

ALBERTA FOOTHILLS
CUMULATIVE EFFECTS
SCREENING TOOL

User Guide

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Prepared for Environment and Climate Change Canada



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Climate Change Canada
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CONTACT

Chris G. Buse, PhD
chris.buse@ubc.ca

COVER PHOTO

Alberta Foothills, Chris Buse, August 2021

WHAT IS THE ABFOOTHILLS ENVIROSCREEN TOOL?

The ABFootHills EnviroScreen is a data visualization and mapping tool designed to help make sense of cumulative impacts that are occurring in the Alberta Foothills. Cumulative impacts refer to the lasting legacies of multiple land-uses on environmental, community (socioeconomic) and health values.

The tool has two primary functions:

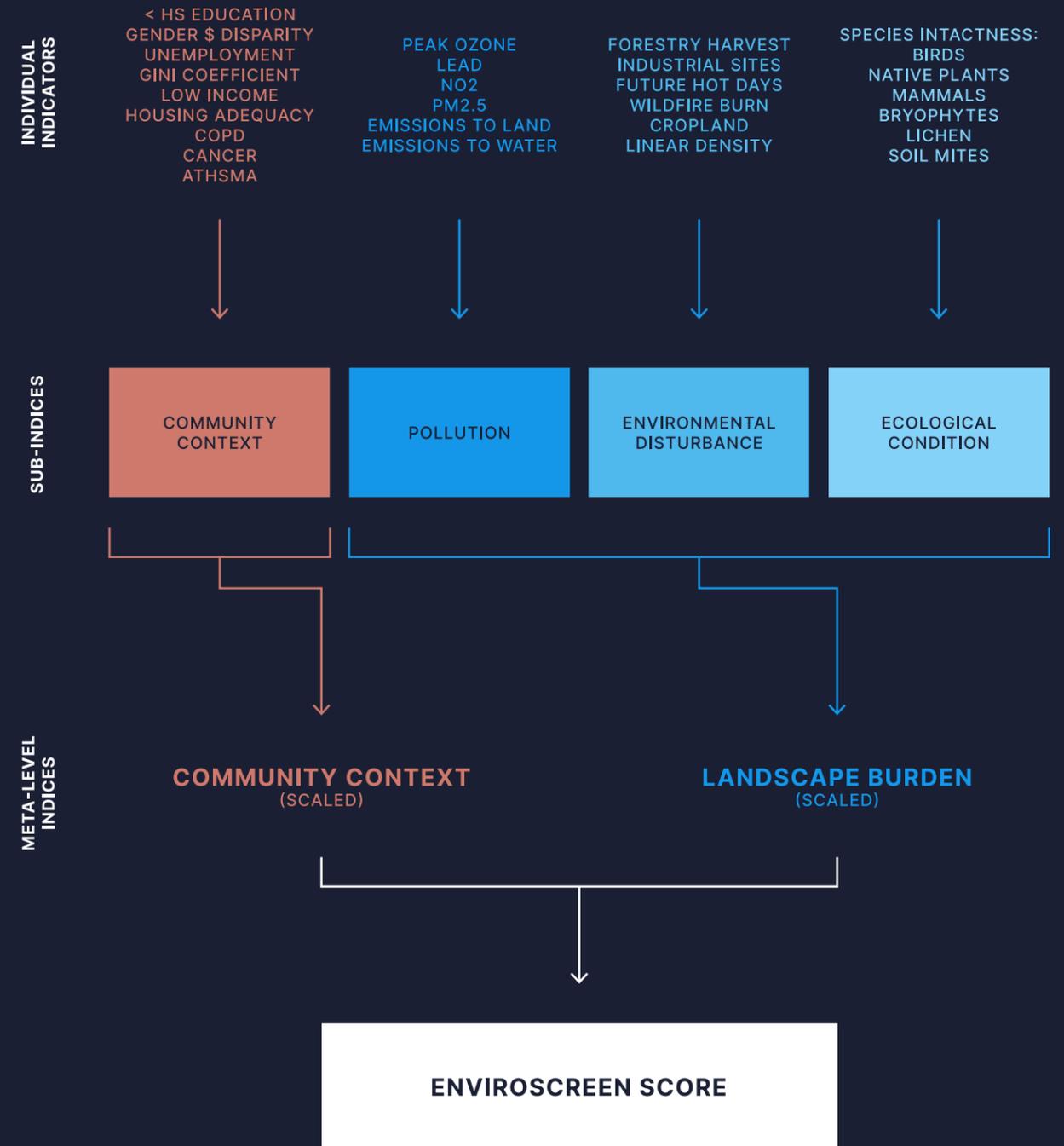
- 1 To store, rank and visually display a wide variety of publicly available and by request datasets that are related to cumulative impacts of natural resource development and associated land-uses, and
- 2 To combine datasets describing similar domains of impact that can quantify cumulative impacts and be compared across the region.

HOW ARE SCORES CALCULATED?

The Overall EnviroScreen score is calculated in a multi-step process, combining datasets and grouping individual variables in ways that can inform certain aspects of cumulative impacts (see Figure 1). Displayed values are relative to all other landscape units in the analysis, and indicate how regions compare to one another. The following process is used to calculate the Overall EnviroScreen score:

- 1 Each indicator is transformed into its 'percentile-rank' according to its distribution across the entire sample of geographic areas. For example, an indicator score of "90" indicates that the underlying value is in the 90th percentile of all scores. This transformation standardizes all data sources, and displays where each geographic area's values fall in the distribution of all values within the entire sample.
- 2 Data are then grouped into one of four sub-indices or 'scores' that best represent the unique aspect of cumulative impacts being measured: Community Context, Pollution, Environmental Change, or Ecological Condition.
- 3 Within each independent sub-index, indicator values are averaged to produce an overall score for that group.
- 4 Two 'meta-level' scores are then created: Landscape Burden (which is the average value of the Pollution, Environmental Change and Ecological Condition scores, scaled by the highest score in the sample and multiplied by 10) and Community Context (which is similarly scaled by dividing the average value of all indicators by the highest score in the entire sample and multiplying the result by 10).
- 5 Finally, the two meta-level scores are multiplied together into an all-encompassing EnviroScreen score out of 100 possible points.

HOW ENVIROSCREEN SCORES ARE CALCULATED



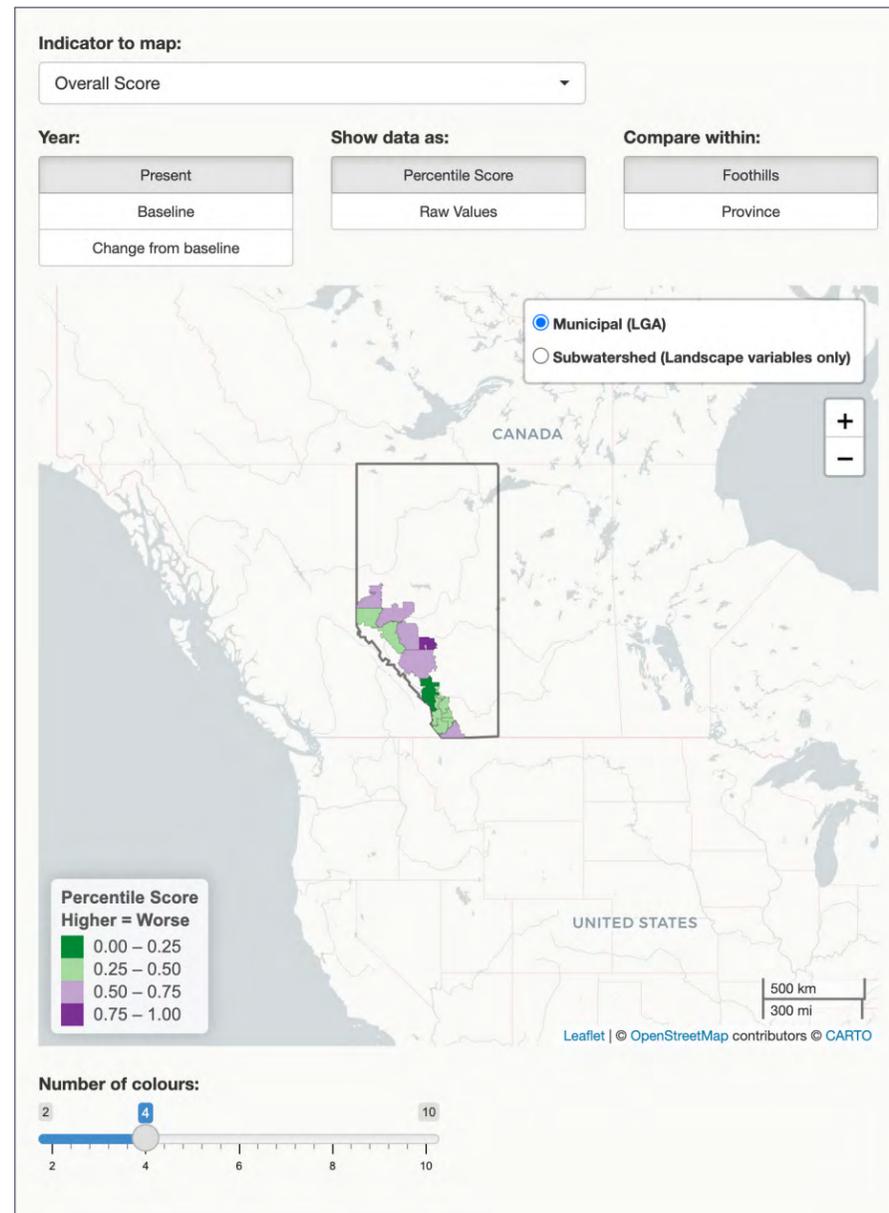
TOOL INTERFACE

Upon arriving on the landing page, a brief welcome message will pop-up containing a brief introduction to the tool, a link to where you can find more information including project reports, information on where to locate data, as well as contact information. Click 'Close' to access the tool.

The landing page has two main components, a map interface (left side) and lollipop charts (right side):

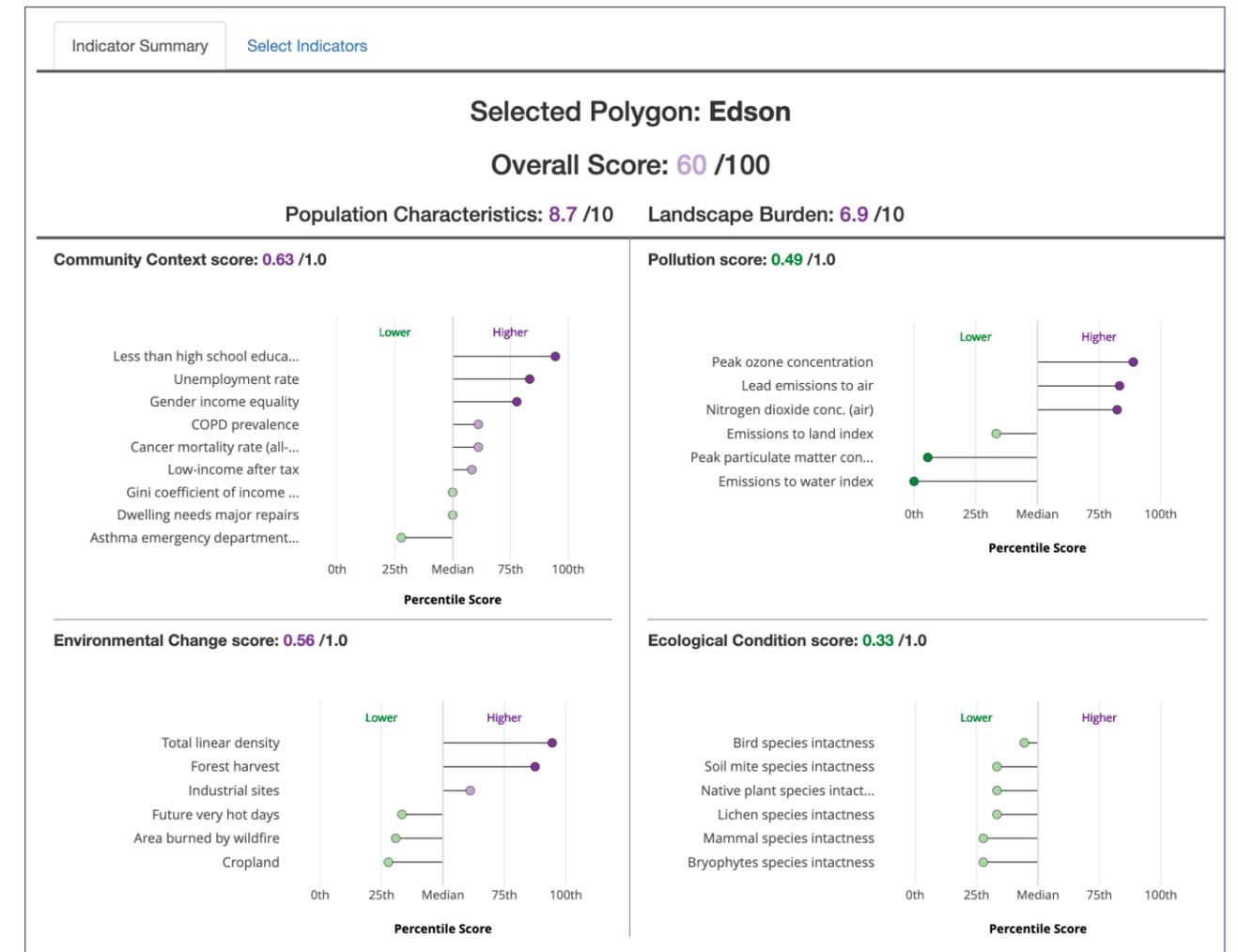
MAP INTERFACE (LEFT)

- The indicator or score being visualized is specified in the drop-down menu under 'Indicator to map'.
- Further customization tools are located above and below the map (more info in the 'Tool Features' section).
- Colours range from green to purple, which correspond to "better" and "worse", respectively.
- Click on a local geographic area (LGA) to see how it ranks as compared to the others (Lollipop charts on the right-side are updated in real time).



LOLLIPOP CHARTS (RIGHT)

- The 'Selected Polygon' and its 'Overall Score' (out of 100) is specified at the top.
- Each chart corresponds to a score (Community Context, Pollution, Environmental Change, or Ecological Condition) and displays a value out of 1.
- Each indicator is listed beneath the score it contributes to and its relative value is indicated by the length and direction of the lollipop.
- The lollipop chart is similar to a bar chart in that the longer the lollipop, the bigger the value. The vertical black line is the median value (the middle value). When the lollipop extends to the right of the vertical bar this indicates a higher value (worse) than the median and when it extends to the left of the vertical bar, this indicates a lower value than the median. A longer lollipop also has a darker colour associated with it than the shorter lollipops, and the colour scheme matches those presented on the map.
- Beneath the charts is a description of the selected variable, including the data source and years.



MAIN TOOL FEATURES

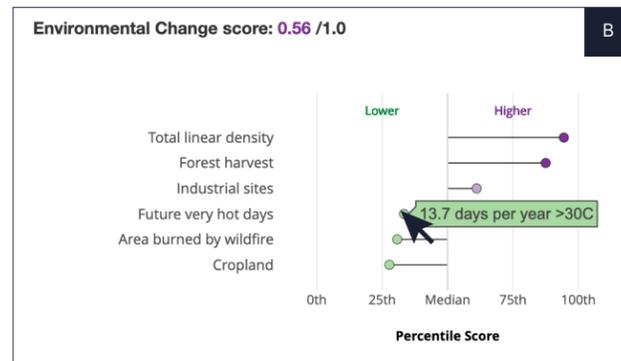
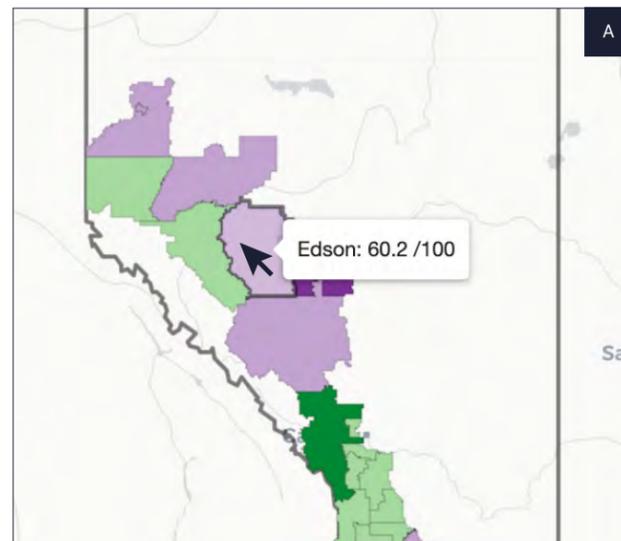
The tool has eight features to enable you to explore included data. Clicking on certain widgets will automatically update the map whenever a new option is selected. You can click back and forth between settings to see how maps change based on the feature being selected.

1 SELECT AN LGA OR WATERSHED

Click on any LGA (or watershed) to instantly update the lollipop charts and see how it ranks among any of the indicators as compared to the rest of the study region.

Hover the mouse over:

- A An LGA (or watershed) to see the LGA name and the underlying value and range.
- B Any of the individual lollipops in the chart to see the raw data and unit of measurement for the indicator.
- C The score names on the lollipop chart for a description.

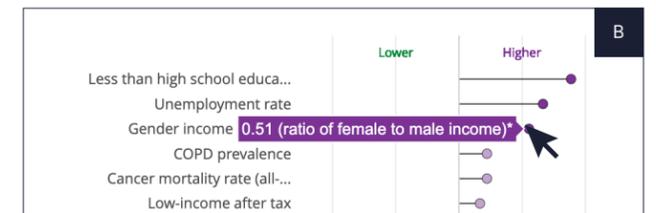
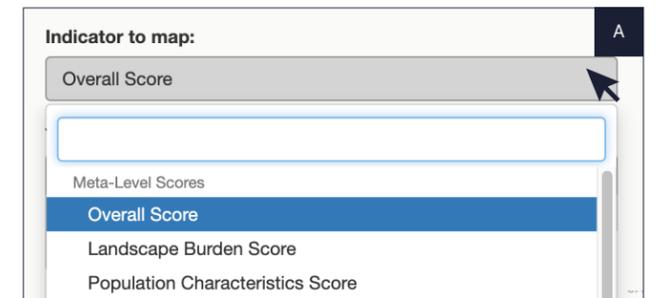


NAVIGATING THE INTERFACE

- Navigating the map is very similar to popular apps like Google Maps.
- When an LGA or watershed is clicked on, the lollipop charts are updated immediately with new values.
- Hover the mouse over a polygon to see the name of the polygon and the value for the selected indicator.
- The further the User zooms in (by either clicking on the "+" button on the map, or by rolling the wheel on the mouse), the more place names will become visible.
- To recenter the map to a different region, click anywhere on the map and hold the mouse button down while dragging the map to the desired location. Once satisfied with the new position, release the mouse button.

2 CHOOSE AN INDICATOR OR SCORE

- A Update the map by selecting a single indicator (e.g. road density) or a group of indicators called a score (e.g. Ecological Condition) from the 'Indicator to map' dropdown list. By default, the map will show the Overall EnviroScreen score, but you can use this feature to map any indicator included in the indicator suite.
- B For variable descriptions, click on the tip of the lollipop for the variable of interest and the text box at the bottom of the page will be updated automatically with a description, the data source and years.



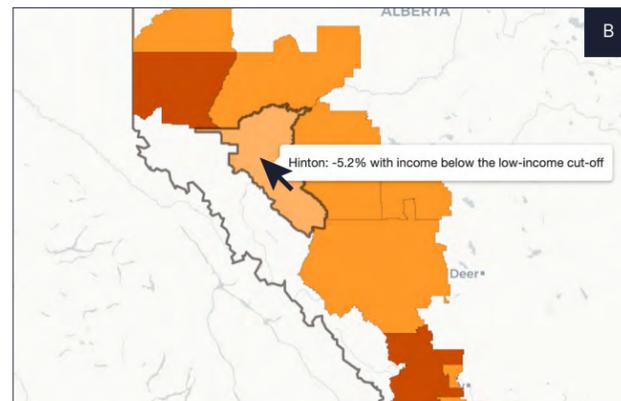
Gender income equality
 Click a data point above to view description
 Median income for men divided by median income for women. Higher values indicate greater incomes for women relative to men (values <1 indicate women make less than men, values >1 indicate women make more than men).
 *For the purposes of calculation, the tool reverses the directionality of this variable so that regions with lower levels of pay for women actually reflect higher levels of impact.
 Baseline year: 2011 | Present year: 2016
 Source: Statistics Canada

3 SELECT A TIME PERIOD

A Adjust the 'Year' parameter to choose between a 2010 historical baseline or the most current available data. To see the percent change between the baseline and most up-to-date data, select "Change from baseline".

B **NOTES FOR WHEN USING "CHANGE FROM BASELINE"**
Avoid using the "Percentile score" option due to difficulty in interpretation of the results. Further, when the User hovers over an LHA or subwatershed, the value presented is the difference between the baseline and the present time period and is not the actual value itself.

For example, the value of -5.2% on the screenshot to the right refers to the proportion of low-income earners having decreased by 5.2% from the baseline to the present.



4 CUSTOMIZE SCORES

Scores can be fully customized by the 'Select Indicators' feature to add or remove indicators according to the interests of the User (more info in the Additional Customization Options section of this user guide).

Customization may be desired if the User feels certain indicators may not belong in the suite (or that additional indicators do belong) and would like to tailor the tool to reflect those understandings.

IMPORTANT

The default indicators shown on the right of the interface (e.g. the lollipop charts) are the result of a statistical validation of this collection and arrangement of indicators. Selecting your own indicators will bring up a warning indicating you are moving away from the validated model and that findings should be interpreted with caution.

5 SELECT A TIME PERIOD

Percentile score (default) or raw values can be used to visualize the data. For raw values, the bins are calculated using equal-intervals, while bins for percentile scores each have an equal number of observations within them (e.g. LGAs).

The original data distributions can be observed by using raw values instead of the percentile score, whereas the percentile score will generate an even distribution across the number of bins.

NOTE The percentile score option should be avoided when using the "Change from baseline" time period due to difficulty in interpretation of the results.

6 NUMBER OF BINS

Number of colours, referred to as "bins", can be customized to show more or less variation within the datasets. Try changing the number of bins to see how the relative values change across each unit.

7 COMPARE WITHIN

Variables and scores can be calculated using only the variables in the Foothills regions (default), or can be compared to all values across all Local Geographic Units in the province of Alberta using the 'Compare within' selector.

A high score within the foothills may become a low score when compared within the entire province, or vice versa. In fact, our findings show that the Foothills region generally has lower overall environmental, socioeconomic and health pressures when compared with the rest of the province.

8 LGA OR SUBWATERSHED UNIT

Choose between the default municipal local geographic area (LGA) unit or the subwatershed unit.

The subwatershed unit is an ecologically meaningful boundary that is more appropriate when characterizing ecological processes, as compared to the municipal LGA. The main drawback to using the subwatershed unit is that the Community Context score is not available at that scale because of the way that health information is reported provincially. However, you can still see each of the three buckets measuring ecological pressures, and display individual values.

IMPORTANT

When subwatershed is selected, the map may become a solid grey colour. To fix this, be sure that the indicator or score being selected does not contain the Community Context score, for which there is no data available at the subwatershed unit - this includes the Overall EnviroScreen score. The Landscape Burden meta-level score, its three Component scores and their indicators can all be viewed at the subwatershed level. If you ever encounter a grey map, simply reselect the Landscape Burden Score or an associated sub-index or environmental variable by using the drop-down menu.

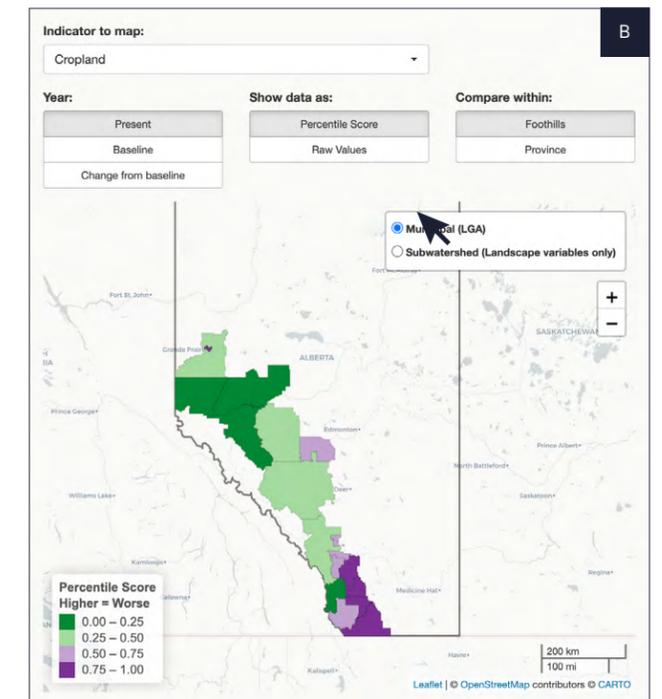
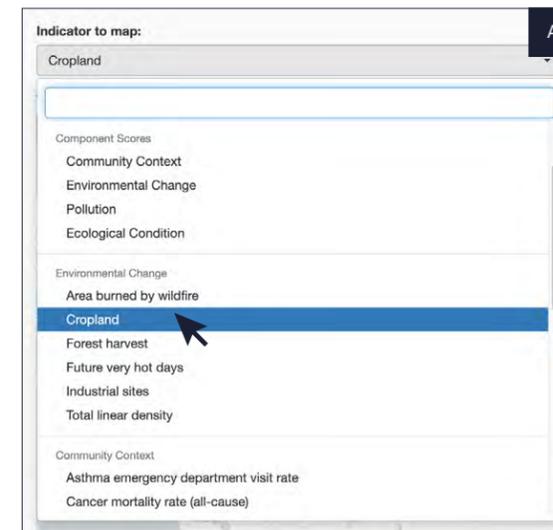


ADDITIONAL CUSTOMIZATION OPTIONS

The tool has eight features to enable you to explore included data. Clicking on certain widgets will automatically update the map whenever a new option is selected. You can click back and forth between settings to see how maps change based on the feature being selected.

1 VIEW A SINGLE INDICATOR OR SCORE

- A In the dropdown menu beneath 'Indicator to map;', choose a single indicator or score to view on the map by clicking on it.
- B Map will update automatically.



2 CUSTOMIZING AN INDICATOR SUITE

- A The indicators included in each of the Component scores can be added or removed using the 'Select Indicators' feature. The default suite of indicators in the tool have been validated using a statistical analysis called a Principle Component Analysis (PCA). For more information on this approach, please refer to the project report available [here](#). Any alterations made to the default suite of indicators have not been statistically validated.
- B Each of the four Component scores can be customized by clicking on the dropdown menu and selecting/deselecting individual indicators by clicking on them. In the example, Commute Time has been unselected from the Community Context score. Indicators in these lists that are unselected by default are not included in the statistically validated model but can be added in the customization process.
- C Once satisfied with the selection, click 'GO' to update the map and scores.
- D To return to the lollipop charts, click the 'Indicator Summary' tab.
- E If the map becomes a solid grey instead of the green/purple colour scheme, at least one of the Component scores being visualized contains no indicators. In the LGA example, the Overall EnviroScreen score is grey because the Community Context score has no indicators selected. To fix this issue, at least one indicator must be added for the Community Context score. The map would also become grey in this example if all three Component scores comprising the Landscape Burden meta-level score had no indicators selected. At the bare minimum, one of the Component scores in each of the meta-level scores require at least one indicator for the tool to calculate the Overall EnviroScreen score, in addition to the Community Context score requiring at least one indicator.

NOTE If when using the subwatershed unit the map becomes grey, this could be because the User is attempting to add Community Context indicators, for which there is no data available at the subwatershed level. This can also occur when there are no indicators selected for the Component score being visualized. To fix this, do not attempt to visualize the Overall EnviroScreen score at the subwatershed level and instead stick to the Landscape Burden meta-level score and the three Component scores that comprise it. If the map is still grey, check to make sure there is at least one indicator added to the score being visualized.

3 VIEWING A SINGLE INDICATOR THAT IS NOT INCLUDED IN THE DEFAULT SUITE OF INDICATORS

Only those indicators that have been statistically validated to be included in the EnviroScreen score are available in the main drop-down menu for selection. In order to view a single indicator that is not part of that validated suite, the following steps must be followed precisely.

- A Click on the "Select Indicators" tab, and then click the "Deselect All" option for all four of the Component scores.
- B Click on the single indicator to be viewed.
- C Under the "Indicator to map" drop-down, click on the Component score under which the indicator that is selected is located. In the above example, the 'Commute time' indicator is located in the Community Context score.
- D Click on "GO" and the map will automatically update for that single variable.

A Indicator Summary Select Indicators

Community Context
Asthma emergency department visit rate, ▾
Select All Deselect All
Asthma emergency department visit rate ✓

B **Community Context**
Commute time ▾
Select All Deselect All
Asthma emergency department visit rate
Cancer mortality rate (all-cause)
Commute time ✓
COPD prevalence

C **Indicator to map:**
Community Context
Meta-Level Scores
Overall Score
Landscape Burden Score
Population Characteristics Score
Component Scores
Community Context
Environmental Change
Pollution
Ecological Condition

D Select Default Select All
GO

4 RESET THE MAP BACK TO DEFAULT SETTINGS

To revert back to the statistically validated default suite of indicators, either refresh the webpage, or follow these steps:

- A Click on 'Select Default'.
- B Then click on 'GO'.

A Select Default Select All
GO

B Select Default Select All
GO

LIMITATIONS AND CONSIDERATIONS

Standardization of indicators: The rank-percentile approach used to standardize the data results in a loss of data as it relates to the distribution of values. Each LGA is simply ranked according to its peers on a linear scale and is assigned the value of the order in which it stands. In this process, the data distributions of each indicator become identical to one another. This function can introduce variability into data that is homogenous, or it can suppress the variability of data that is heterogenous.

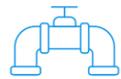
This means that percentile-rank scores can become artificially inflated or compressed in some cases, even when the range of values across landscape units is small. Using the data exploration feature to look at raw values can help understand where this may be occurring so you can interpret relative differences with nuance and caution.

Now that you know how to use the tool, we can use some hypothetical scenarios to ask and answer questions about cumulative effects using the screening tool.

EXAMPLE SCENARIOS OF HOW TO USE THE ENVIROSCREEN TOOL

HYPOTHETICAL SCENARIO

The Government of Alberta recently received proposals for two major projects aimed for development within the Alberta Foothills: "ABC Oil and Gas Co's Pipeline Project" and the "ABC Oil and Gas Refinery Project". We want to use the ABFoothillsEnviroScreen tool to screen each project for potential cumulative effects.



1 ABC PIPELINE PROJECT

ABC Oil and Gas Co. is proposing the ABC Pipeline Project as a means to transport crude oil from a facility south of Grande Prairie to a processing facility located in Drayton Valley. The project will include the creation of a right of way and construction of more than 350km of pipeline which will stretch from Grande Prairie County (just south of Grande Prairie city) south through Grande Cache and into Hinton, running parallel to the Rocky Mountains before turning east to run through Edson and ultimately end in Drayton Valley. It will create more than 2000 temporary construction jobs and approximately 75 full-time jobs during operation.

Pipelines are highlighted in the prospective assessment as one of the safest ways to transport oil and gas. Spill mitigation procedures are clearly outlined in the project's initial assessment, and the project is intentionally being developed to minimize stream crossings and to avoid sensitive habitats and ecosystems. However, it is noted that the project will lead to further habitat fragmentation through the introduction of the right of way, which may negatively impact terrestrial species already impacted by multiple land uses. The company is interested in hearing from the public about additional risks the pipeline may pose to environmental, community and health values, as well as cumulative effects.



2 ABC REFINERY PROJECT

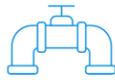
As part of a separate environmental impact assessment process, ABC Oil and Gas Co. is also proposing to building the ABC Refinery Project, an oil refinery, slated to be constructed west of Drayton Valley. The project in question would serve as the terminus for the Foothills Pipeline Project (described above) and aim to process 100,000 barrels of oil per day, where the refined product would then be transported via existing pipeline to domestic and international markets. The project will create approximately 1000 temporary construction jobs, and 150 full-time jobs to operate the refinery.

The project assessment report indicates that the refinery is expected to emit particulate matter, nitrous oxides, and sulphur dioxides during operation, and that refinery processes have historically been associated with contamination of soil and may pose water quality threats. Chemicals utilized and emitted in the refining process are known carcinogens and their emission into the air may worsen respiratory conditions. A full risk mitigation plan is included in the prospective assessment, but ABC Oil and Gas Co. is interested in hearing about additional risks the pipelines may pose to environmental, community and health values, as well as cumulative effects.

OUR CHALLENGE

Each project is undergoing an environmental impact assessment under provincial regulations. Part of that process is to source information from the public on potential (cumulative effects) and to consider interactions between these prospective projects and historical land-uses throughout the Foothills. As a concerned citizen, you want to use the ABFoothillsEnviroScreen tool to learn about the existing state of cumulative effects and develop hypotheses as to how the projects in question could exacerbate the state of cumulative effects across the Foothills.

Please note that these scenarios are hypothetical and do not represent real projects. ABC Oil and Gas is not a real company, nor are the two listed projects.



SCREENING CUMULATIVE EFFECTS FOR THE ABC PIPELINE PROJECT

ASSERTIONS MADE BY THE PROPONENT

- Most risks associated with pipeline development have been addressed in an initial assessment submitted by the proponent.
- Project will create temporary jobs during construction and opportunities for full-time employment.
- Largest identified risks are to landscape disturbance through the development of linear features (e.g. roads, railway lines, seismic lines, transmission lines, etc.).

PROCESS FOR EXPLORING AND SCREENING CUMULATIVE EFFECTS WITH THE TOOL

IMPORTANT Remember that most of the scores are relative. Raw values for specific indicators can be mapped, but the value of the tool is its potential to screen for cumulative effects. To that end, the tool can illustrate what might be driving impacts and direct user's attention to analyze potentially impacted areas and determine which areas could benefit from further study, environmental remediation, or more concerted risk mitigation activities.

STEP 1

Open the ABFootHills Data Portal and begin by mapping the Overall Scores using the dropdown menu (set by default) across the potentially impacted areas of the pipeline (e.g. Grande Prairie County, Hinton, Edson and Drayton Valley).

To do this, you can:

- **CHANGE THE SLIDER BAR TO 10 COLORS** to better differentiate relative scores
 - > We can note that the pipeline project would flow through two areas with pre-existing moderate levels of regional cumulative impacts at the highest level – this is our starting point – a measure of cumulative environmental, community and health impacts (Grande Prairie County and Edson), two areas with low overall pre-existing levels of impact (Hinton and Grande Cache), and one area with high overall pre-existing levels of impact.

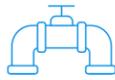
STEP 2

Examine the sub-index scores for each potentially impacted area of the pipeline to determine different aggregated levels of overall impact (again, you can use the toggles to view these sub-index values at the watershed level, view their raw values, or compare to the rest of the province.

- **USE THE DROPDOWN MENU TO SELECT THE EACH OF THE SUB-INDEXES 'POPULATION CHARACTERISTICS' AND 'LANDSCAPE BURDEN'** score to gain an understanding of cumulative socioeconomic and health pressures (i.e. population characteristics) and environmental pressures on the other. Remember that only socioeconomic and health variables can be displayed at the level of an LGA, and environmental data can be displayed for both LGAs and subwatersheds.
 - > **LANDSCAPE BURDEN** pressures are generally the highest at the start and terminus of the pipeline, lowest for Grande Cache and moderate impact in Hinton and Edson.
 - > **POPULATION CHARACTERISTICS** are among the highest in Drayton Valley and Grande Cache, but are also high in Edson and GP county, even when compared against the rest of the province. They are moderate in Hinton.
 - > **WATERSHED TOGGLE** indicates that at a finer detail level of analysis, cumulative environmental effects are highest in the Lower Wapiti and Wabuman sub-watersheds, signaling a potential pre-existing need to take a precautionary development approach in those areas.

- **USE TOGGLES** to compare within vs against the broader province, show results for sub-watersheds and also toggle to see percent changes in index values over time.
 - > We notice that impacts diminish across the foothills, but are still moderately high in Drayton valley, and have historically seen moderate increases relative to the historical baseline.
 - > Most impacts seem to be in sub-watersheds located around the town of Drayton Valley.
 - > **REMEMBER** health and socioeconomic information cannot be displayed at the level of sub-watersheds. Selecting the watershed feature will return gray shaded polygons because the EnviroScreen score cannot be computed at this level of analysis.
- **CLICK ON EACH AFFECTED AREA** to see scores and their breakdowns. The lollipop charts can give an initial sense of key differences in relevant data that are contributing to those scores, and these can also be mapped using the dropdown menus

- Use the drop-down menu to navigate through and re-map the sub-index scores to increase attention to specific types of values.
 - > **COMMUNITY CONTEXT** scores are highest in Grande Cache, and moderate throughout the rest of the areas of interest.
 - > **ENVIRONMENTAL CHANGE** and **POLLUTION SCORES** are highest at the start and terminus of the proposed project, although pollution scores tend to be lower than provincial median values, whereas environmental change values are higher than provincial median values.
 - > **ECOLOGICAL CONDITIONS** are generally worse in Drayton Valley relative to other impacted areas throughout the Foothills, although when compared provincially, the level of ecological pressure is relatively low, comparatively.
- Overall, the initial screen suggests that there is the greatest pre-existing presence of cumulative effects on environmental values in Grande Prairie and Drayton Valley, and that socioeconomic and health pressures may be greatest in Grande Cache and Drayton Valley.



STEP 3

Examine key indicators relevant to the assessment of the pipeline across potentially impacted areas of the pipeline (remember to look first at relative scores, and then again for raw values). Remember that you can use the watershed tool to look at environmental variables, but that socioeconomic and health data can only be displayed at the level of LGAs.

— **LINEAR DENSITY** click on the lollipop chart to bring up the indicator description and data source.

- > Already highest out of any LGAs in the foothills in Drayton Valley and Edson. These values are also high when compared to the rest of the province. The project may pose risks to habitat intactness in these areas specifically, and development should seek to maximize the use of existing linear corridors wherever possible.

— **MAMMAL SPECIES INTACTNESS**

- > Mammal species intactness is lowest of all the foothills in Drayton Valley, but only in the 30th percentile of impact when compared provincially at 68% intact. Further linear development could exacerbate these values, and also lead to declines in mammal species intactness in other LGAs.

— **EMPLOYMENT AND LOW-INCOME**

- > Unemployment rates are particularly high in Grande Cache and Drayton Valley. These regions also have the among the highest relative proportion of low-income people, signalling the need for more economic opportunities. Prioritizing jobs in these communities should be a priority if the project moves ahead.

STEP 4

Consider alternative variables that resemble cumulative effects, explore model building.

— Use the “select indicators” function to map alternative indicators that may be of interest to explore other indicators. You can also create your own EnviroScreen based on available data. Simply check or uncheck specific variables you may be interested in, making sure you have at least one indicator selected per sub-index measure.

- > For example, we may feel that the community context measures explored above meets our needs for this scenario, but we want to explore alternative landscape burden metrics at the level of sub-watersheds.

> First, deselect all the community context variables.

> Select variables of interest for the other sub-indices (here, we are interested in chemical emissions to water and land only so select emissions to land, water and groundwater threats).

> Return to the map interface and select the ‘sub-watershed’s toggle’ to view and interpret the results for the study area of interest

STEP 5

Recommendations based on what you have learned.

KNOWING WHAT YOU NOW KNOW, WHAT TYPES OF RECOMMENDATIONS OR COMMENTS WOULD YOU SUPPLY TO THE REGULATOR AND THE PROPONENT?

- Most risks associated with pipeline development have been addressed in the initial assessment submitted by the proponent.
 - > The ABEnviroScreen still projects significant potential cumulative impacts in the project area.
- Assessment will create temporary jobs during construction and opportunities for full-time employment.
 - > Any employment should be prioritized for Grande Cache and Drayton Valley given pre-existing high rates of unemployment and low-income individuals.

— Largest identified risks are to landscape disturbance through the development of linear features.

- > This synergizes with findings from ABEnviroScreen – Drayton Valley has among the lowest mammal species intactness across the Foothills, and among the highest linear features suggesting a high degree of habitat fragmentation.

Construction should make the best use of existing right of ways (e.g. already fragmented and/or disturbed land) if the project proceeds. Consideration should be given to minimize cumulative linear density, especially in the Drayton Valley LGA.

Need for more granular research along the proposed development corridor to minimize creation of new right of ways, project should aim to support and remediate other right of ways that are unused and in need of mitigation to operate the project.



ASSESSING IMPACTS FROM THE ABC REFINERY PROJECT

ASSERTIONS MADE BY THE PROPONENT

- Enhanced risks to air quality. Air quality risks are transboundary and prevailing winds blow west to east, whereas most of the physical impacts of the actual project will be highly localized to Drayton Valley and the area surrounding the project.
- Existing evidence suggests that chemicals emitted from the facility and those utilized in the refining process pose risks to human respiratory health and to the development of certain forms of cancer.
- Will create temporary jobs during construction and opportunities for full-time employment.

PROCESS FOR EXPLORING AND SCREENING CUMULATIVE EFFECTS WITH THE TOOL

STEP 1

Open the ABFootHills Data Portal and explore the Overall Scores across the potentially impacted areas of the refinery (e.g. Drayton Valley) (remember to use toggles to compare within vs against the broader province, and to look at historical changes in raw values, as well as watershed levels of analysis for environmental variables).

- **CHANGE THE SLIDER BAR TO 10 COLORS** to better differentiate relative scores.

- > **CLICK ON DRAYTON VALLEY** to see scores, you can use the lollipop charts to gain an initial sense of key differences in relevant data and these can also be mapped using the dropdown menus. You can also click to toggle to between provincial and foothills comparison.

FINDINGS Drayton Valley has the highest overall presence of existing cumulative effects per the screening tool (94/100). When compared to the rest of the province, it is still moderately high (55.9/100).

STEP 2

Examine the meta-level index scores for each potentially impacted area of the refinery to determine different aggregated levels of overall impact.

- Select each of the 'POPULATION CHARACTERISTICS' and 'LANDSCAPE BURDEN' score from the dropdown menu to gain an understanding of cumulative socioeconomic and health pressures on one hand and environmental pressures on the other.
 - > **LANDSCAPE BURDEN** pressures are the highest of all foothills LGAs in Drayton Valley (10/10) and moderately high relative to the rest of the province (6.9/10).
 - > **POPULATION CHARACTERISTICS** are among the highest in Drayton Valley among all Foothills LGAs and they are high in terms of provincial comparison, suggesting high prevalence of cumulative socio-economic and health pressures.
- **MAP THE SUB-INDICES** using the dropdown menu or by viewing the right hand panel for the selected LGA of Drayton Valley, and examine lollipop charts to see what variables are driving scores higher and lower in Drayton Valley.
 - > **COMMUNITY CONTEXT SCORES** are in the 70th percentile for both provincial and within Foothills comparisons.

Score is primarily driven by cancer mortality, unemployment, proportion of population with low education, low income after tax, chronic obstructive pulmonary disorder prevalence, gender income disparity and income inequality – the region tends to perform better in terms of housing suitability and low rates of asthma.

- > **ENVIRONMENTAL CHANGE** is among the highest scores in the foothills and the 60th percentile provincially.
 - Driven mostly by Total Linear Density and presence of industrial sites.
- > **POLLUTION SCORES** are among the highest in the foothills, but in the 50th percentile provincially.
 - PM, Ozone, Lead and NO2 concentrations are among the highest in Drayton Valley relative to the rest of the foothills. The LGA has typically lower levels of emissions to water and land than average.
 - PM, Ozone, Lead and NO2 are known carcinogens that also exacerbate respiratory conditions.
- > **ECOLOGICAL CONTEXT SCORES** are in the 70th percentile of LGA scores but 30th percentile provincially.
 - Scores are driven by lower levels of mammal species intactness, bird species intactness and bryophyte species intactness.
- > Toggling to the 'sub-watershed level' illuminates that the western watershed that comprises the town of Drayton Valley appears to be where the majority of the pressures are located.

- Overall, the initial screen suggests that Drayton valley has a high-pre-existing level of cumulative effects relative to the rest of the Foothills LGAs. These values range from the 30th to 70th percentile of impact when compared to the rest of the province, suggesting Drayton Valley typically has higher than average presence of cumulative impacts relative to the rest of the province.



STEP 3

Examine key indicators relevant to the assessment of the refinery across potentially impacted areas of the refinery.

NOTE look first at relative scores, and then again for raw values. You can also use the sub-watershed toggle to increase resolution of the tool, and toggle to historical baselines or map the change from baseline values.

— INDUSTRIAL SITES

- > Already highest footprint in Drayton Valley of industrial land uses out of any LGAs in the foothills. These values are also high when compared to the rest of the province. Absolute values show that the proportionate footprint is relatively low, and at the watershed level show that raw values are highest in the two sub-watersheds closest to Drayton valley.

— EMISSIONS TO LAND AND WATER

- > Rates are relatively low compared to both the foothills and the rest of the province.

— MAMMAL SPECIES INTACTNESS

- > Mammal species intactness is lowest of all the foothills in Drayton Valley, but only in the 30th percentile of impact when compared provincially at 68% intact. Further development could exacerbate these values, and also lead to declines in mammal species intactness in other LGAs.

— HEALTH

- > High rates of COPD prevalence and all-cause cancer mortality, but lower rates of asthma.

— EMPLOYMENT

- > Unemployment rates are particularly high in Drayton Valley. These regions also have the among the highest relative proportion of low-income people, signalling the need for more economic opportunities. Prioritizing jobs in these communities should be a priority if the project moves ahead.

STEP 4

Consider alternative development paths or recommendations, based on what you have learned by revisiting what we know.

KNOWING WHAT YOU NOW KNOW, WHAT RECOMMENDATIONS OR COMMENTS WOULD YOU SUBMIT TO THE REGULATOR AND THE PROPONENT?

- Enhanced risks to air and water quality, with potential for soil contamination. Air quality risks are transboundary and prevailing winds blow west to east, whereas most of the physical impacts of the actual project will be highly localized to Drayton Valley and the area surrounding the project.
 - > *Drayton Valley has among the highest concentration of industrial activities in the AB Foothills (0.69% of total landcover) which corresponds to higher rates of environmental cumulative effects, and impacts to human health. This value is also high relative to the provincial median for this type of land use.*
 - > *Need specific studies to understand impacts to mammal species and birds, which are already cumulatively impacted by existing industrial pressures.*

- Existing evidence suggests that chemicals emitted from the facility and those utilized in the refining process pose risks to human respiratory health and to the development of certain forms of cancer.

- > *Drayton Valley has low rates of health service utilization for Asthma (343 emergency department visits per 100,000 per year), but among the highest rates in the foothills for COPD prevalence (4.1%) and all-cause cancer mortality (262 per 100,000 per year).*
- > *Recommend prospective health impact assessment and identification of risk mitigation, particularly for respiratory diseases and cancer related to industrial emissions. Siting the location in areas that are not upstream in the airshed from the town of Drayton Valley (the LGAs largest population centre) may mitigate some of the risks, but may also transmit those risks through the airshed to other populations downstream of the facility.*

- Will create temporary jobs during construction and opportunities for full-time employment.

- > *The region is challenged by high rates of unemployment (11.7%) which could be positively impacted by the refinery.*