRRC 2011; TRRC 2012).

The Sahtu members harvest plant species as both food and medicine. Berries harvested include, cranberries, blueberries, blackberries, raspberries, gooseberries, cloudberries, juniper berries, knuckleberries, moose berries (highbush cranberries) and rose hips (Tulita Renewable Resource Council 2012; Norman Wells Renewable Resource Council 2011).

Medicinal plants harvested for use in treating a variety of ailments include:

- wild onions
- wild carrots (bear root, *Kwaa*)
- Labrador tea (*Ledi'maghi*)
- spruce gum, sap and inner bark
- tamarack
- common yarrow
- moss
- fireweed
- alder
- birch (inner bark)
- poplar
- pine
- red willow
- rat root
- tree fungus
- root plants

Traditional land use sites and areas located throughout the SSA include:

- cabins
- campsites
- stone features
- workshops
- quarries
- rock art
- burials
- settlements
- dwelling sites
- trading posts
- trails and access routes (key components of Sahtu members harvesting)
- ceremonial or religious sites and areas
- harvesting locations and areas

Tourism is the third largest industry in the NWT, after mineral and, oil and gas development. Visitors are attracted to the NWT and the SSA because of its remoteness and pristine landscape, and for fishing and hunting opportunities. There is no commercial forestry within the SSA, with wood harvested primarily for personal use.

Mining, oil and gas, and tourism are the most economically important non-traditional land uses within the SSA. Mining companies working in the SSA include:

- North American Tungsten Corporation Ltd.
- Santana Resources Inc.
- Selwyn Resource Ltd.
- Eagle Plain Resources Ltd.
- Alberta Star Development Corp.

Major oil and gas producing companies active in the SSA include:

- Husky.
- IORVL
- ConocoPhillips
- MGM
- Shell

The Norman Wells to Zama pipeline transports oil south from the Norman Wells oil field to Zama, Alberta.

Tourism is the third largest industry in the NWT, after mineral and, oil and gas development. Visitors are attracted to the NWT and the SSA because of its remoteness and pristine landscape, and for fishing and hunting opportunities (Golder Associates 2011; SLUPB 2010b; Salmo Consulting Inc. 2004). There is no commercial forestry within the SSA, with wood harvested primarily for personal use.

3.3.4.2 Future

Land use activity in the future will be influenced by a complex set of factors, some of which will be as a result of cumulative development activities and related infrastructure in the region. The cumulative effects of current, planned and potential future programs will add to the current effects on areas and species important for traditional resource harvesting, including potential negative effects on vegetation and wildlife communities, soils and landscape aesthetics. Changes to traditional land use sites and areas, and changes to harvesting activities are possible. Access construction, well site construction and drilling are expected to have greater interaction with species at risk, wildlife, vegetation, soils and landscape aesthetics.

On a landscape scale, the dominant effects on traditionally harvested species are associated with vehicular use of access routes (e.g., roads, trails). While mitigation measures will help to reduce the cumulative effects of access construction, well site construction and drilling, multiple exploratory programs (with related transport and physical infrastructure) could mean that effects might have a greater likelihood of interacting in a cumulative manner.

Other exploration programs could also affect traditional use sites, such as trails, and non-traditional uses, such as mining, public recreation and tourism, although such interactions are not expected to substantially affect these other uses because:

- exploration activities primarily occur in the winter
- the area of land physically disturbed relative to the total licence areas is small
- mitigation measures, such as avoidance of traditional use sites, would likely be implemented by other exploration companies

Traditional resource harvesters would also be concerned that any proposed permanent roads would facilitate third-party access to their preferred hunting, fishing and gathering areas, thus putting additional pressure on those resources.

On a landscape scale, the dominant effects on traditionally harvested species are associated with roads and trails. Mitigation measures and effective management will help to reduce the cumulative effects to harvested species associated with access construction and related transportation.

As with other areas where unconventional oil and gas exploration and development are occurring, such as Northeast British Columbia, the *perceived* effects of industrial development might substantially outweigh predicted changes. There are concerns over such issues as cumulative effects, large-scale water use, hydraulic fracturing and environmental degradation. Given the substantial dependence on

country foods by community members within the SSA, it is reasonable to seek a high level of assurance that environmental protection and mitigation measures will be effective before authorizing a social license to proceed with regional scale exploration and beyond.

The oil and gas industry might be reasonably expected to participate in enhanced baseline data collection and to engage in long term monitoring of harvestable species and other environmental components important to traditional harvesters.

Comprehensive, meaningful and ongoing engagement with local communities will be required to:

- help address perceptions
- improve the understanding of effects of development
- develop appropriate mitigation, compensation and monitoring mechanisms
- build overall social acceptance for expanded exploration within the SSA

4 CANOL SHALE ACTIVITIES: MANAGING CHANGE

Effects associated with future exploration activity within the Canol shale play can be managed using:

- project-specific measures
- regional collaborative measures
- regional land use plans
- regional monitoring

4.1 Project-Specific Measures

Project-specific measures are the application of design and effects-based mitigation, both mandatory and innovative. This represents the greatest available opportunity to manage effects, since certain aspects of a project's design can minimize effects to the extent that they are not measurable and do not add up over time. Designing and applying appropriate, effective project-specific measures requires an understanding of the detailed changes the project will cause, and the associated effects that may need to be mitigated. This might require additional study or data collection about existing conditions, knowledge about environmental response and some experience with the measures' effectiveness. Project-specific measures can also be applied to enhance positive project effects, such as business opportunities and local employment.

Examples of project-specific measures include:

- restriction of certain activities during times of year sensitive to fish and wildlife
- application of setback distances to certain wildlife habitat and land use features
- application of low impact seismic techniques
- minimal clearing, including use of existing rights-of-way
- careful site selection
- early development of conservation and reclamation plans
- development of innovative environmental protection plans
- adherence to geophysical operating guidelines
- application of construction best practices and innovative design
- wastewater treatment and recycling
- undertaking groundwater studies
- establishment of employment targets
- investment in training

Industry, resource managers and regulators could develop new or updated project-specific measures from the experience gained in the Sahtu from unconventional oil activities to ensure that future effects are minimized to the extent possible.

4.2 Regional Collaborative Measures

Regional collaborative measures derive from coordinated and cooperative programs or initiatives that involve industry and government engagement with communities. Each of these organizations brings their knowledge, expertise and interests to a forum where clear objectives, outcomes and collective interest in developing creative, effective and consistent means of managing key effects of multiple activities. Developing guidelines or requirements through collaborative input extends the benefits of management measures beyond each proponent's project and lease, so that the cumulative effects are minimized or avoided to a greater extent than would be possible individually. Whether these measures are prescriptive or not, they are consistent across a region and may be enforceable by regulators if their jurisdiction allows. Examples of such measures that might be applicable to managing effects of industrial activities include:

- coordinating certain baseline studies and monitoring programs
- providing development plans
- practicing integrated landscape management
- using common infrastructure, such as access roads
- developing traffic management plans
- contributing to regional inventories of renewable and non-renewable resources
- investment in training programs

These types of measures can also apply to other stakeholders. For example, government agencies and resource management agencies might be required or encouraged to:

- conduct harvest studies
- establish management thresholds and quotas
- revise or streamline regulation
- improve public infrastructure and services
- complete regional inventories of renewable and non-renewable resources
- provide advice based on analysis of results and experience from other jurisdictions
- provide access to regional data and information (information management)
- establish employment or business training programs

Regional collaborative measures for the oil and gas industry have been increasingly practiced in Alberta and BC. The following describes two recent initiatives focused on regional management of unconventional resource plays.

4.2.1 Alberta Play Focused Regulation

In Alberta, the Energy Resources Conservation Board (ERCB) recently published a draft discussion paper, *Regulating Unconventional Oil and Gas in Alberta* (2012), which proposed the concept of performance-based and play-focused regulation[6]. This approach is specifically intended to manage cumulative effects by ensuring development based on coordinated, current and innovative information and development plans. To obtain approval from the ERCB, the proposed process makes the preparation of a play development plan mandatory by all the operators in a given unconventional play. Individual operators meet the ERCB's expectations through collaboration with other operators in the play and with communities affected by development.

Collaborative mitigation options identified by the ERCB include:

- low-impact surface footprint by design
- collaboration on siting and routing to minimize road proliferation and traffic
- maximizing use of infrastructure
- use of existing disturbed sites

Specific other measures focus on water quality, water quantity, waste management and air quality.

4.2.2 British Columbia Area-based Analysis

The Government of British Columbia has recently initiated a Cumulative Effects Assessment Framework for the province, to be implemented within various regions. One region is Northeast British Columbia, the most active region in the province for unconventional (shale) programs. The Ministry of Forests, Lands and Natural Resource Operations is leading development of an overall framework to address effects from multiple activities. The Oil and Gas Commission (OGC), the province's regulator of oil and gas operations, is leading development of an Area-based Analysis approach to specifically manage effects of unconventional resource development in various gas basins[7]. Some of these basins overlap the NWT.

The Area-based Analysis examines trends in resource development and examines the regional landscape to assist the identification of appropriate management measures. This includes use of regulatory mechanisms, guidance on operational best practices, monitoring and thresholds for managing effects on identified values.

[6] Further information on the ERCB initiative available at http://www.ercb.ca/about-us/what-we-do/current-projects/urf
[7] Further information on the OGC 's Area-based analysis available at http://www.bcogc.ca/

4.3 Regional Land Use Plans

Ultimately, a powerful tool that can be used to manage future effects is a quality land use plan. Development and implementation of such plans is beyond the capacity of industry proponents, but does fall within the mandate of government land and resource use managers. Regional land use plans contribute to managing cumulative effects in several key ways:

- Establishment of a compensatory mechanism, through the process of land use zonation, to offset effects in one area by setting aside other areas for enhanced protection of environmental values. This approach is the same as establishing protected areas (e.g., parks) as ecological offsets. This is a pragmatic compromise that acknowledges the benefits of economic development, while balancing its implications with land and water elsewhere in the planning area. This is what the Sahtu Land Use Plan has done through the establishment of four land use zones. The existence of this plan substantially advances the ability of the Sahtu people to manage cumulative effects.
- Establishment of thresholds, either land use based (e.g., access density, maximum volume water removal, maximum number of stream crossings) or ecology based (e.g., maximum habitat loss, maximum concentration of introduced substances).
- Implementation of mandatory conditions on project approvals and performance based objectives.
- Initial identification of environmental values, their spatial correlation on the landscape, and establishment of desired outcomes that set the benchmark of change, which in turn provides a basis for establishing a regional monitoring program.

4.4 Regional Monitoring

Regional monitoring can be an essential part of managing cumulative effects through an adaptive process of continual confirmation of the state of environmental values. Substantial precedence exists in western and northern Canada of regional monitoring programs established to address concerns about cumulative effects of resource development, such as in Alberta's oil sands under the Land Use Framework and under the NWT Cumulative Impact Monitoring Program (CIMP).

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