Municipal Land Use Suitability Tool Report for the Municipality of Crowsnest Pass

Diane Horvath, Hailey Winder, Tracy Lee, and Ken Sanderson

April 2021



Municipal Land Use Suitability Tool (MLUST) for Municipality of Crowsnest Pass

Diane Horvath, Hailey Winder Tracy Lee, and Ken Sanderson

Funds provided by: ***Shell Foothills Legacy Grant***

April 2021

Oldman River Regional Services Commission
3105 – 16th Avenue North
Lethbridge, Alberta T1H 5E8

Phone: (403) 329-1344
Toll-free phone: 1-844-279-8760
Email: admin@orrsc.com
Web: www.orrsc.com

Miistakis Institute
Rm U271, Mount Royal University
4825 Mount Royal Gate SW
Calgary, Alberta T3E 6K6

Phone: (403) 440-8444
Email: institute@rockies.ca
Web: www.rockies.ca

Acknowledgments

The Municipal Land Use Suitability Tool was developed for Municipality of Crowsnest Pass with funds from *The Shell Foothills Legacy Grant*

Thank you to the Municipality of Crowsnest Pass and the following representatives:
Blair Painter, Mayor
Marlene Anctil, Councillor
Dave Filipuzzi, Councillor
Doreen Glavin, Councillor
Lisa Sygutek, Councillor
Dean Ward, Councillor
Patrick Thomas, Chief Administrative Office

For the Oldman River Regional Services Commission (ORRSC) we would like to acknowledge staff that contributed:
Ryan Dyck, Planner for the Municipality of Crowsnest Pass
Mike Burla, Senior Planner for the Municipality of Crowsnest Pass
Jamie Thomas, GIS Analyst

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY 1

What Lands are Suitable to be Developed? 2

What Other Land Use Did We Value? 4

We Valued Ecosystems 4

We Valued the Existing Built Environment 5

We Valued Culture and Iconic Landscapes 6

Combining Values 9

Most Suitable Areas for Development 10

MUNICIPAL LAND USE SUSTAINABILITY TOOL FINAL REPORT

Introduction 11

Background of Process 12

Project Constraints 13

Decision Support 13

Scale of Use 13

Spatial Modeling 13

MLUST Overview 14

MLUST Terminology 14

MLUST Process 15

Selection of Land Use Themes, Groups and Features 17
Feature Scoring and Buffering Exercise 17
Quantification of the Score 19
Quantification of Buffers 20
Modeling Overview 21
Modelling Process 21
Mapping Process 22
Results 24
Residential Development Potential Results 26
Commercial / Light Industrial Development Potential Results 38
Primary Industrial Development Potential Results 50

APPENDIX A: Municipal Land Use Suitability Tool Feature Scoring Exercise

APPENDIX B: Municipal Land Use Suitability Tool Feature Scoring Exercise Results

APPENDIX C: Spatial Representation of Ecological Features

APPENDIX D: Spatial Representation of Cultural Features

APPENDIX E: Top 20% Suitability Maps and Combined Results



Executive Summary



Executive Summary

Executive Summary

When municipal governments consider urban development, it immediately becomes clear that not everywhere is suitable for those activities, and not everywhere is unsuitable. For some areas it is a clear-cut 'yes' or 'no', but most areas sit somewhere on a continuum between those two extremes.

The Miistakis Institute and Oldman River Regional Services Commission (ORRSC) developed the Municipal Land Use Suitability Tool (MLUST) to assist municipalities in planning where development is most suitable in consideration of other land uses including ecological, cultural and existing urban settlement. The MLUST process aims to identify areas within the Municipality of Crowsnest Pass most suitable for urban development while avoiding important ecological, cultural/scenic resources, and settlement and infrastructure at a municipal scale. The MLUST process took six months to complete, engaged municipal stakeholders, made use of existing spatial datasets, and produced a series of map products to inform planning at the municipal scale.

The MLUST serves to support the Municipality of Crowsnest Pass in directing growth and development within the municipality by creating a series of 'Suitability Maps'. These maps are created by identifying lands where Residential, Commercial/Light Industrial, and Heavy Industrial development are less likely to conflict with the existing land use values (*Maps are available in larger sized within the full report)*. The results of the MLUST modelling are caveated with the following limitations:

- Only greenfield development was considered as in a developed urban settlement, infill opportunities would be difficult to identify at the scale of results,
- There was no limit placed on topographical constraints such as slope or elevation as development, while perhaps not economically feasible is still possible.
- The modelling did not consider distance to services or infrastructure.

What Lands are Suitable to be Developed?

To determine where developments are suitable, we needed to consider which lands may not be suitable for development due to either provincial regulations restricting development or lands subject to existing settlement, topographical features, or hazard lands. These impediments to development were classified as “No-Go” areas. Through the modeling process the No-Go features were removed from the land base for the three different development types. (Figures 1, 2 and 3)

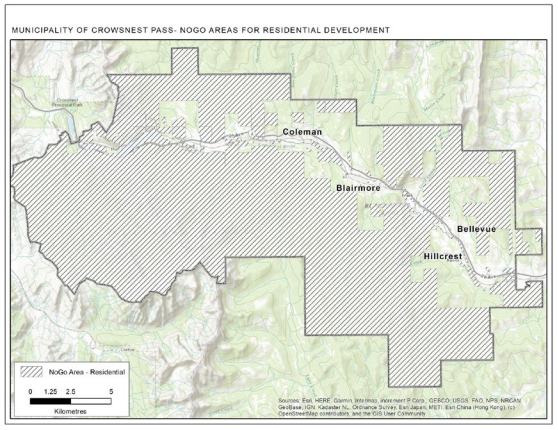


Figure 1

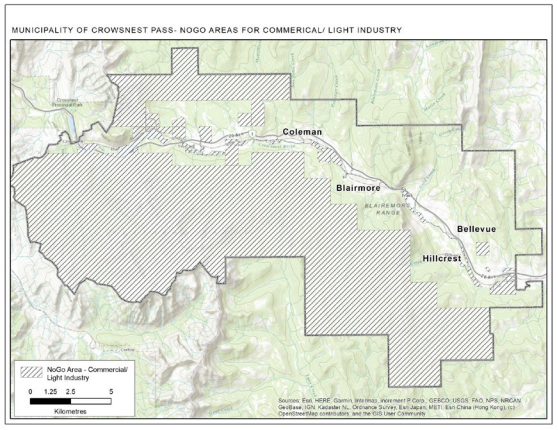


Figure 2

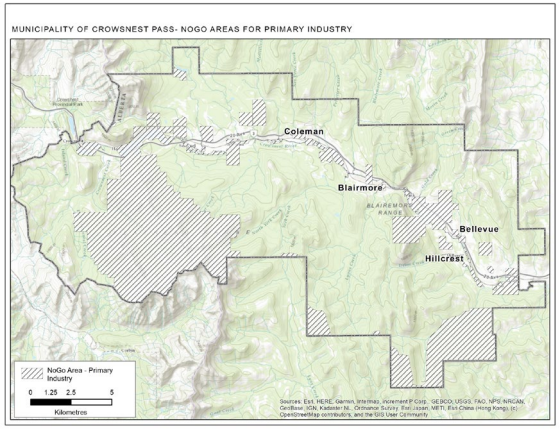


Figure 3

The MLUST process identified:

- 7% of the Municipality of Crowsnest Pass, or 6,425 acres (26 km^2) as has potential for development for Residential uses (Figure 4),
- 19% of the Municipality of Crowsnest Pass, or 18,039 acres (73 km^2) has potential for development for Commercial/Light Industrial uses (Figure 5), and
- 45% of the Municipality of Crowsnest Pass, or 45,502 acres (184 km^2) has potential for development for Heavy Industrial uses (Figure 6).

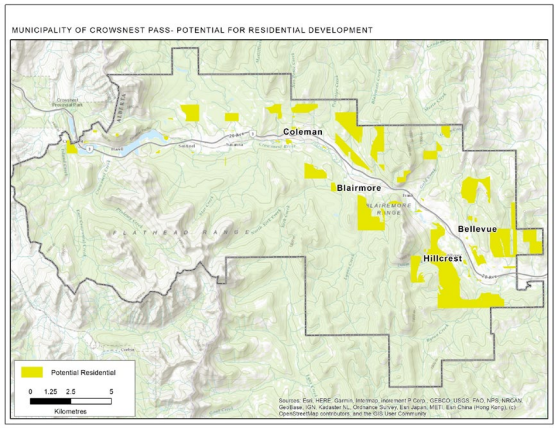


Figure 4

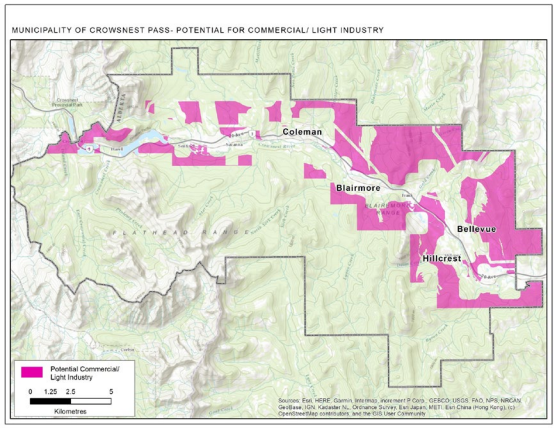


Figure 5

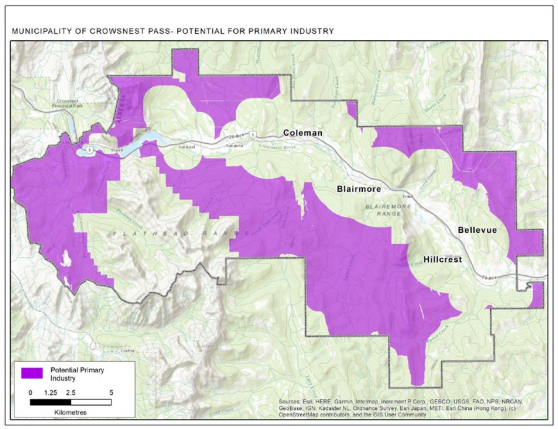


Figure 6

What Other Land Use Did We Value?

We Valued Ecosystems

Municipal stakeholders identified the highest valued lands from an ecological perspective. They identified 13 ecological features (listed in Table 1) and provided a Conflict Probability Rating based on values from 0 to 100; where higher values equate to a high ecological value. Once ecological features were assigned a Conflict Probability Rating, all 13 features were converted into a grid roughly the size of a quarter section, then overlaid and the maximum value was assigned to produce an Ecological Conflict Probability Rating Map for all development types. The map illustrates that as the green colour darkens there is an increasing conflict with ecological values assigned by the municipal stakeholders (Figure 7).

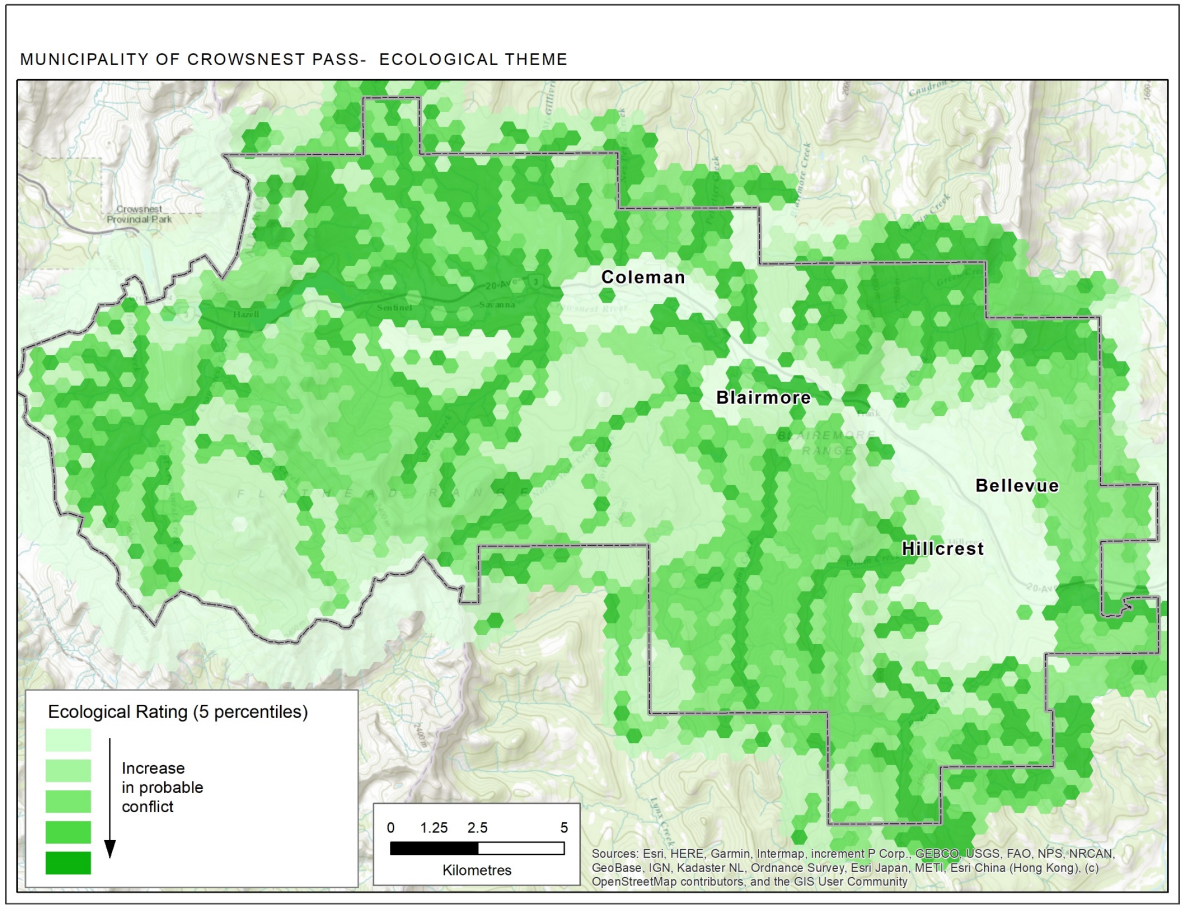


Table 1

Ecological Feature	Conflict Probability Rating
Municipal conservation lands	67
Private conservation lands	50
Grizzly bear zones	64
Mountain goat and bighorn sheep range	64
Cutthroat trout	64
Elk winter range	66
Native grasslands	55
Wildlife movement areas	66
Riparian areas	71
Crowsnest River	85
Creeks	77
Lakes (unnamed)	74
Groundwater aquifer recharge areas	85

Figure 7

We Valued the Existing Built Environment

Participants were asked to buffer existing settlement and infrastructure features which may be of influence on the potential development of new residential development. Table 3 below is a summary of the final buffer determined through consensus and represents the distances between new development and other land uses or infrastructure features. These buffers may be larger or smaller than the regulatory setbacks to highways, landfills or wastewater treatment facilities. This was determined not to factor into the modelling as there is a process to acquire waivers from the Province and therefore the setbacks consider in the modelling process represents the values of the participants in the MLUST project.

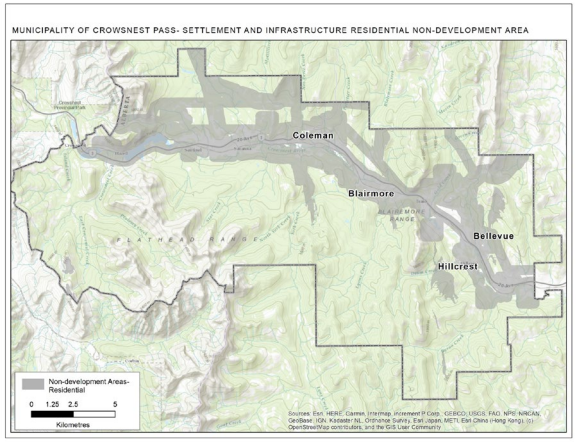


Figure 8

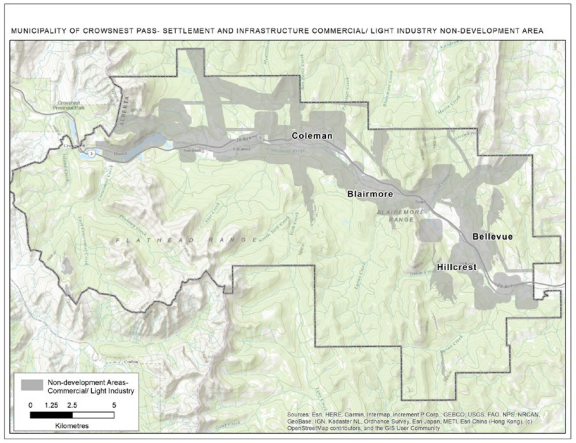


Figure 9

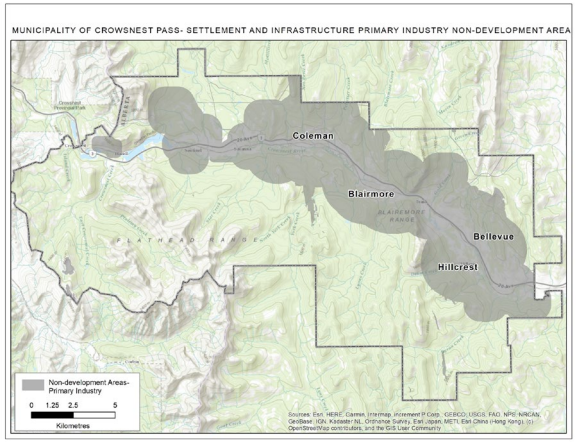


Figure 10

We Valued Culture and Iconic Landscapes

Municipal stakeholders identified the highest valued lands from a cultural perspective. They identified 13 scenic features and historic resource classes (listed in Table 2) and provided a Conflict Probability Rating based on values from 0 to 100; where higher values equate to a high cultural value. In additional municipal stakeholder assigned a "buffer" distance for each of the features that was dependent on type of development and the potential impact of development on the cultural, scenic or historic resource. Once cultural features were assigned a Conflict Probability Rating, all 13 features were converted into a grid roughly the size of a section, then overlaid and the maximum value was assigned to produce a Cultural Conflict Probability Rating Map for each development types utilizing both the Conflict Probably Rating and the buffers.

Table 2

Scenic Features Community/Tourism Features	Conflict Probability Rating	Refined Buffer to Residential (m)	Refined Buffer to Commercial / Light Industrial (m)	Refined Buffer to Primary Industry (m)
Crowsnest River Valley	77	100	500	1000
Viewshed of Crowsnest Mountain	82	500	800	1200
Viewshed of South Coleman	69	300	700	900
Burmis Tree	63	300	700	1100
Frank Slide	93	600	900	1100
Bellevue Mine	79	200	600	800
Leitch Collieries	66	300	600	900
Mine cemeteries	68	200	500	1000
Coke Ovens in Coleman	46	100	400	800
Sulphur Springs in Frank	52	100	400	900
Historic Town Site of Lille	63	100	700	1200
Historic Town Site of Frank	63	300	700	1100
McGilvary Falls	74	400	800	1500
Star Creek Falls	71	400	800	1500
Allison Creek Falls	74	400	800	1500

Cultural Conflict Probability Rating Maps for Residential, Commercial/Light Industrial and Heavy Industrial Development (as the orange colour darkens there is an increasing conflict with cultural values).

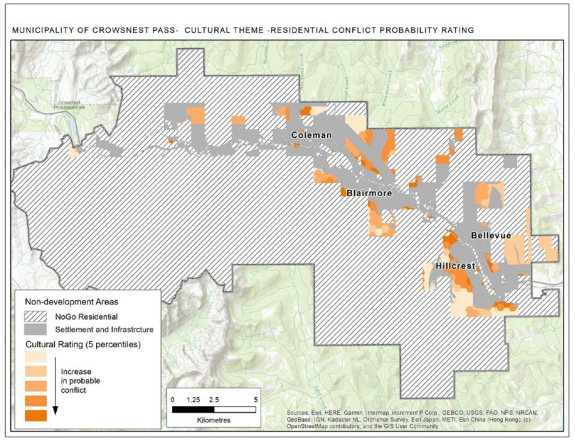


Figure 11

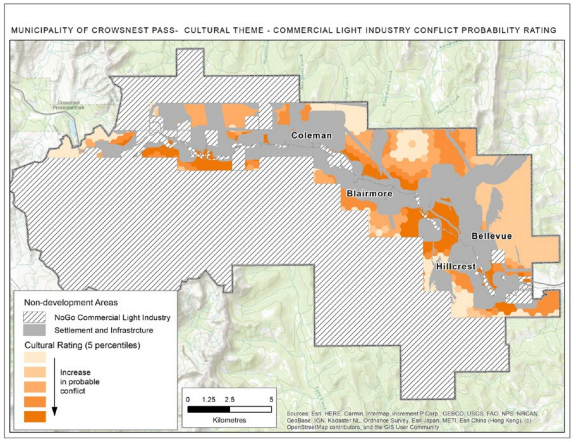


Figure 12

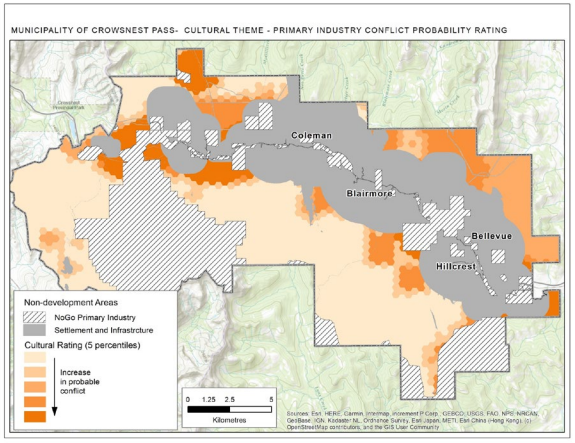


Figure 13

Cultural point buffer maps for Residential, Commercial/Light Industrial and Heavy Industrial Development indicate the desired setback of certain types of development from valued cultural, historic and iconic landscapes.

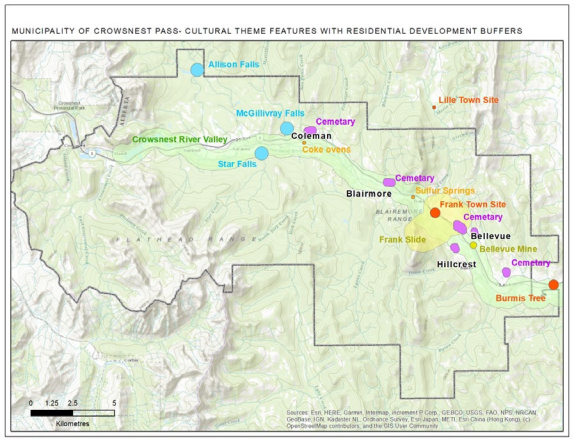


Figure 14

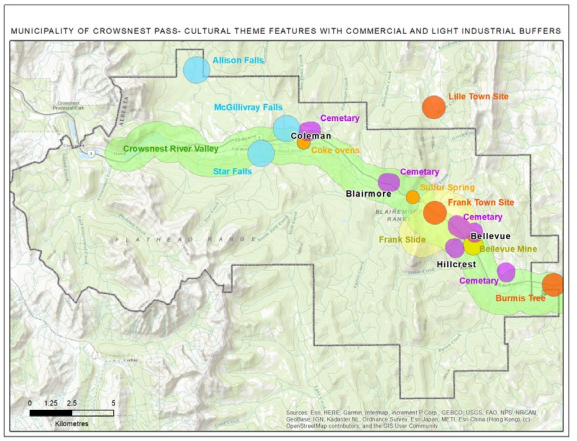


Figure 15

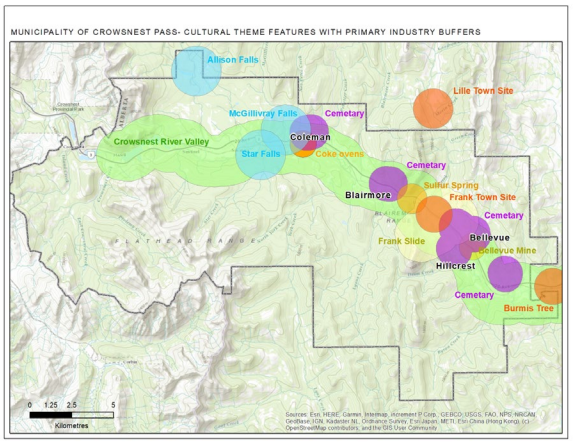


Figure 16

Table 3

Settlement/Infrastructure Feature	Refined Buffer to Residential (m)	Refined Buffer to Commercial / Light Industrial (m)	Refined Buffer to Primary Industry (m)
Low density residential	0	300	2000
Medium density residential	0	300	2000
Grouped country residential	300	300	1000
Commercial establishments	50	0	500
Light industrial parks	300	0	300
Transmission lines	300	100	19
Oil and gas infrastructure - Pipeline	500	500	8
Mineral extraction - Coalmines	0	0	0
Inactive Landfill Quarter Section	300	300	50
Primary highways*	300	0	0
Secondary highways*	300	0	0
Highway 3 realignment*	300	0	0
Paved roads*	0	0	0
Gravel roads*	0	0	0
Railways*	50	50	0
Raw water / Water treatment plants	50	100	2000

Combining Values…

A combined map was developed by overlaying and summing the ecological and cultural Conflict Probability Rating maps and removing No-Go Areas and settlement and infrastructure buffers for each development type. This approach highlighted areas of mutual high Conflict Probability Ratings and identifies on the landscape where development may be less suitable. The maps illustrate that as the brown colour darkens there is an increasing conflict with cultural values assigned by the municipal stakeholders (Figures 17, 18 and 19).

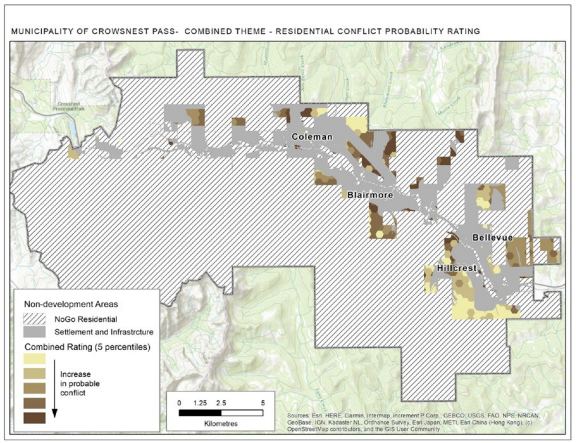


Figure 17

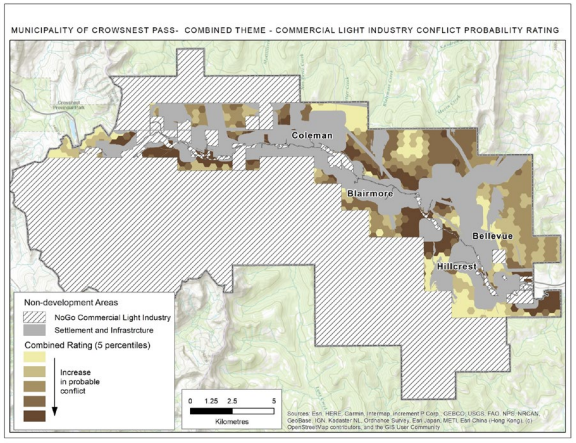


Figure 18

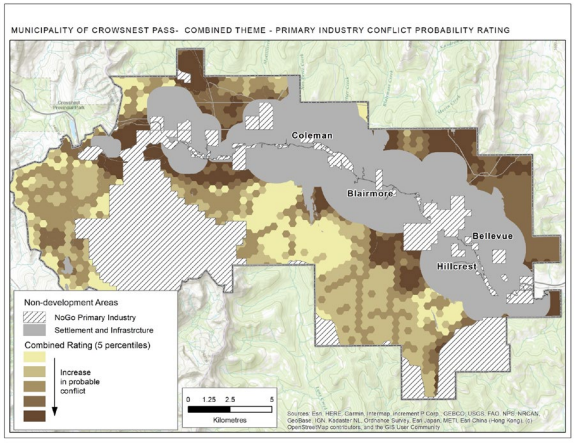


Figure 19

Most Suitable Areas for Development …

Lastly, to identify the most suitable areas for development, we used the inverse of the Combined Conflict Probability Rating Maps. On the maps below we highlight the lands that were identified as the most suitable (top 20%) for Residential development (yellow), the lands most suitable (top 20%) for Commercial / Light Industrial development (pink), and the lands most suitable (top 20%) for Heavy Industrial development (purple).

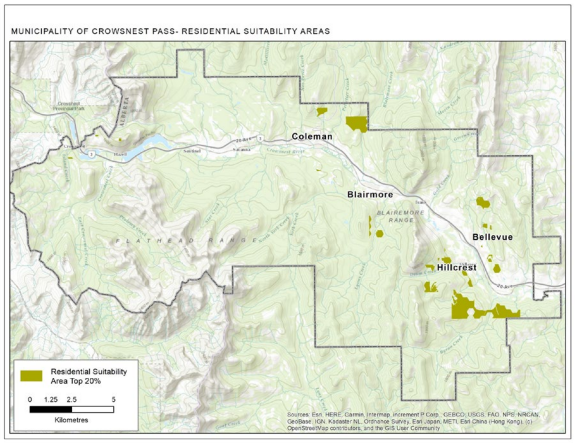


Figure 20

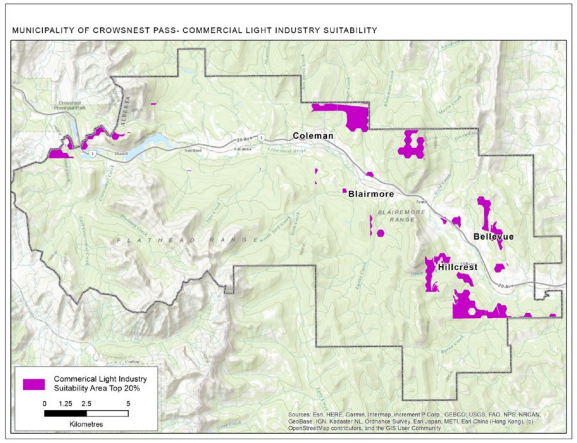


Figure 21

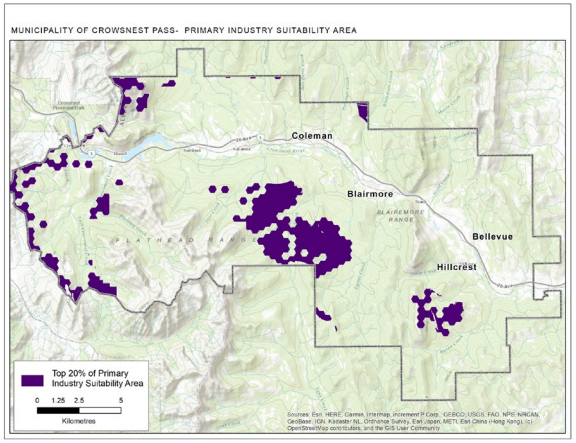


Figure 22



Municipal Land Use Sustainability Tool

Final Report



Municipal Land Use Sustainability Tool

Final Report

Introduction

The Miistakis Institute and Oldman River Regional Services Commission (ORRSC) developed the Municipal Land Use Suitability Tool (MLUST) to assist municipalities in planning where development is most suitable in consideration of other land uses including ecological, cultural and existing urban settlement. The MLUST process aims to identify areas within the Municipality of Crowsnest Pass most suitable for urban development while avoiding important ecological, cultural/scenic resources, and settlement and infrastructure at a municipal scale.

When municipal governments come to consider urban development, it immediately becomes clear that not everywhere is suitable for those various uses, and not everywhere is *unsuitable*. For some areas it is a clear-cut 'yes' or 'no', but most areas sit somewhere on a continuum between those two extremes. The MLUST proposes to support the Municipality of Crowsnest Pass in directing growth and development within the municipality by creating a series of 'Suitability Maps'. These maps are created by identifying lands where Residential, Commercial/Light Industrial, and Heavy Industrial development are less likely to conflict with the existing land use values.

Completion of the MLUST process in the Municipality of Crowsnest Pass provided an adaptable, malleable tool that can be tailored to different types of development. The Miistakis Institute and ORRSC approached the Municipality of Crowsnest Pass to complete the refined MLUST process regarding three overarching types of urban development:

- **Residential**, which is defined as permanent, developed habitations/dwellings which meet municipal servicing standards;
- **Commercial/Light Industrial**, which is defined as retail/business and smaller-scale industrial operations which primarily deal with the sale of personal and/or commercial goods and services and have minimal sound/odor emissions; and
- **Heavy (primary) Industrial**, which is defined as large-scale industrial operations which may potentially produce noxious emissions, undesirable noise and generate larger volumes of traffic.

The timing of the MLUST process coincided with preparation of a new Municipal Development Plan (MDP) by the Municipality of Crowsnest Pass. It was anticipated that the tool may be used in conjunction with the policies found in the MDP to direct development within the municipality.

Background of Process

This is the third iteration of the tool, and the current process has been adapted to address the specific context of the Municipality of Crowsnest Pass. Previously, the Miistakis Institute partnered with the County of Newell and Wheatland County (2018), to develop a Least Conflict Lands (LCL) Decision Support Tool to inform siting for renewable energy development. The LCL process and decision support tool was modeled after the Least Conflict Lands for Solar PV development in the San Joaquin Valley of California developed by Conservation Biology Institute, UC Berkeley School of Law, and Terrell Watt Planning Consultants[1]. The LCL process was rapid (6 months) and resulted in a municipal scale, non-regulatory planning tool that could be used by municipalities facing renewable energy development interest.

Upon completion of the LCL process, Miistakis partnered with ORRSC to identify improvements to the process and expansion of the tool to other rural municipalities in Alberta. ORRSC (municipal planning specialists) is well positioned to deliver MLUST as planners in southern Alberta. Improvements included expansion of the tool to consider other development types, clarity on function of feature within each theme, addition of a new settlement and infrastructure theme, adjustment of the engagement process to reduce time and focus on municipal council and staff and rebranding of the LCL decision support process and tool to MLUST.

The MLUST project was then taken to the Municipal District of Pincher Creek (MD) in 2019 and adapted to address suitability for wind and solar development. Initially, the exercise addressed renewable energies as a singular overarching category (i.e. wind and solar), however; throughout the process, it was determined that it would be more effective to separate the two types of renewable development due to differences in land consumption and structural features. With the guidance of council, municipal staff and agricultural service board representatives, the MD was able to develop two sets of Suitability Maps to assist in the decision-making process regarding the placement of wind and solar developments. Throughout the process, additional suggestions for improvement and refinement of the tool were brought forth including:

- Separating development types
- Providing clear definitions of landscape features
- Determining the scope of features concerning ‘viewsheds’

The current MLUST process builds on the successes of the previous iteration of the tool and tackled the challenge of creating a municipal scale, non-regulatory planning tool that could be used by urban and rural municipalities when planning Greenfield development.

[1] https://consbio.org/products/projects/san-joaquin-valley-planning

Project Constraints

Decision Support

It is important to remember that the MLUST is a decision-*support* tool, not a decision-*making* tool. The tool shows decision makers the relative suitability of various parts of the municipality for urban development, but it is not appropriate for parcel level decisions. The local government's final decision has two other critical mechanisms. First, municipal councillors must consider numerous other factors including economic development priorities, landowner attitudes, and costs to the municipality when they make a land use decision. The MLUST process supports this by identifying lands which may be more or less appropriate for a particular type of development. Second, while the MLUST is a planning tool, it is large scale and high level and does not provide site specific analyses or assessments at the parcel level. The development process requires detailed study about the specific development proposal at a specific location and it is anticipated that the proposal will generally align with the MLUST modeling, the MLUST tool should never be construed as providing this site-specific direction.

Scale of Use

The outputs of the MLUST process can be used to support development of statutory plans at two scales. The first being the Municipal Development Plan which provided guidance and directs high-level indications of priorities at the scale of the entire municipality. Secondly, the scale of the MLUST outputs can easily be incorporated into an Area Structure Plan, which supports broad intentions for the type and general location of different types of development within a municipality).

Spatial Modeling

Products from MLUST are spatial maps of the Municipality of Crowsnest Pass representing probable least conflict areas for ecological, cultural and existing settlement themes based on scoring and/or buffering of landscape features within each theme area or conversely, areas suitable for urban development. The process is dependent on availability and accuracy of the spatial data used to represent each identified feature. Sometimes features could not be represented spatially, or accurate data could be acquired, and are not included in the modeling.

MLUST Overview

MLUST Terminology

There are many terms used during the MLUST process, to help you navigate the language and process, terms are defined below:

Conflict Probability Rating – A derived score indicating an estimated likelihood that the proposed development (wind or solar) will come into conflict with an identified land use value.

Quantification – The process of converting the qualitative scores (very low, low, medium, high, very high) to quantitative scores (0-100), such that they can be incorporated into the modelling.

Land Use Theme – The three high-level categories of land use incorporated into the MLUST process and modelling: Ecological, Cultural, and Settlement and Infrastructure. Each theme is broken down further into 'Features.'

Feature – A subset of any of the three overarching land use Themes, used to break each Theme down into manageable, measurable land use values, and created to allow users to score different facets of a land use Theme.

Greenfield Development - The creation of new development on previously undeveloped land.

No-Go Area – An area with a prohibition or restriction for development due to an existing policy or regulatory constraint.

Scoring – The participant exercise of indicating if a given Feature was of value (very low, low, medium, high, very high) relative to the development type, indicating an inverse likelihood of compatibility.

Suitability Map – The ultimate product of the MLUST process, and the inverse of the Conflict Probability maps, showing where in the municipality wind/solar development would be best suited (most compatible) with existing land use values.

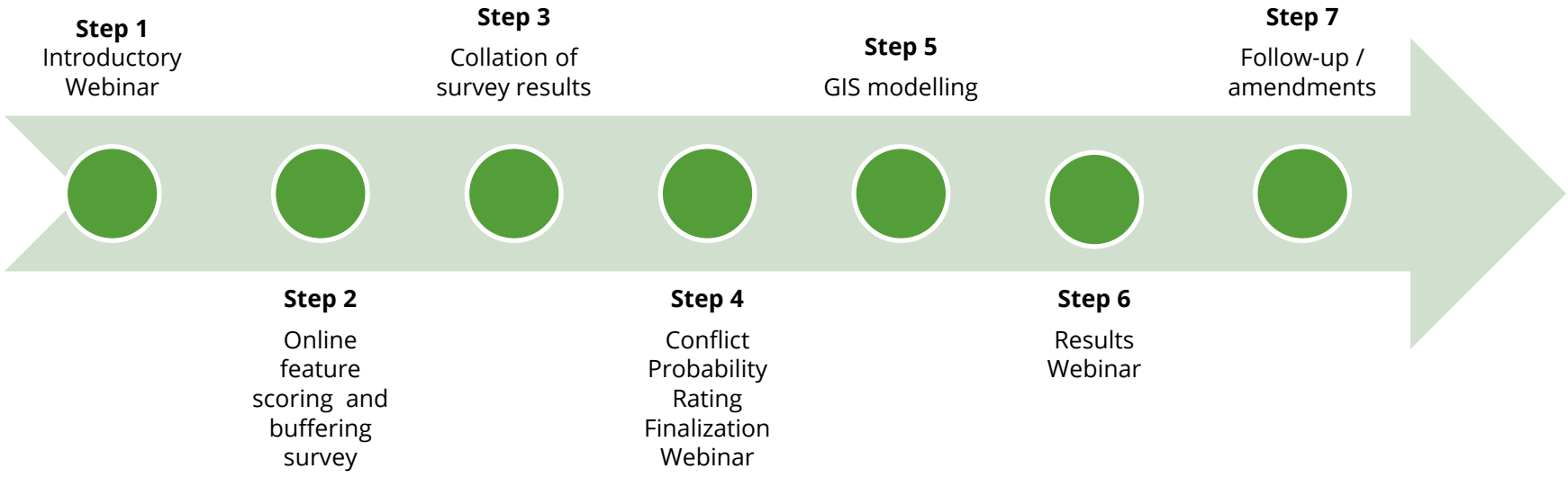
MLUST Process

The MLUST process uses a survey/scoring exercise to gather input on the 'value' of features which are then modelled to produce a series of maps. The process is dependent on available data and the accuracy of the spatial data to represent each of the themes and features.

The lead organizations, Miistakis Institute and ORRSC developed, managed and facilitated the MLUST process for the Municipality of Crowsnest Pass. ORRSC facilitated the survey/scoring exercise and Miistakis used the results to complete the GIS modelling and the development of maps, which can be used individually or layered to provide a composite map of land "values" identified by the municipality. Municipal stakeholders included all council members and municipal staff members including Chief Administrator and Planner. They participated in the engagement portions of the process, including three webinars and the online survey exercise.

A seven-step process was used to create the Municipal Land Use Suitability Tool.

FIGURE 1:



Due to the COVID-19 restrictions in 2020, ORRSC prepared and delivered an online webinar, with the assistance of the Miistakis Institute, which provided municipal stakeholders an overview of the MLUST project and the potential outcomes of the tool. In addition, participants were introduced to the "Themes and Features" components of the process and were taken through a tutorial regarding the online scoring exercise. Participants also identified scenic, tourism and landscape features of the municipality that would be included in the cultural theme of the scoring exercise. The first webinar was held twice to ensure all municipal stakeholders were introduced to the project and had a chance to provide input into the cultural theme feature discussion.

Municipal participants were asked to complete (via an emailed link) the online survey/scoring exercise which included both a value scoring exercise of the identified ecological and cultural features and a buffering exercise, which captured how far participants believed different uses should be separated from one another. All municipal stakeholders were provided two weeks to complete the survey. ORRSC tabulated the results of the scoring exercise and quantified the scores to create a Conflict Probability Rating for the features. The results were further examined to determine which Features which had high levels of agreement among participants regarding the value score as well as those Features which had greater disagreement in how participants valued them.

A second webinar with municipal participants was delivered to review and work through all areas of variation to come to consensus. ORRSC designed a web-based workshop, with support of Miistakis, which reviewed the Conflict Probability Rating for all the Features. As well participants reviewed the average buffer associated with Features and through discussion, came to consensus on those buffers that had a high degree of disagreement.

The Miistakis Institute undertook and completed the modelling exercise. This included creating a series of maps which depicted "No-Go" areas of the Municipality which included lands that could not be developed due to current legislation, the existence of natural or hazard lands or contained existing urban development or infrastructure. Miistakis also created a visual depicting the conversion of the Conflict Probability Rating for each feature into a composite map for each of the three Theme areas. Modelling results were provided back at the municipal scale which depicted the entire Municipality of Crowsnest Pass.

In early 2021, a final Webinar was delivered to present the modeling results to the Municipality. A copy of all supporting materials was kept by the Municipality of Crowsnest Pass, ORRSC, and the Miistakis Institute.

Selection of Land Use Themes, Groups and Features

Themes were selected by the lead organizations to represent broad categories of land uses that may occur within the Municipality of Crowsnest Pass. It was determined that the themes selected would focus on features of the following themes:

- Ecological,
- Cultural, and
- Settlement and Infrastructure.

Each of the Land Use Themes were divided into broad groups of features that comprised the larger theme. The Theme Groups contained a number of associated "features" which represented a subset of any of the three Land Use Themes. This approached was used to break each theme down into manageable and measurable land use values and created an opportunity to allow participants to score different components of a Land Use Theme.

During the first webinar, participants were provided an overview of land use themes proposed to be used in the project and examples of specific features within the theme areas to familiarize each person with the features and themes to be scored during the online survey. In addition, participants were requested to identify cultural resources (features) throughout the municipality that were of local importance.

Feature Scoring and Buffering Exercise

An online survey was created using *Survey Monkey* (https://www.surveymonkey.com/) and a copy of the Municipal Land Use Suitability Tool Feature Scoring Exercise is found in Appendix A.

Each participant was required to complete the exercise which included:

- indicating if a given feature was of value (very low, low, medium, high, very high) relative to the development type, and
- determining if a buffer should be applied to the footprint of the feature to setback development from the feature and if yes, to select the size of the buffer.

The online survey was delivered remotely, and participants were given two weeks to complete the exercise. The survey exercise was categorized by Theme and each section had a brief description of the Theme, the groups of features associated with the Theme and a list of additional land features that had been determined to be non-developable based on provincial/federal regulations that would be included in the modelling but are not required to be scored by the participants.

Ecological Theme

Participants were asked to score features by indicating if a given feature was of value to them personally (very low, low, medium, high, or very high).

Cultural Theme

The features identified by participants were separated into two subcategories: scenic features and community/tourism features for scoring exercise. Participants were asked to score each feature in terms of score each feature in terms its value to cultural theme value (very low, low, medium, high, very high). In addition, participants were asked to determine if a buffer was necessary to mitigate impacts from different broad categories of development (residential, commercial/light industrial, and heavy (primary) industrial)

Settlement and Infrastructure

Participants were provided a series of existing settlement and infrastructure features that may influence future development. The features were separated into four subcategories: urbanized areas, industrial infrastructure, transportation, and water management features. Participants were asked to identify desired buffers (distances) between the features and the different categories of development to identify desirable proximity between these uses.

TABLE 1: LAND USE FEATURE SCORE AND NUMERICAL QUANTIFICATION

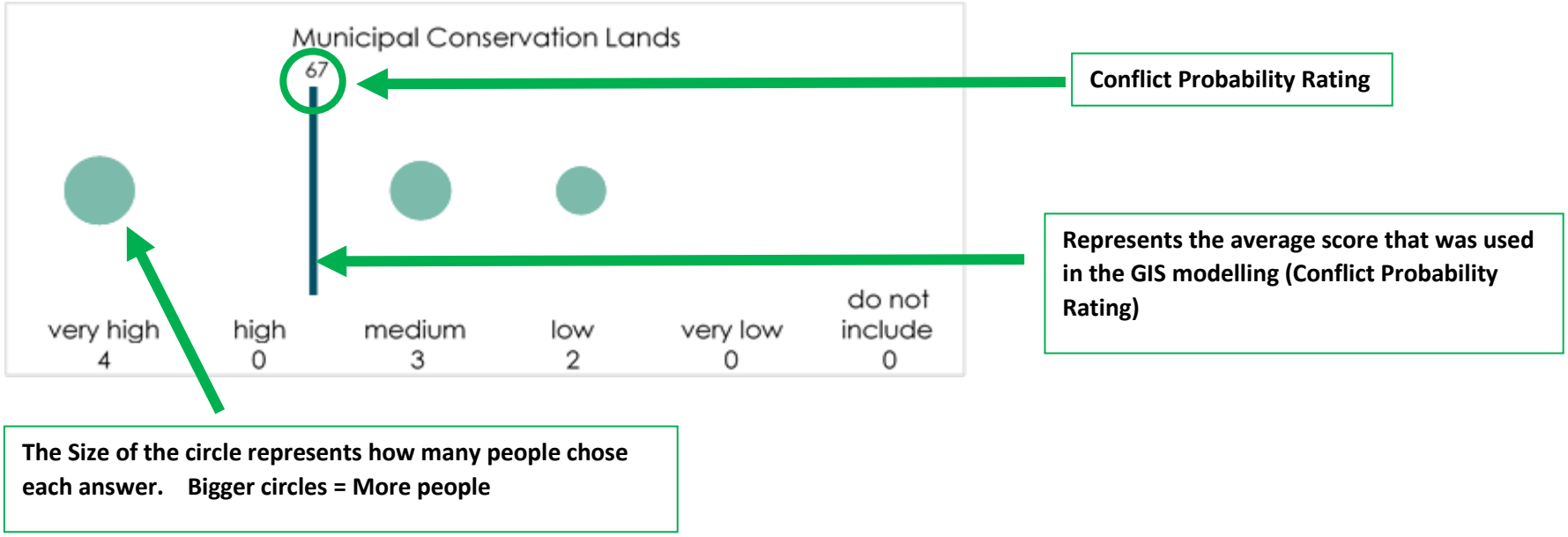
Land Use Feature Score	Numerical Quantification
VERY HIGH	100
HIGH	75
MEDIUM	50
LOW	25
VERY LOW	0
DO NOT INCLUDE	0

Quantification of the Score

Each participant provided a qualitative score for features to indicate if a given Feature was of value (very low, low, medium, high, very high) relative to the development type, indicating an inverse likelihood of compatibility. If there was a less agreement between participants on scores (less than 60% threshold) scores were averaged across all participants equally to create a Conflict Probability Rating for that feature. If there was strong agreement of scores between participants (threshold of 60%), the score was quantified to a number as shown in Table 1, where 100 represent very high and the highest score. Conflict Probability Ratings at the high end would indicate a higher probability of development coming into conflict with that land use (ecological or cultural), while scores at the lower end would indicate a low probability of conflict.

A table was created for each feature and the percent represents the participants who selected that score. Scores were quantified from (low<-->high) to a number (0-100) and averaged to produce a Conflict Probability Rating per feature. The feature scores from all participants were converted into graphs to display their Probability Conflict Rating. Bubble charts were then utilized as a visual aid for the process. In the bubble charts, the placement of each circle (aligned with the scores from Very Low to Very High) and the size of the circle represents how many people chose each answer (bigger circles = more people). The blue line represents the Conflict Probability Rating (average score) that was used for this feature in the GIS modelling.

Example of Bubble Graph:



Participants were presented the bubble graphs during Webinar 2 and features with higher levels of disagreement were highlighted for discussion. The scores were not changed and the average of these features with higher levels of disagreement was maintained. The full results are found in Appendix B.

Quantification of Buffers

Buffers for the cultural theme and the settlement and infrastructure theme were determined based on the average of the responses. However, there were certain features which showed a large level of disagreement, therefore the average could not be representative of all the responses. For instances of large disagreement, participants were asked if they were comfortable with maintaining the average of the responses or if they felt that the buffer should be changed. Discussion between the participants resulted in a number of settlement and infrastructure buffers being adjusted. Furthermore, the buffer options within the settlement and infrastructure theme included *>500 metres*. When that response was the preferred buffer distance for a given feature, participants were asked to discuss the feature, clarify their concerns, and come to a consensus on buffer distance. The full results are found in Appendix B.

Modeling Overview

MLUST results in a series of products, including Conflict Probability Rating Maps for the following Themes:

- Ecological,
- Cultural, and
- Settlement and infrastructure.

Together these maps are combined to create Conflict Probability Rating Map. To create the Suitability Maps for residential, commercial/light industrial, and primary (heavy) industrial development, No-Go areas and the settlement and infrastructure theme were extracted from the Combined Conflict Probability Rating Maps. Creating the maps required several steps to be performed in sequential order and the process is outlined under the Mapping Process section.

Modelling Process

To determine suitable areas for urban development, areas regulated as "No-Go" by provincial, municipal and organizational policies were mapped. In addition, settlement and infrastructure features footprints and associated buffers were mapped.

For the **Ecological Theme**, each feature was *scored* by each participant (low <--> high potential for conflict), *quantified* (converted to '0 <--> 100'), and then *averaged* (across all participants) to create a Conflict Probability Rating for that feature relative to urban development. A high Conflict Probability Rating indicates a higher probability of development coming into conflict with that land use, while ratings at the lower end indicate a low probability of conflict. These conflict probability ratings were applied to each ecological feature to create the 'Ecological Conflict Probability' layer and is applicable to all types of development.

For the **Cultural Theme**, the same Conflict Probability Rating process was completed for each feature and is applicable to all types of development. Additionally, a set of questions asked participants to indicate a preferred buffer between each cultural feature and the types of development that might occur in close proximity. The results for the cultural theme provided three distinct sets of buffer distance values as participants determined the optimum separation distance between the valued cultural feature and future urban development. The average separation distance, or buffer, was determined by the participants for each separate type of future development (residential, commercial/light industrial, and primary (heavy) industrial).

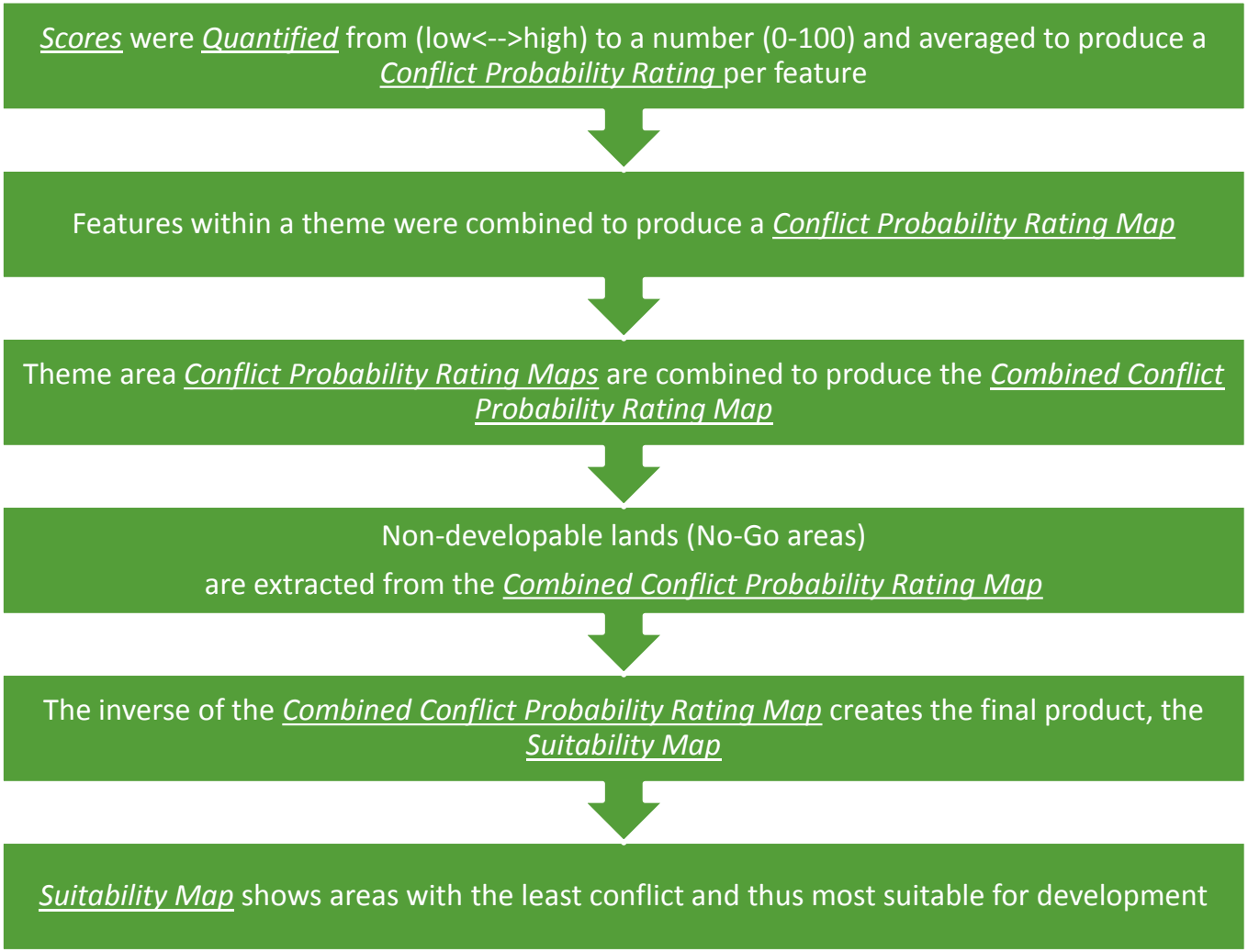
For the **Settlement and Infrastructure Theme**, participants were not asked to value the feature, so no Conflict Probability Rating was created. Rather, a set of questions asked participants to indicate a preferred buffer between each settlement and infrastructure feature and the types of development that might occur in close proximity. The results provided three distinct sets of buffer distance values as participants determined the optimum separation distance between the different settlement features and infrastructure features and future urban development. The average separation distance, or buffer, was determined by the participants for each separate type of future development (residential, commercial/light industrial, and primary (heavy) industrial). It should be noted that many of the settlement and infrastructure features have regulated setback distances which were considered in the finally modelling which would have set a minimum buffer. If the participants determined that a buffer should be greater than the mandated setback, the larger buffer was incorporated into the modelling.

Mapping Process

To visually map the Conflicting Probably Ratings for each theme, the Municipality of Crowsnest Pass was partitioned into equal-sized hexagons (equivalent to approximately 1 quarter section each). This pattern was chosen specifically to be less representative of landownership due to wanting the results not to be considered at the parcel scale. Each feature was applied to the hexagon grid based on area occurring in the hexagon and its assigned theme Conflict Probability Rating. To represent the entire theme for a given hexagon, the maximum value of that theme's underlying features was selected (taking the maximum value prevented double counting of features within the theme). Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating a rating in the highest 20%.

The Ecological and Cultural Conflict Probability Rating scores were added together to create a Combined Conflict Probability Rating Map for all of the lands within the Municipality. The Combined Conflict Probability Rating Map was then overlaid with the No-Go and Settlement and Infrastructure layers for each of the land use types (residential, commercial/light industrial and heavy industry) to depict the lands that would be most in conflict with the valued ecological and cultural features on the landscape. To highlight the lands most suitable for urban conversion and development, a map was produced that illustrated the inverse of the Conflict Probability Rating and highlighted suitable lands with lower Conflict Probability Rating values.

An additional map was created to illustrate the 20% percentile of most suitable land for each development type. The process is outlined below:



Results

The following subsections present the results of the process to identify Suitability Maps for residential, commercial/light industrial, and primary industrial development, respectively, within the Municipality of Crowsnest Pass. The modelling process for each type of development will be illustrated using the output maps accompanied by the applicable values determined through the MLUST Feature Scoring Exercise.







Residential Development Potential Results



Residential Development Potential Results

To understand where there is potential for urban residential development in Municipality of Crowsnest Pass we assessed the land availability as well as regulations that restrict urban development, documented as No-Go Areas (i.e., crown land, flood ways, conversation lands, etc.) in based on regulations/policy.

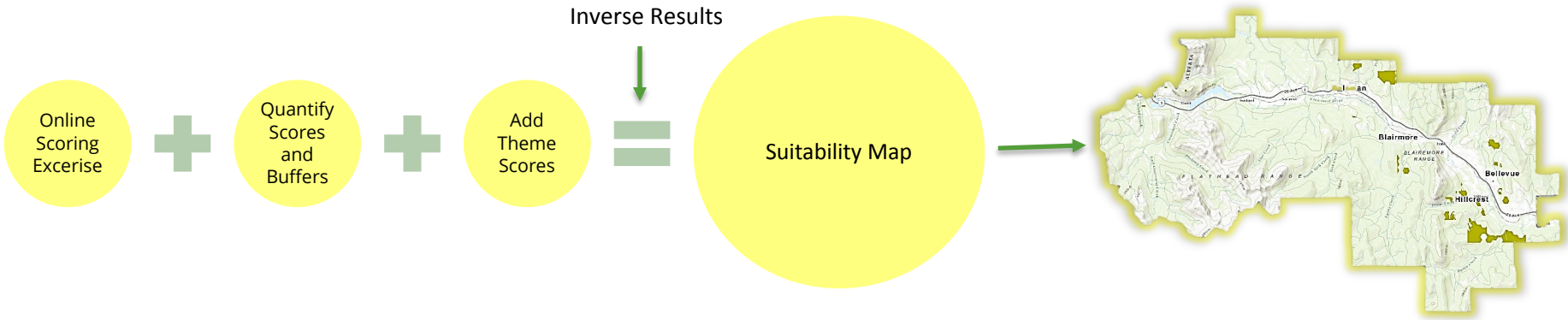
To create a layer of No-Go areas the following information was mapped:

- Private conservation lands
- Protected Areas
- Floodway and Flood Fringe
- Named Lakes, 30m Buffer
- Crown Land

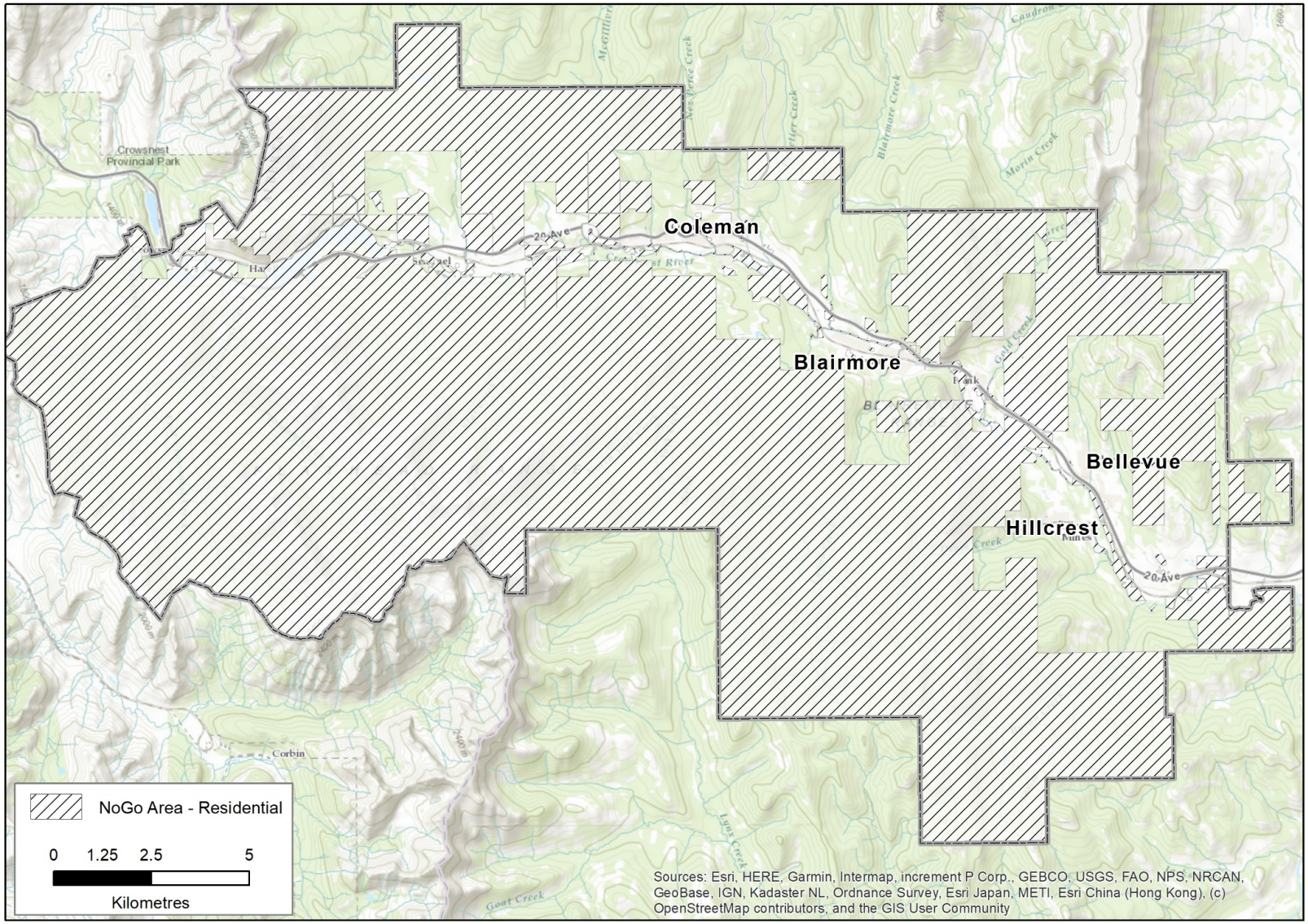
Crown Land was adjusted around Tent Mountain, so it is treated as No-Go as well. The following two feature layers were not included in the **No**-Go layer for residential development:

- Named Lakes, 100m Buffer
- Historic Resource Value 1-2

It was determined that residential development could occur in existing buildings that may have designated historic value and that for the purposes of this process those lands would be included in the calculation of potential lands available for development.



MUNICIPALITY OF CROWSNEST PASS- NOGO AREAS FOR RESIDENTIAL DEVELOPMENT

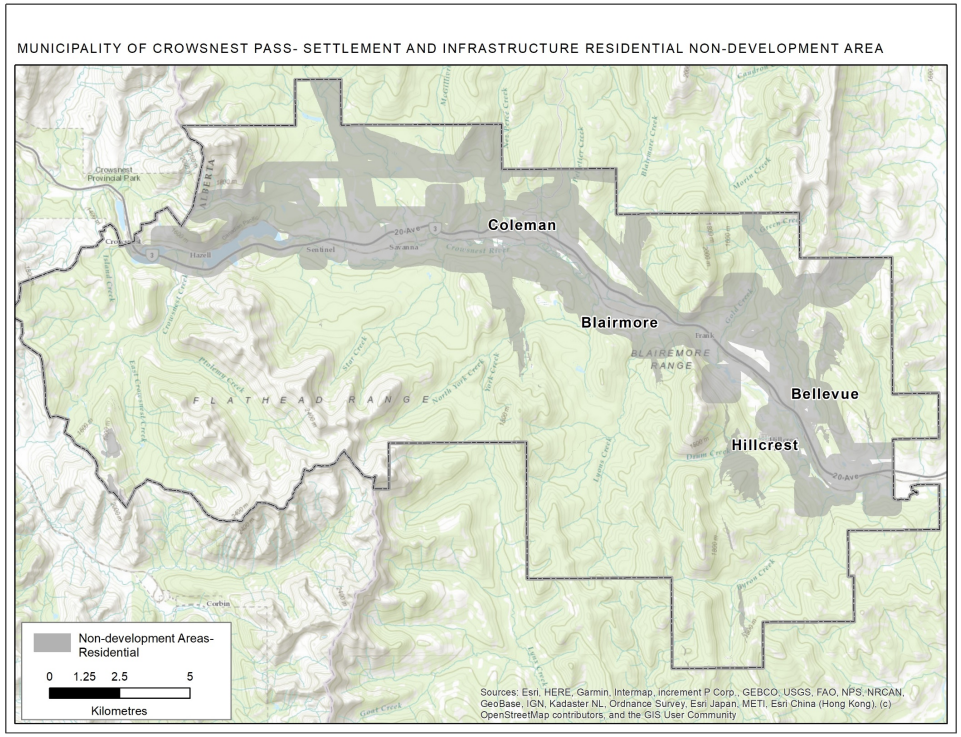


As well, participants were asked to buffer existing settlement and infrastructure features which may be of influence on the potential development of new residential development. The table below is a summary of the final buffer determined through consensus built during Webinar 2 and represents the distances between new residential development and other land uses or infrastructure features. These buffers include may be larger or smaller than the regulatory setbacks to highways, landfills or wastewater treatment facilities as there is a process to acquire waivers from the Province, therefore the setbacks consider in the modelling process represents the values of the participants in the MLUST project.

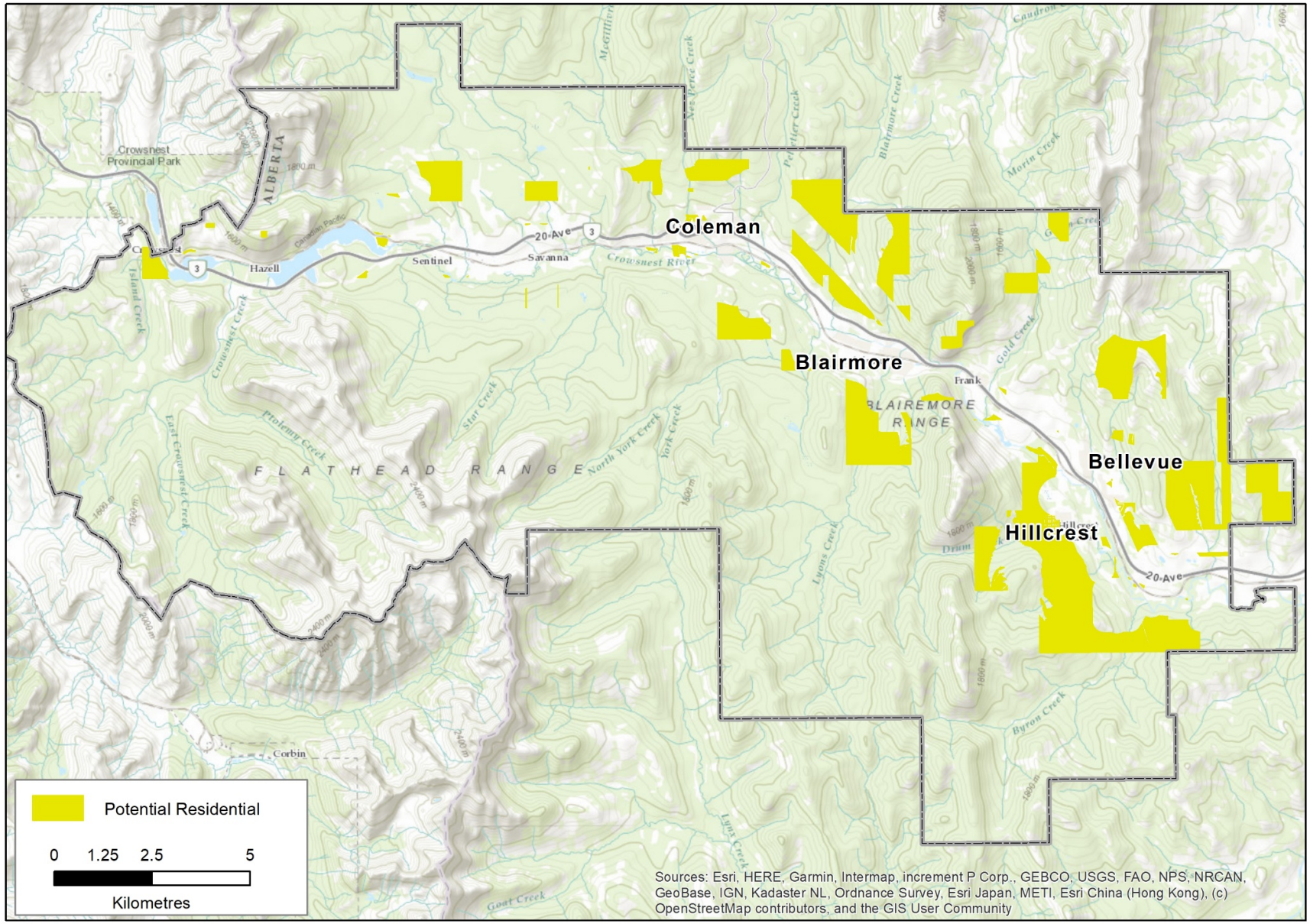
In order to identify what lands in the Municipality are available for residential development, the each of the GIS layers for No-Go areas and settlement and infrastructure were added together to create a Potential Residential Development Map.

TABLE 2: LAND USE FEATURE AND BUFFER - RESIDENTIAL

Settlement/Infrastructure Feature	Buffer in metres (m)
Low density residential	0
Medium density residential	100
Grouped country residential	300
Commercial establishments	50
Light industrial parks	300
Transmission lines	300
Oil and Gas Infrastructure	500
Mineral extraction	2000
Power plants	2000
Landfills	1500
Primary highways	300
Secondary highways	300
Highway 3 realignment	300
Paved roads	0
Gravel roads	0
Railways	50
Raw water/ Water treatment plants	50



MUNICIPALITY OF CROWSNEST PASS- POTENTIAL FOR RESIDENTIAL DEVELOPMENT



Municipal stakeholders were asked to identify the highest valued lands from an ecological perspective. They scored the ecological features (listed in table below) and provided a Conflict Probability Rating based on values from 0 to 100; where higher values equate to a high ecological value. Once ecological features were assigned a Conflict Probability Rating, all features were converted into a grid roughly the size of a section, then overlaid and the maximum value was assigned to produce an Ecological Conflict Probability Rating Map for all development types.

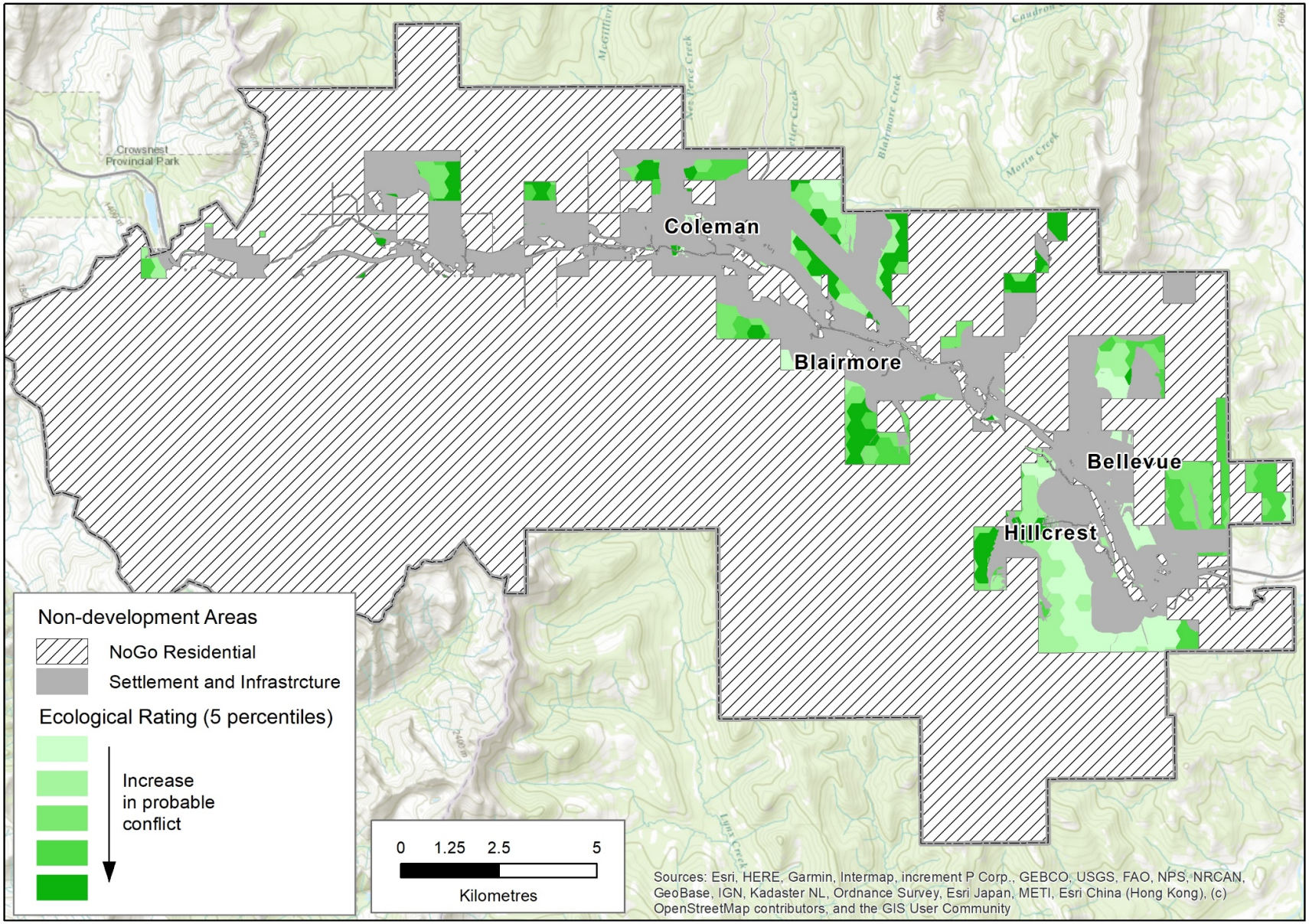
Many Ecological Theme features represent No-Go Areas and were not included in the Ecological Theme modeling. Wildlife movement areas were removed from modeling as this function is represented within the key wildlife and biodiversity zones. Features included in the modeling – wildlife habitat (key wildlife and biodiversity zones and grizzly bear core habitat, native prairie, riparian, waterways (rivers, streams and creeks), waterbodies (unnamed lakes and wetlands).

TABLE 3: ECOLOGICAL FEATURE AND CONFLICT PROBABILITY RATING - RESIDENTIAL

ECOLOGICAL THEME FEATURES	CONFLICT PROBABILITY RATING
Municipal conservation lands	67
Private conservation lands	50
Grizzly bear zones	64
Mountain goat and bighorn sheep range	64
Cutthroat trout	64
Elk winter range	66
Native grasslands	55
Wildlife movement areas	66
Riparian areas	71
Crowsnest River	85
Creeks	77
Lakes	74
Groundwater aquifer /recharge areas	85

The Ecological layer then had the No-Go layer and the settlement and infrastructure overplayed to produce a map which indicated of the potentially available lands for development. Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating the highest 20% or most conflict.

MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME - RESIDENTIAL CONFLICT PROBABILITY RATING



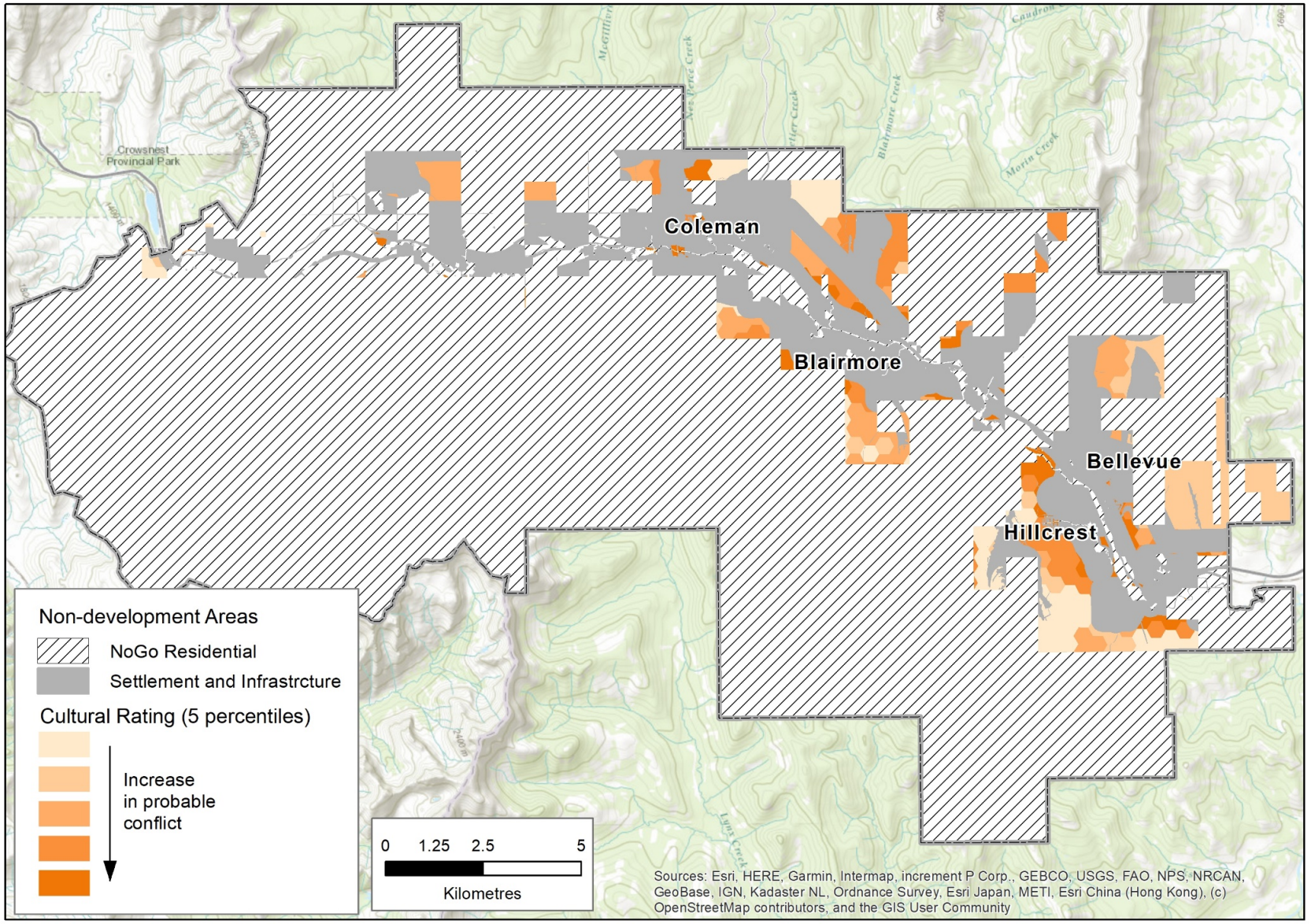
Municipal stakeholders were also asked to identify and score important scenic and tourism features within the municipality. The Conflict Probability Rating determined for each feature within the Cultural Theme were attributed to their respective GIS layers and the combined (averaged) CPR values are depicted on the 'Cultural Conflict Probability Map'. In addition, participants were asked to provide a buffer between the cultural feature and potential residential development. The table below is a summary of the final buffer determined through consensus built during Webinar 2 and represents the distances between new residential development and other land uses or infrastructure features.

TABLE 4: SCENIC FEATURE AND CONFLICT PROBABILITY RATING AND BUFFER - RESIDENTIAL

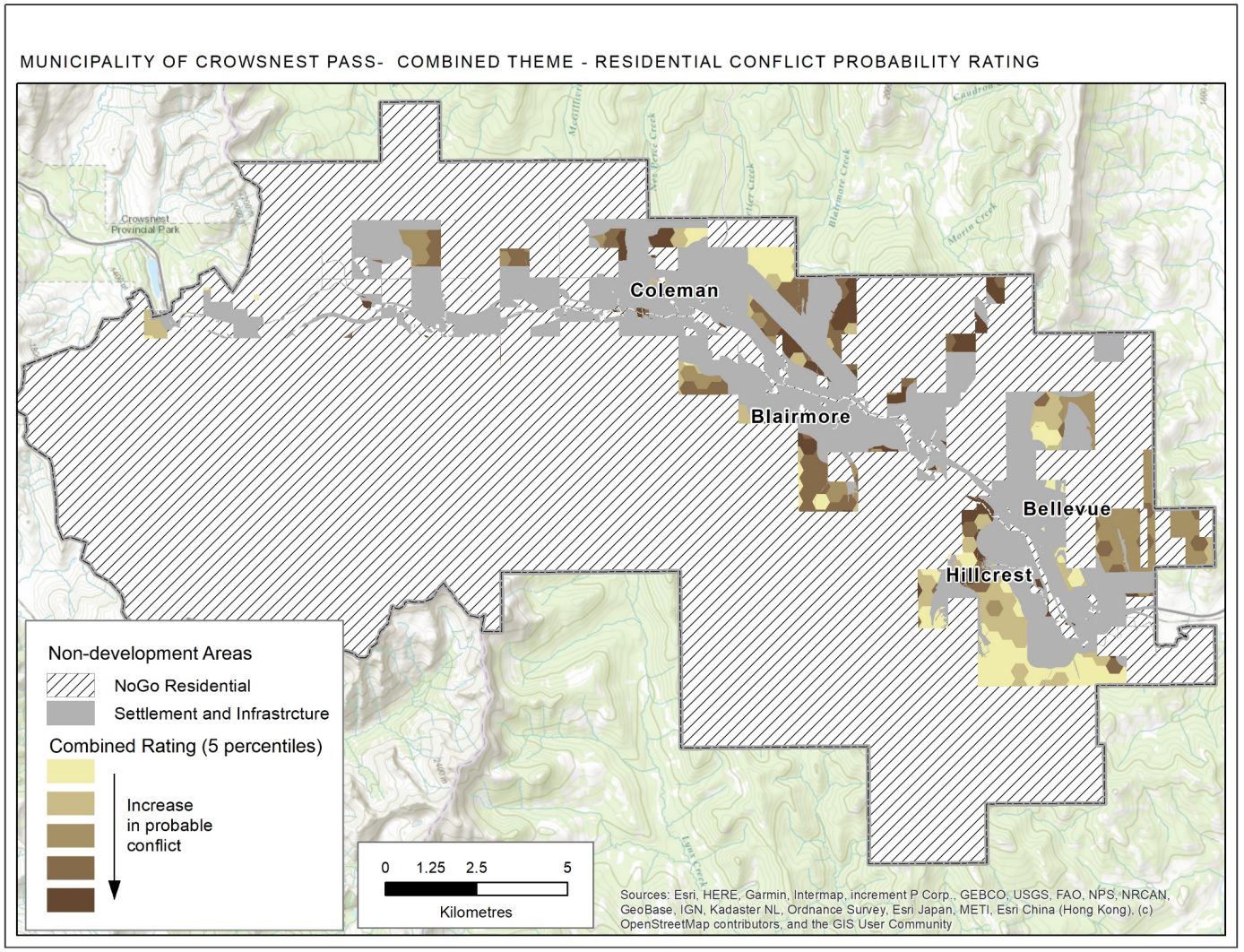
SCENIC FEATURES COMMUNITY/TOURISM FEATURES	CONFLICT PROBABILITY RATING	REFINED BUFFER (m)
Crowsnest River Valley	77	100
Viewshed of Crowsnest Mountain	82	500
Viewshed of South Coleman	69	300
Burmis Tree	63	300
Frank Slide	93	600
Bellevue Mine	79	200
Leitch Collieries	66	300
Mine cemeteries	68	200
Coke Ovens in Coleman	46	100
Sulphur Springs in Frank	52	100
Historic Town Site of Lille	63	100
Historic Town Site of Frank	63	300
McGilvary Falls	74	400
Star Creek Falls	71	400
Allison Creek Falls	74	400

Historic Resource Value (HRV) Class 1 and 2 are not included in the No-Go Areas and while HRV Class 3, 4, and 5 were included in the Cultural Theme modeling. It was decided for modelling purposes that each of the cultural features identified would be represented as a point and would have the associated buffer applied to the point data. It was determined that the Viewshed of Crowsnest Mountain and South Coleman would be best represented as a buffer around the point at the 100 m. The Cultural layer then had the No-Go layer and the settlement and infrastructure overlaid to produce a map which indicated those lands that had the highest and lowest Cultural value of the potential lands available for development. Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating the highest 20% or most conflict.

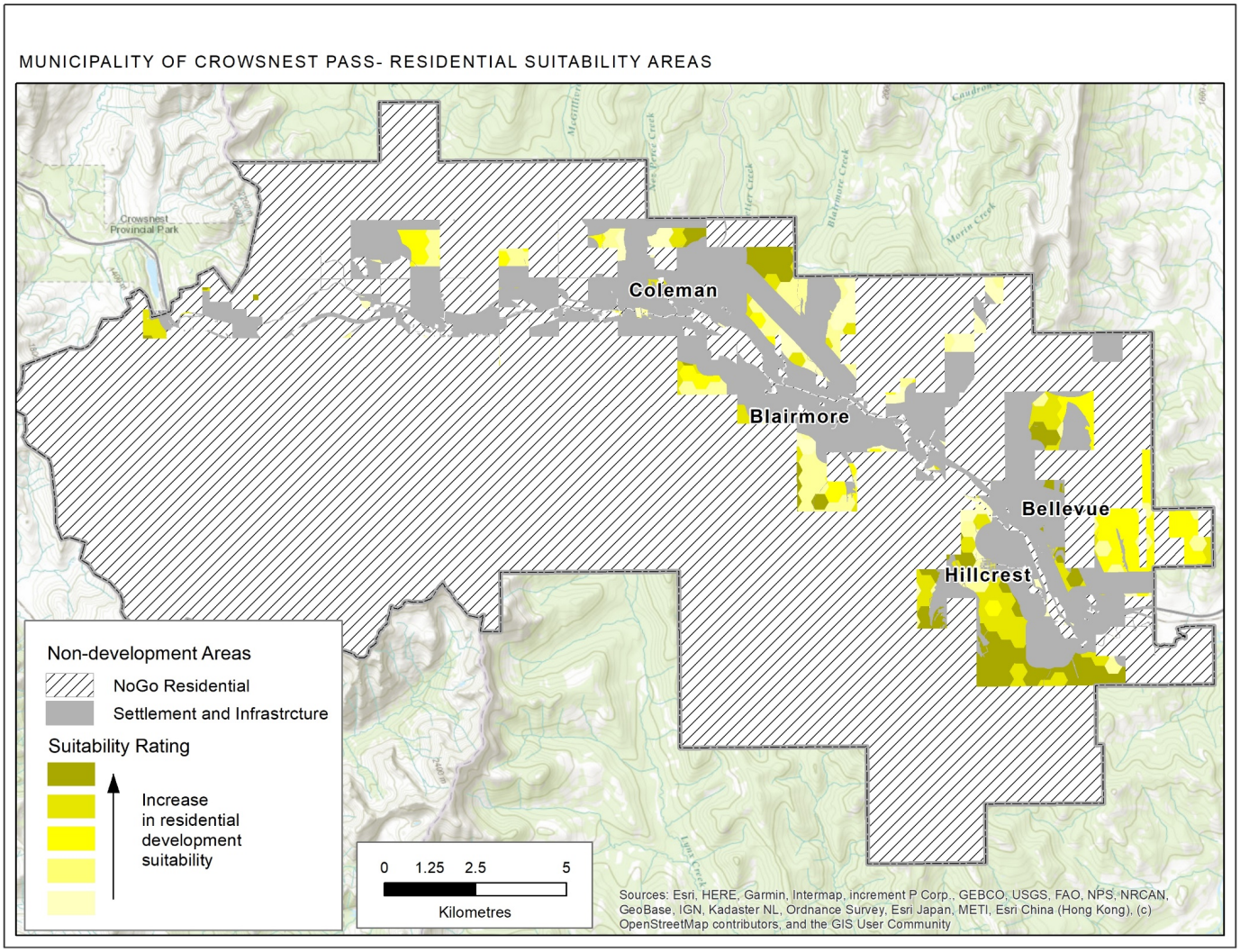
MUNICIPALITY OF CROWSNEST PASS- CULTURAL THEME -RESIDENTIAL CONFLICT PROBABILITY RATING



A combined map was developed by overlaying and summing the ecological and cultural Conflict Probability Rating maps. This approach highlighted areas of mutual high Conflict Probability Ratings and identifies on the landscape where residential development may be less suitable. Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating the highest 20% or most conflict.

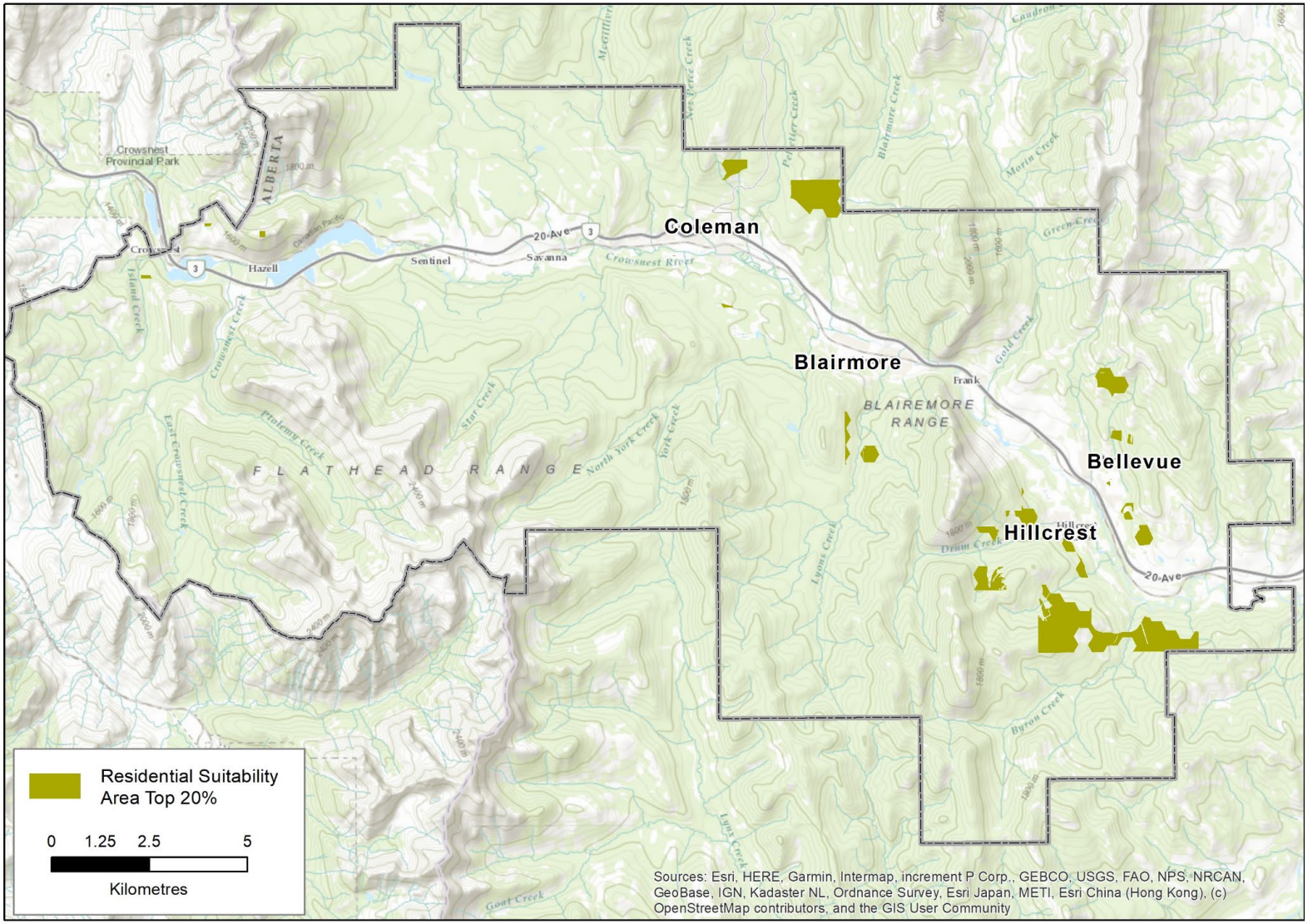


To determine the Urban Development Suitability Areas we used the Combined Conflict Probability Rating Map and extracted the No-Go Areas and Settlement and Infrastructure Theme model to produce Urban Development Suitability Areas. Suitability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicates the highest 20% or most the suitable.



The map was further refined to depict the top 20 percent of land most suitable for residential development.

MUNICIPALITY OF CROWSNEST PASS- RESIDENTIAL SUITABILITY AREAS



Commercial / Light Industrial Development Potential Results



Commercial / Light Industrial Development Potential Results

To understand where there is potential for urban non-residential development in Municipality of Crowsnest Pass we assessed the land availability as well as regulations that restrict urban commercial and/or light industrial development which were documented as No-Go Areas (i.e., crown land, flood ways, conversation lands, etc.) in based on regulations/policy.

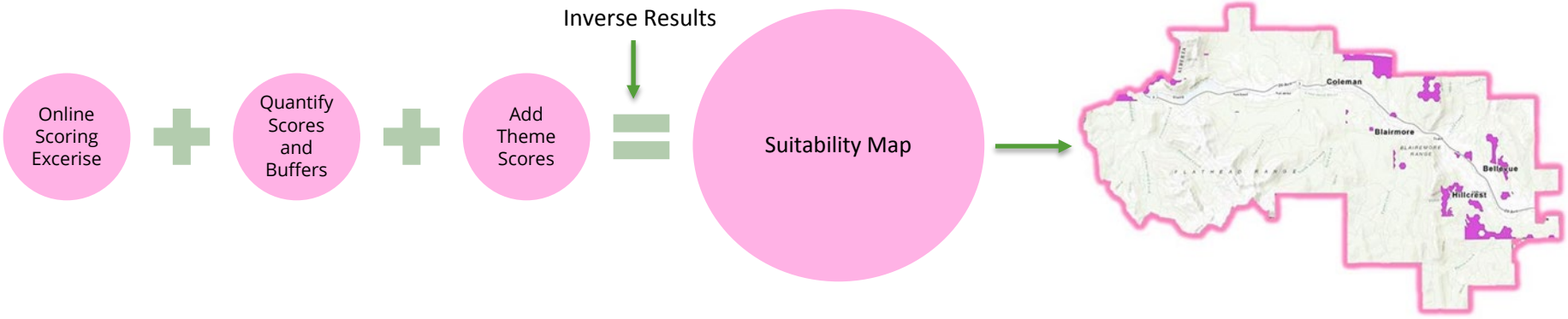
To create a layer of No-Go areas the following information was mapped:

- Private conservation lands
- Protected Areas (including Castle Provincial Park)
- Floodway and Flood Fringe
- Named Lakes, 30m Buffer
- Crown Land

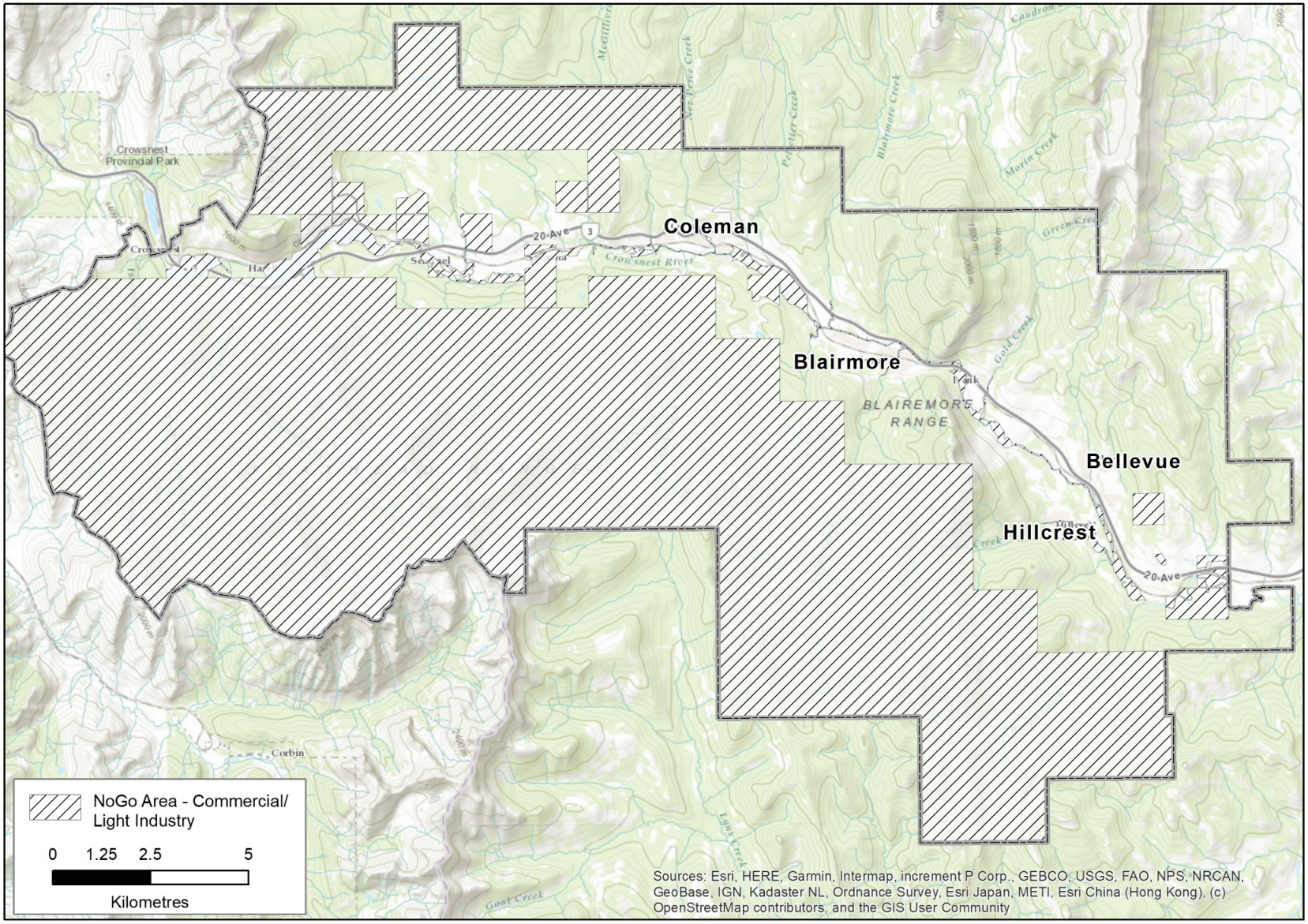
Crown Land was adjusted to include lands around Tent Mountain, which determined to be similar to Crown land, so it is treated as No-Go. As well as it was determined that the likelihood of commercial development on Crown land would be low. The following two feature layers were not included in the No-Go layer for residential development:

- Named Lakes, 100m Buffer
- Historic Resource Value 1-2

It was determined that commercial / light industrial development could occur in existing buildings that may have designated historic value and that for the purposes of this process would be included in the calculation of potential lands available for development.



MUNICIPALITY OF CROWSNEST PASS- NOGO AREAS FOR COMMERICAL/ LIGHT INDUSTRY

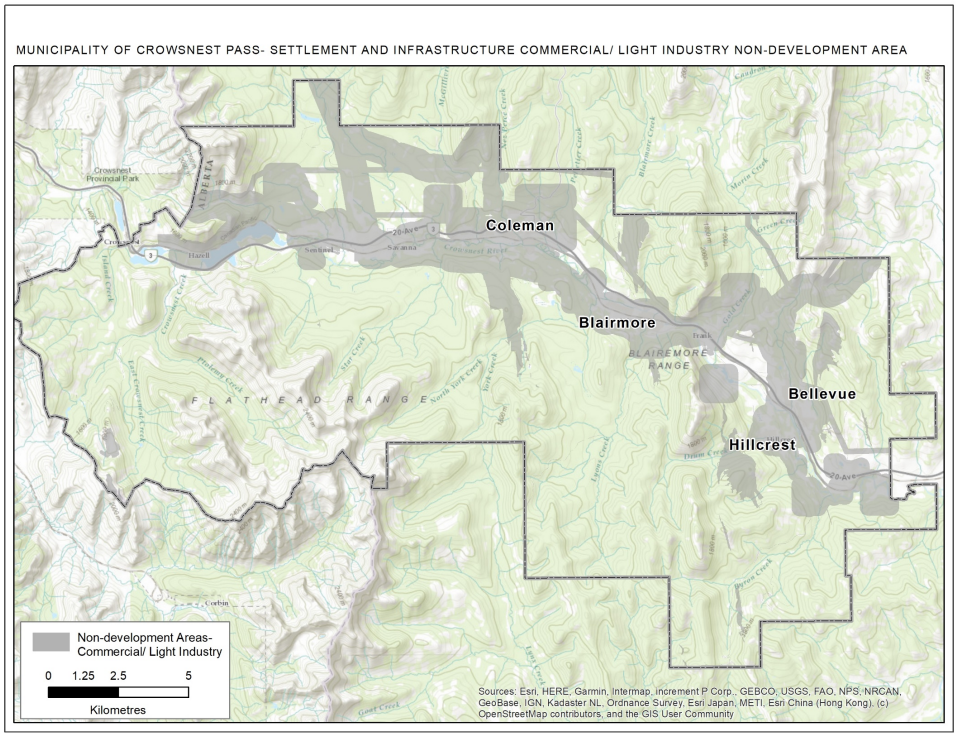


As well, participants were asked to buffer existing settlement and infrastructure features which may be of influence on the potential development of new commercial / light industrial development. The table below is a summary of As well, participants were asked to buffer existing settlement and infrastructure features which may be of influence on the potential development of new commercial / light industrial development. The table below is a summary of the final buffer determined through consensus built during Webinar 2 and represents the distances between new commercial / light industrial development and other land uses or infrastructure features. These buffers include may be larger or smaller than the regulatory setbacks to highways, landfills or wastewater treatment facilities as there is a process to acquire waivers from the Province, therefore the setbacks consider in the modelling process represents the values of the participants in the MLUST project.

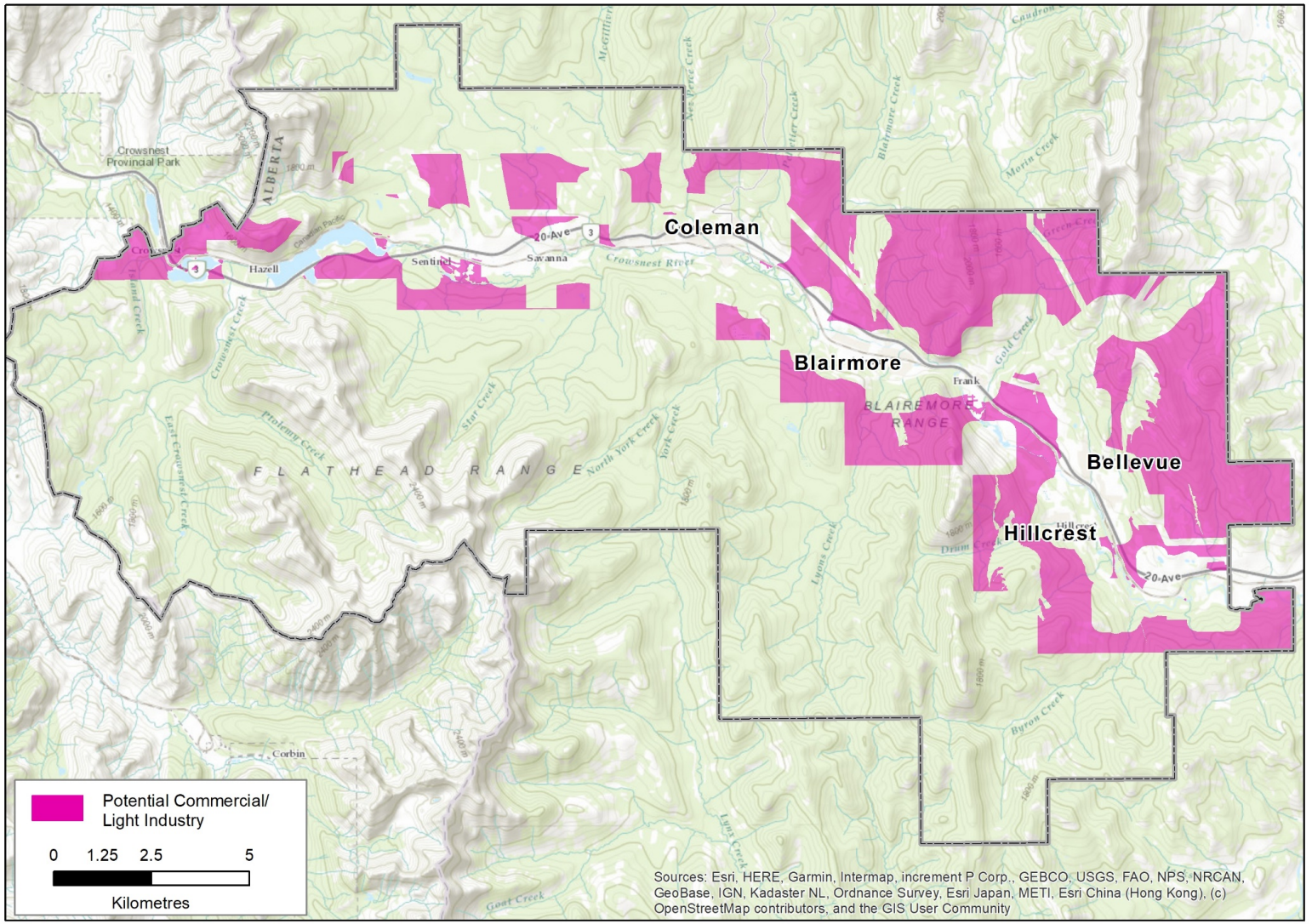
To identify what lands in the Municipality are available for commercial / light industrial development, the each of the GIS layers for No-Go areas and settlement and infrastructure were added together to create a Potential Commercial / Light Industrial Development Map.

TABLE 5: SETTLEMENT AND INFRASTRUCTURE FEATURES AND BUFFER - COMMERCIAL / LIGHT INDUSTRIAL

Settlement/Infrastructure Feature	Buffer in metres (m)
Low density residential	300
Medium density residential	300
Grouped country residential	300
Commercial establishments	0
Light industrial parks	0
Transmission lines	100
Oil and Gas Infrastructure	500
Mineral extraction	2000
Power plants	2000
Landfills	1000
Primary highways	0
Secondary highways	0
Highway 3 realignment	0
Paved roads	0
Gravel roads	0
Railways	50
Raw water / Water treatment plant	100



MUNICIPALITY OF CROWSNEST PASS- POTENTIAL FOR COMMERCIAL/ LIGHT INDUSTRY



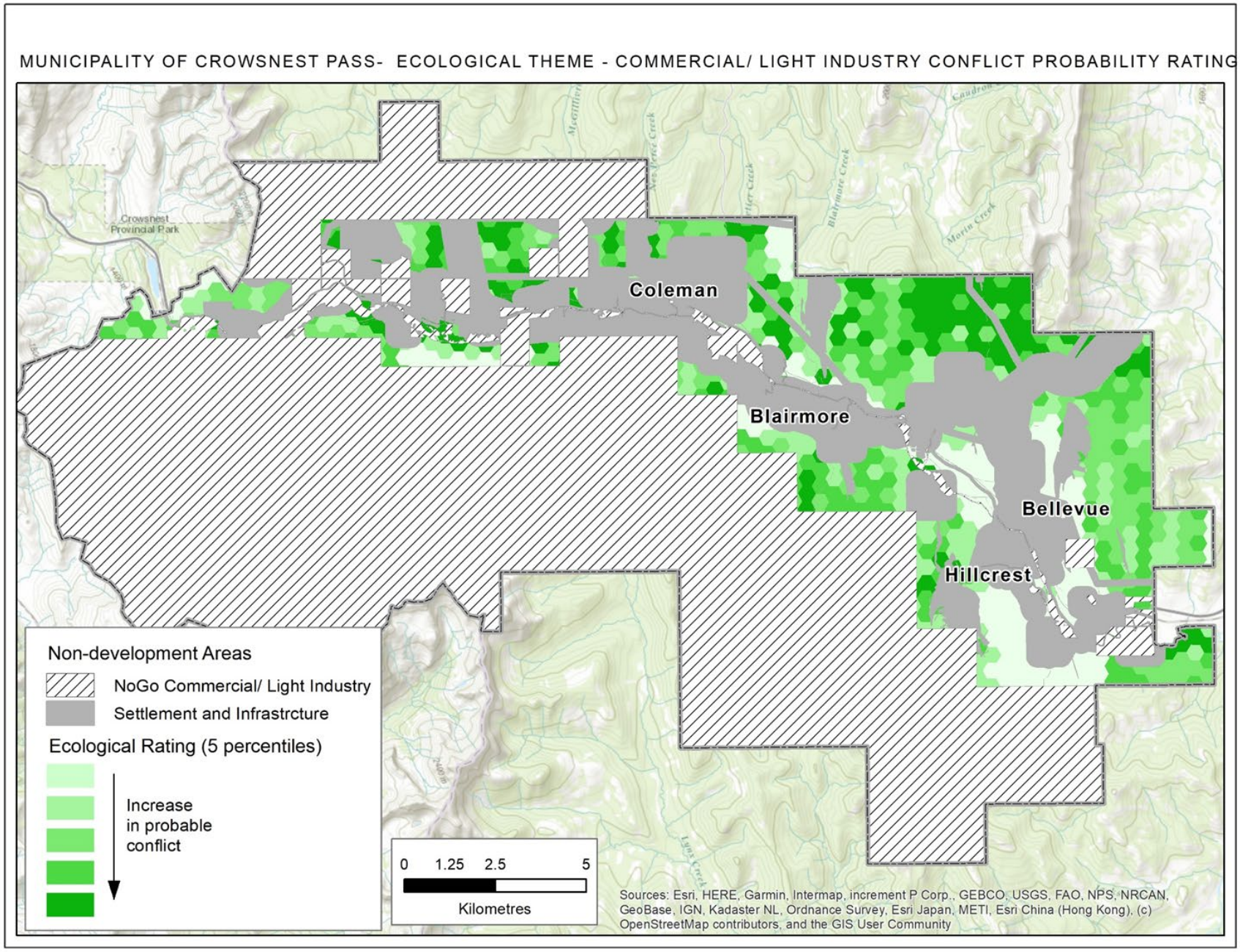
Municipal stakeholders were asked to identify the highest valued lands from an ecological perspective. They scored the ecological features (listed in table below) and provided a Conflict Probability Rating based on values from 0 to 100; where higher values equate to a high ecological value. Once ecological features were assigned a Conflict Probability Rating, all features were converted into a grid roughly the size of a section, then overlaid and the maximum value was assigned to produce an Ecological Conflict Probability Rating Map for all development types.

Many Ecological Theme features represent No-Go Areas and were not included in the Ecological Theme modeling. Wildlife movement areas were removed from modeling as this function is represented within the key wildlife and biodiversity zones. Features included in the modeling – wildlife habitat (key wildlife and biodiversity zones and grizzly bear core habitat, native prairie, riparian, waterways (rivers, streams and creeks), waterbodies (unnamed lakes and wetlands).

TABLE 6: ECOLOGICAL FEATURES AND CONFLICT PROBABILITY RATING - COMMERCIAL / LIGHT INDUSTRIAL

ECOLOGICAL THEME FEATURES	CONFLICT PROBABILITY RATING
Municipal conservation lands	67
Private conservation lands	50
Grizzly bear zones	64
Mountain goat and bighorn sheep range	64
Cutthroat trout	64
Elk winter range	66
Native grasslands	55
Wildlife movement areas	66
Riparian areas	71
Crowsnest River	85
Creeks	77
Lakes	74
Groundwater aquifer recharge areas	85

The Ecological layer then had the No-Go layer and the settlement and infrastructure overplayed to produce a map which indicated of the potentially available lands for development. Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating the highest 20% or most conflict.


MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME - COMMERCIAL/ LIGHT INDUSTRY CONFLICT PROBABILITY RATING
Crowsnest Provincial Park
Coleman
Blairmore
Bellevue
Hillcrest
Non-development Areas
NoGo Commercial/ Light Industry
Settlement and Infrastrcture
Ecological Rating (5 percentiles)
Increase in probable conflict
0 1.25 2.5 5
Kilometres
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

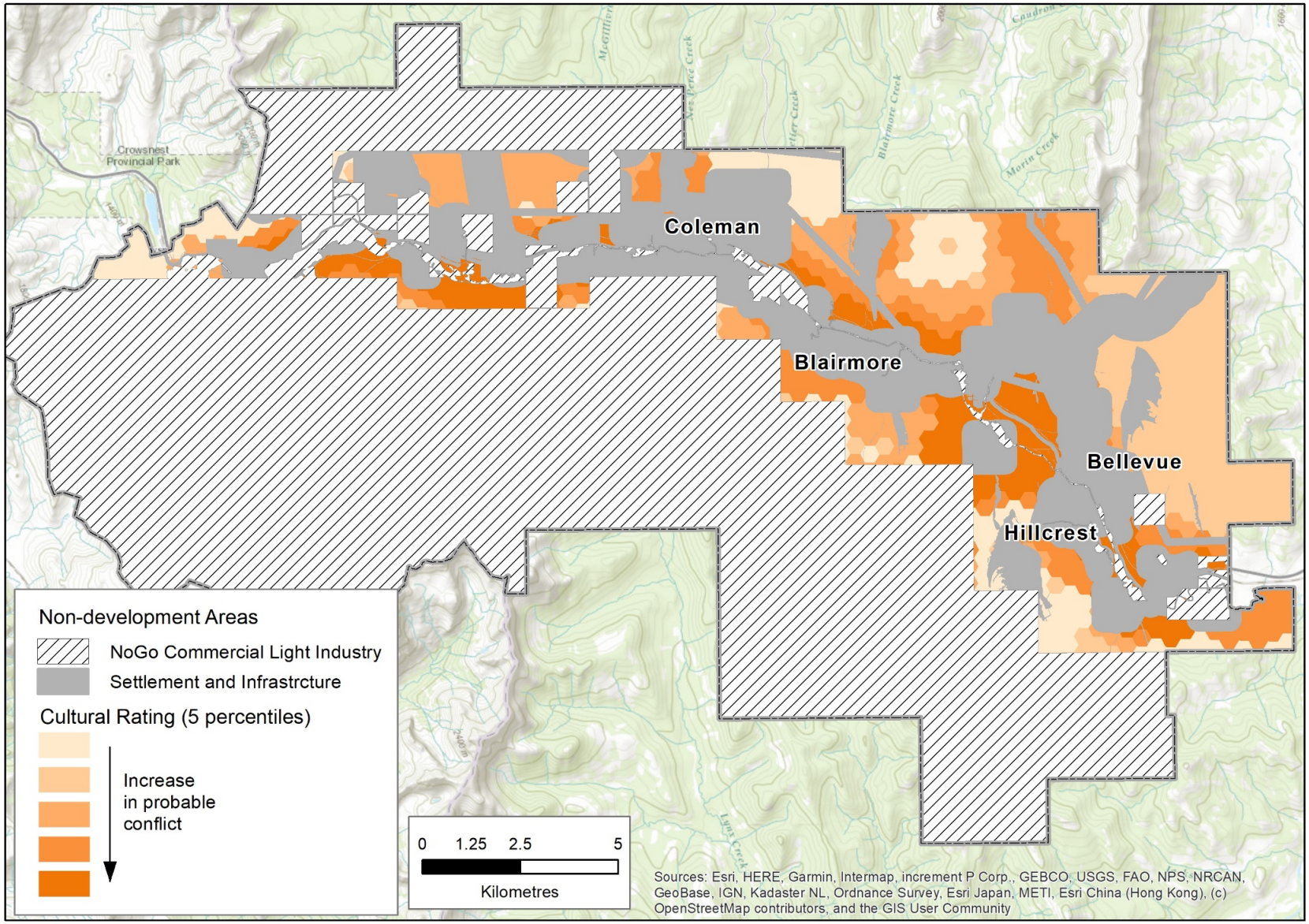
Municipal stakeholders were also asked to identify and score important scenic and tourism features within the municipality. The Conflict Probability Rating determined for each feature within the Cultural Theme were attributed to their respective GIS layers and the combined (averaged) CPR values are depicted on the 'Cultural Conflict Probability Map'. In addition, participants were asked to provide a buffer between the cultural feature and potential commercial / light industrial development. The table below is a summary of the final buffer determined through consensus built during Webinar 2 and represents the distances between new commercial / light industrial development and other land uses or infrastructure features.

TABLE 7: SCENIC FEATURES AND BUFFER - COMMERCIAL / LIGHT INDUSTRIAL

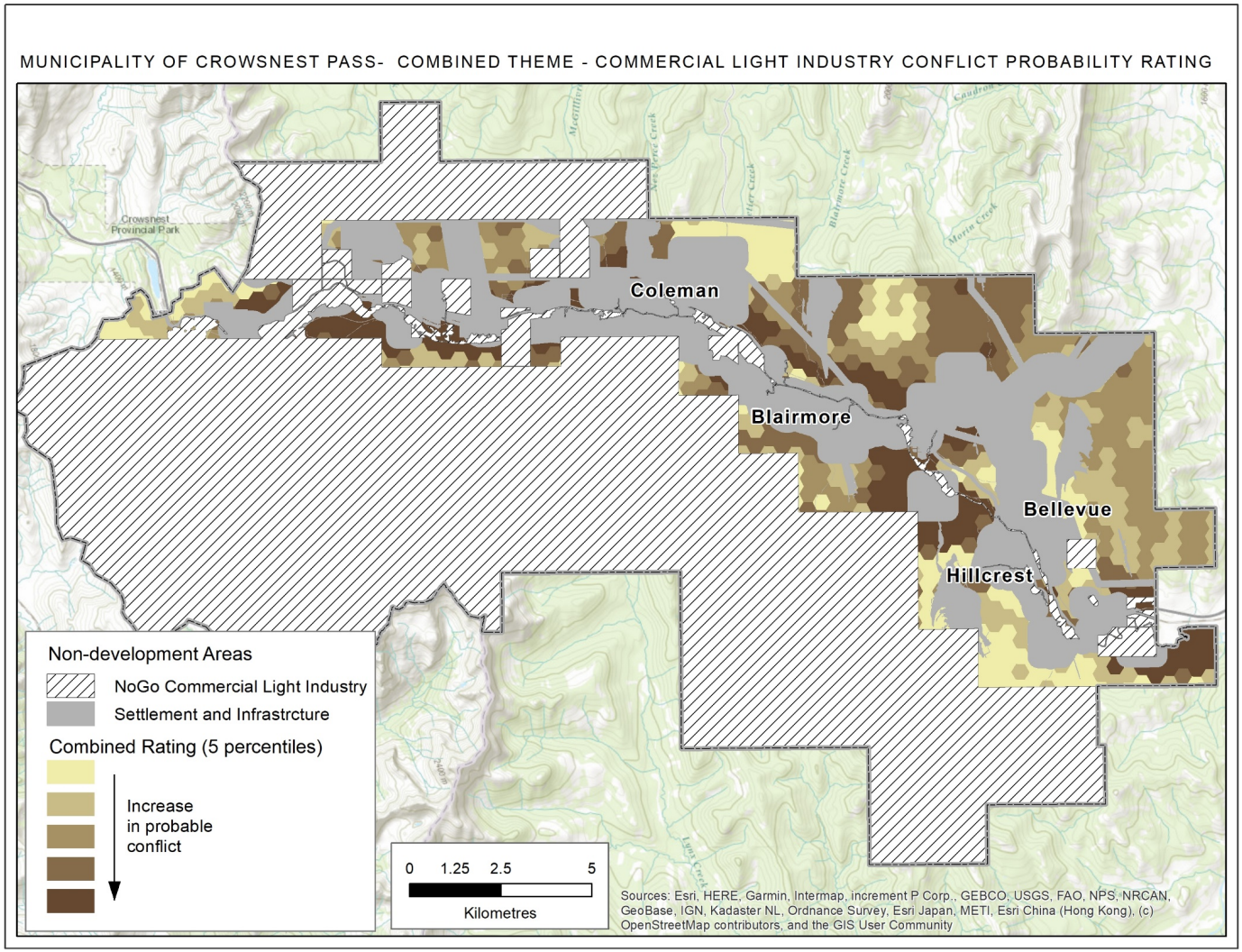
SCENIC FEATURES COMMUNITY/TOURISM FEATURES	CONFLICT PROBABILITY RATING	REFINED BUFFER (m)
Crowsnest River Valley	77	500
Viewshed of Crowsnest Mountain	82	800
Viewshed of South Coleman	69	700
Burmis Tree	63	700
Frank Slide	93	900
Bellevue Mine	79	600
Leitch Collieries	66	600
Mine cemeteries	68	500
Coke Ovens in Coleman	46	400
Sulphur Springs in Frank	52	400
Historic Town Site of Lille	63	700
Historic Town Site of Frank	63	700
McGilvary Falls	74	800
Star Creek Falls	71	800
Allison Creek Falls	74	800

Historic Resource Value (HRV) Class 1 and 2 are not included in the No-Go Areas and while HRV Class 3, 4 and 5 were included in the Cultural Theme modeling. It was decided for modelling purposes that each of the cultural features identified would be represented as a point and would have the associated buffer applied to the point data and it was determined that the Viewshed of Crowsnest Mountain and South Coleman would be best represented as a buffer around the point at the 100 m. The Cultural layer then had the No-Go layer and the settlement and infrastructure overlaid to produce a map which indicated those lands that had the highest and lowest Cultural value of the potential lands available for development. Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating the highest 20% or most conflict.

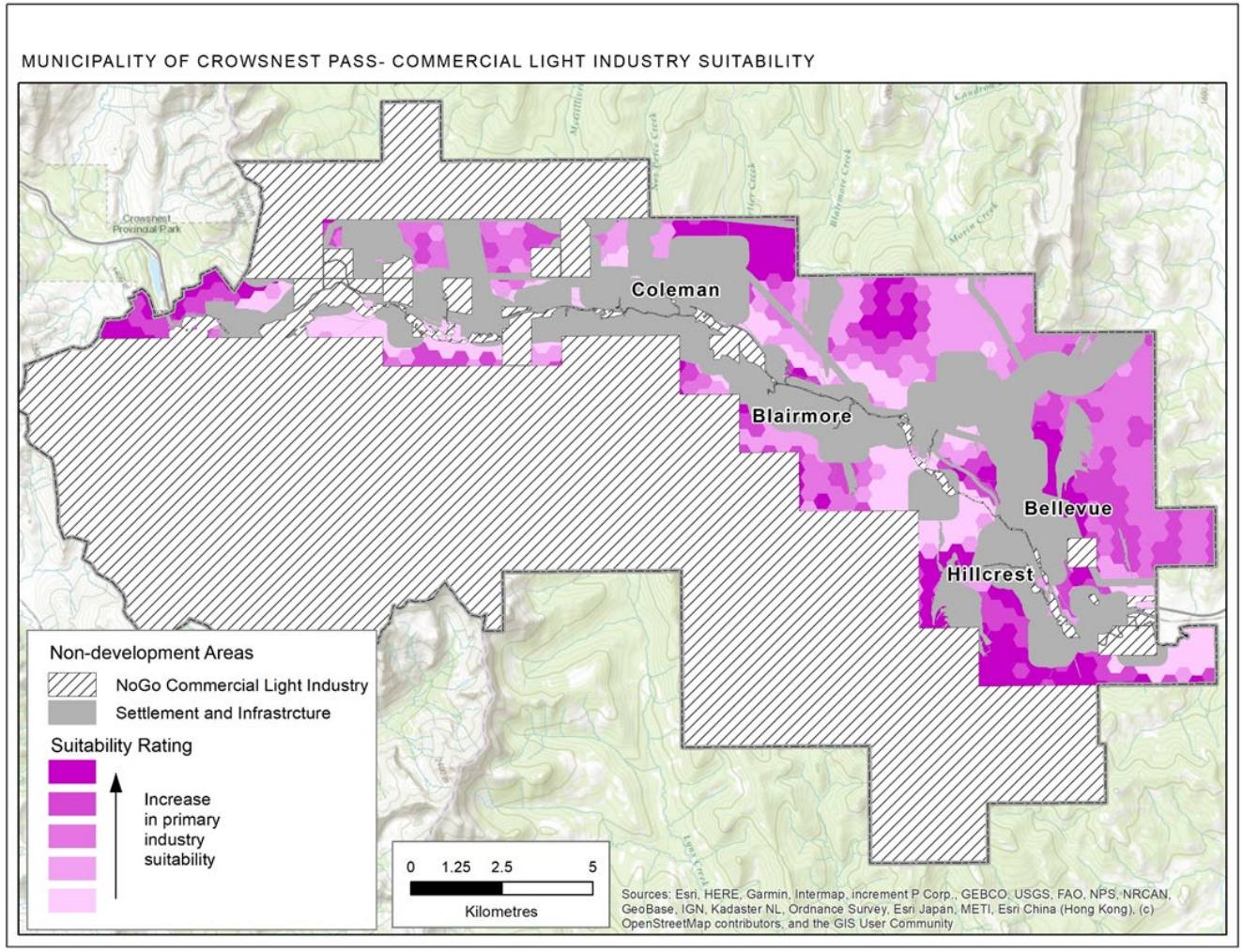
MUNICIPALITY OF CROWSNEST PASS- CULTURAL THEME - COMMERCIAL LIGHT INDUSTRY CONFLICT PROBABILITY RATING



A combined map was developed by overlaying and summing the ecological and cultural Conflict Probability Rating maps. This approach highlighted areas of mutual high Conflict Probability Ratings and identifies on the landscape where residential development may be less suitable. Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating the highest 20% or most conflict.

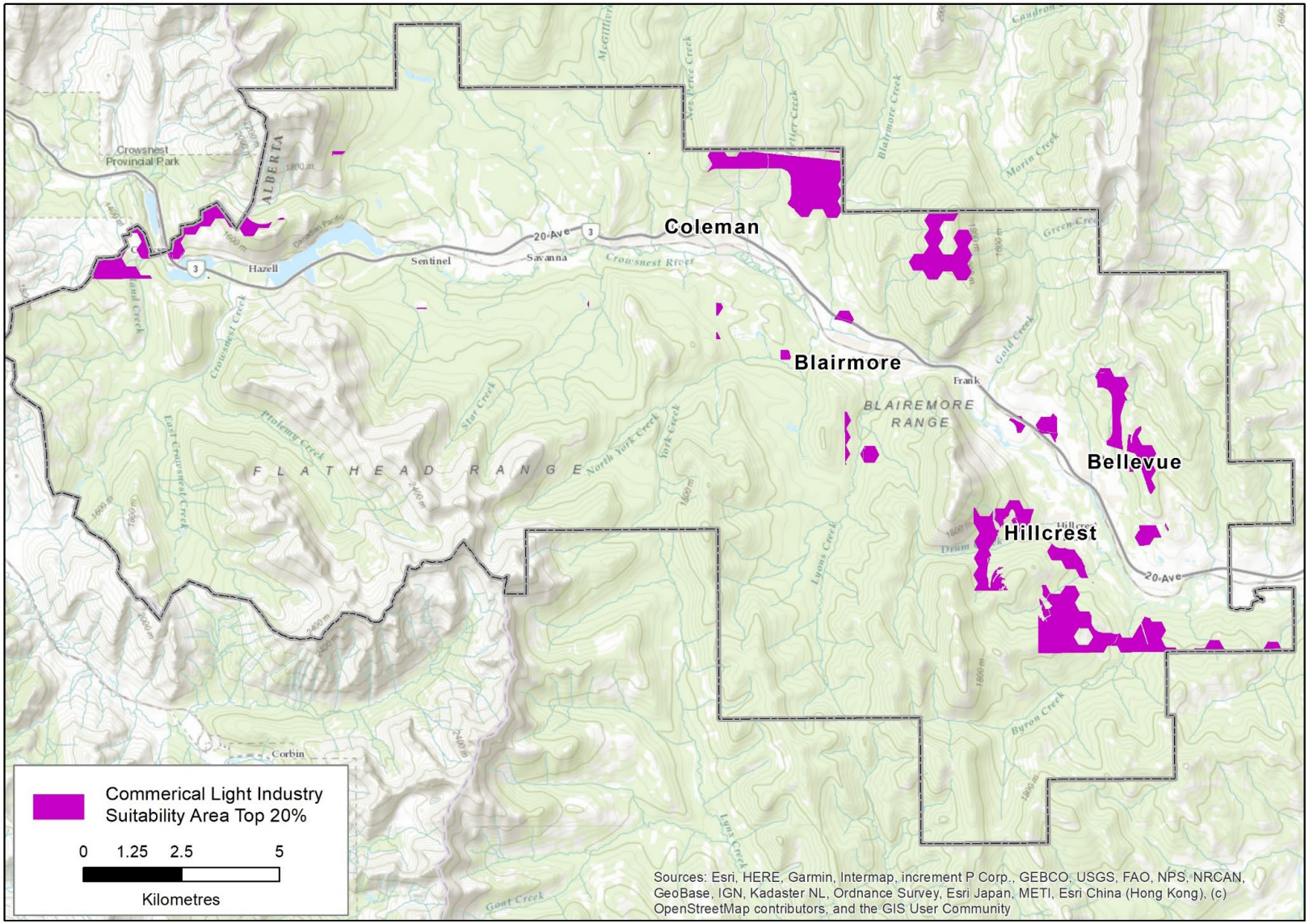


To determine the Urban Development Suitability Areas we used the Combined Conflict Probability Rating Map and extracted the No-Go Areas and Settlement and Infrastructure Theme model to produce Urban Development Suitability Areas. Suitability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicates the highest 20% or most the suitable.



The map was further refined to depict the top 20 percent of land most suitable for commercial / light industrial l development.

MUNICIPALITY OF CROWSNEST PASS- COMMERCIAL LIGHT INDUSTRY SUITABILITY



Primary Industrial Development Potential Results

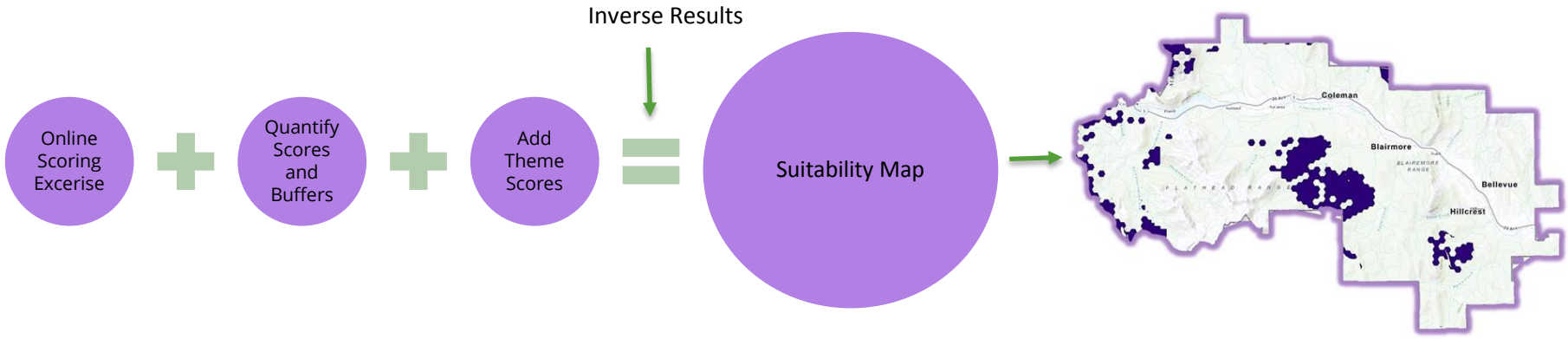


Primary Industrial Development Potential Results

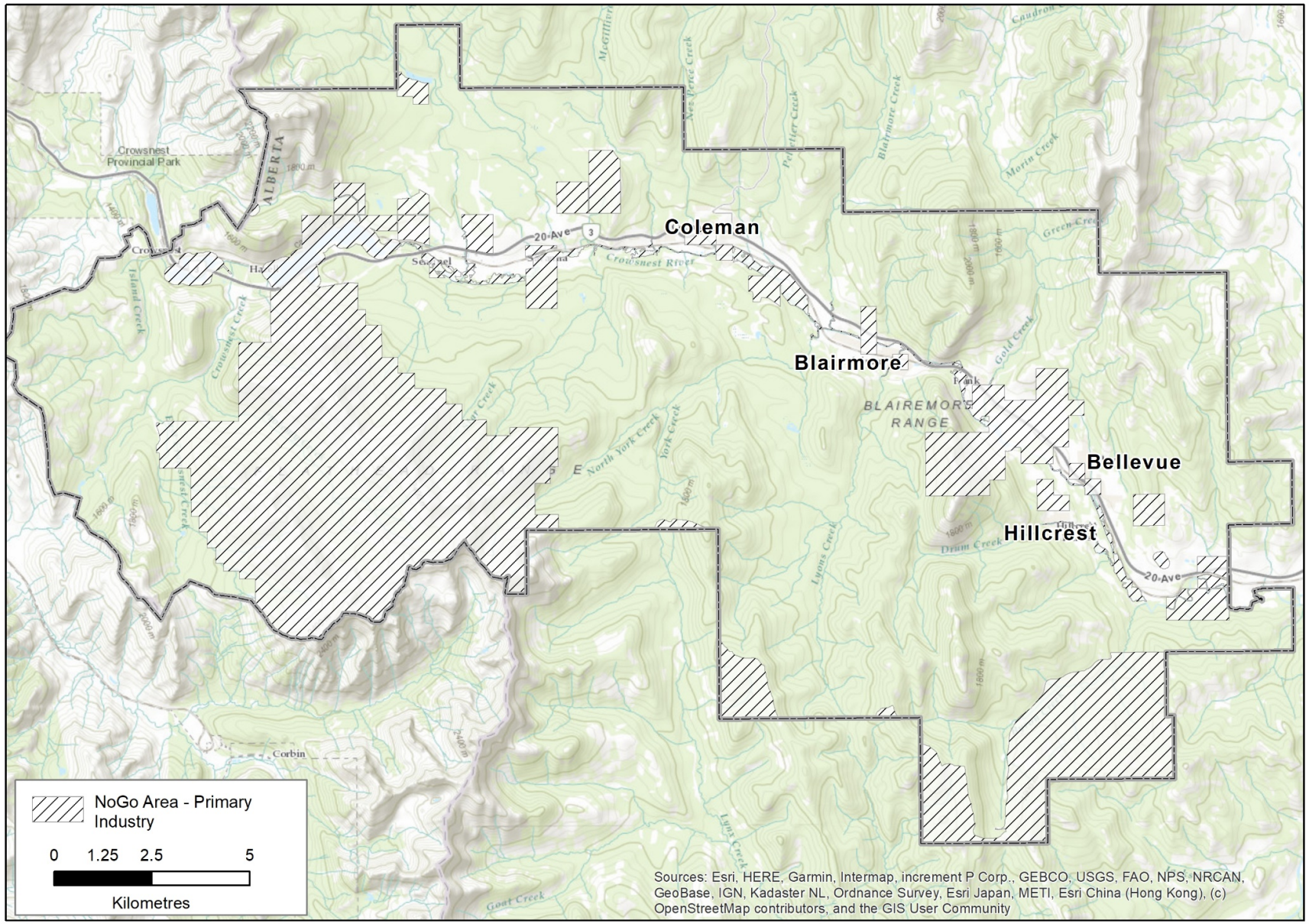
To understand where there is potential for urban non-residential development in Municipality of Crowsnest Pass we assessed the land availability as well as regulations which impacts the ability to development. To create a layer of No-Go areas the following information was mapped:

- Private conservation lands
- Protected Areas (including Castle Provincial Park)
- Historic Resource Value 1-2
- Named Lakes
- Floodway and Flood Fringe

Crown Land was not considered a No-Go feature as dispositions development of forestry or mining can occur on public lands.



MUNICIPALITY OF CROWSNEST PASS- NOGO AREAS FOR PRIMARY INDUSTRY

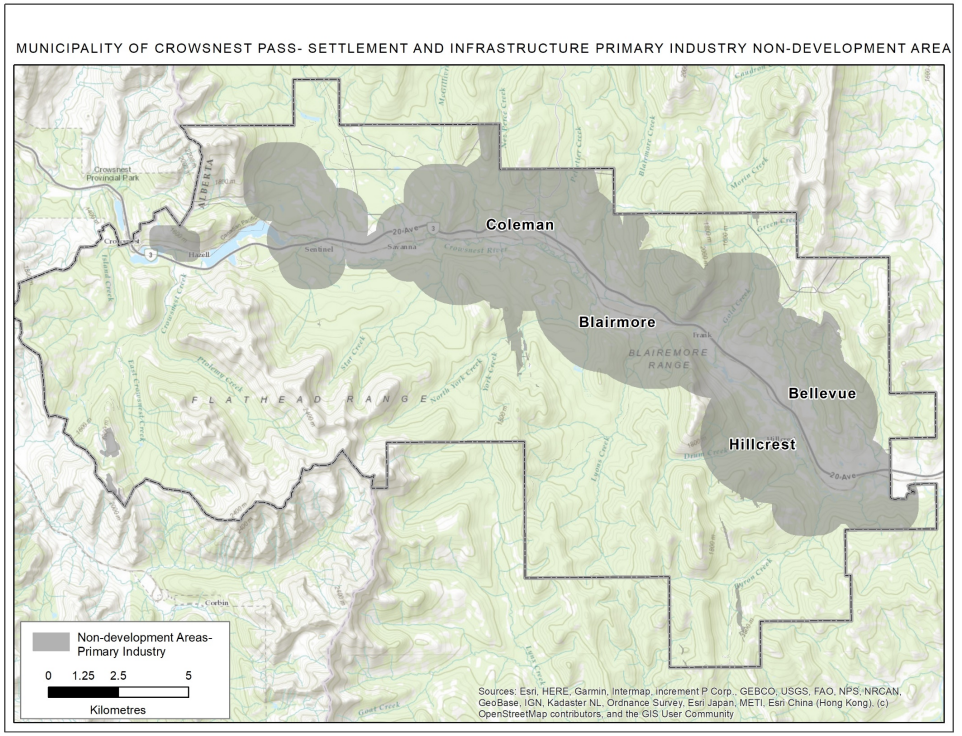


As well, participants were asked to buffer existing settlement and infrastructure features which may be of influence on the potential development of new primary industry development. The table below is a summary of the final buffer determined through consensus built during Webinar 2 and represents the distances between new residential development and other land uses or infrastructure features. These buffers include may be larger or smaller than the regulatory setbacks to highways, landfills, or wastewater treatment facilities as there is a process to acquire waivers from the Province, therefore the setbacks consider in the modelling process represents the values of the participants in the MLUST project.

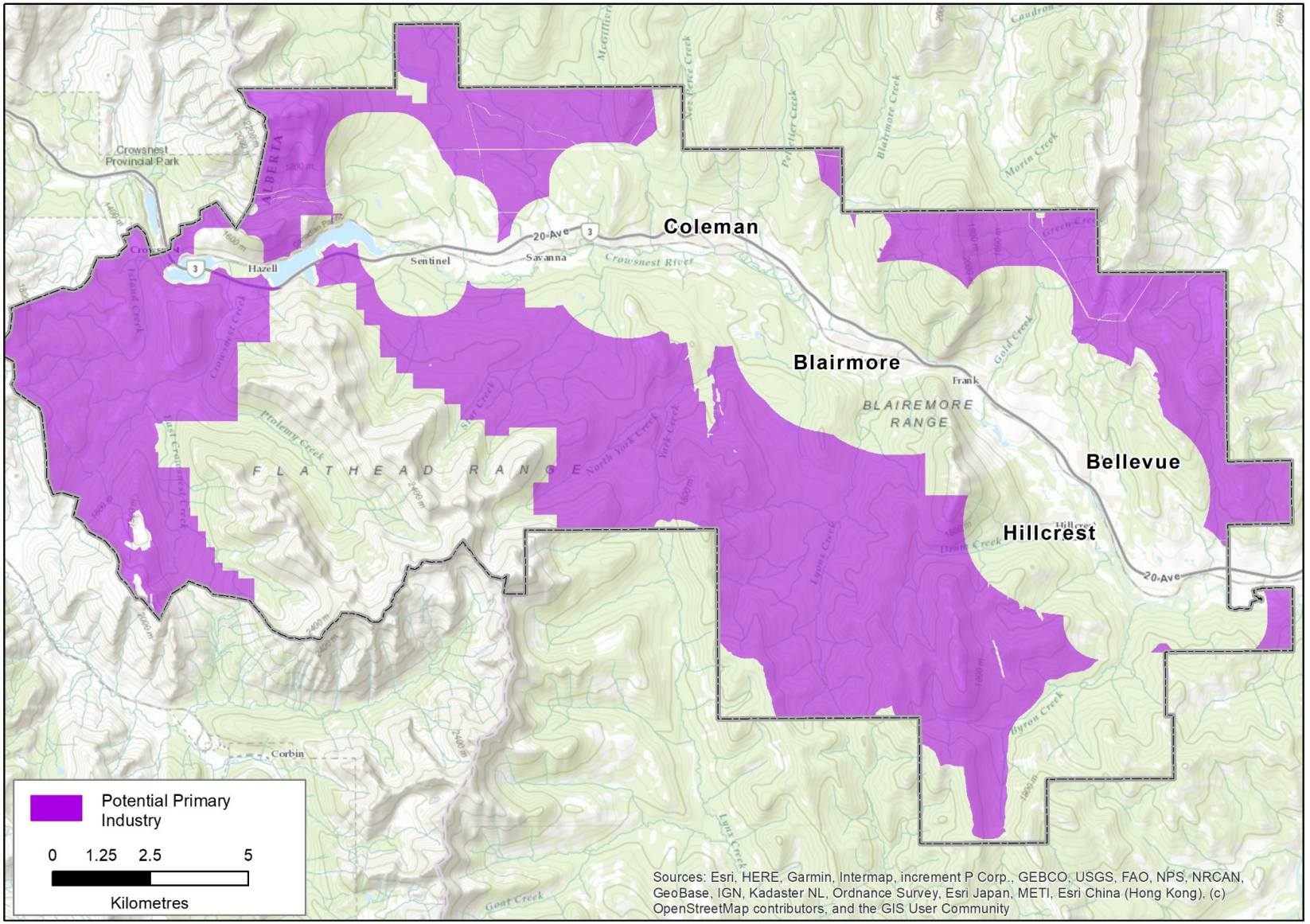
To identify what lands in the Municipality are available for primary industrial development, the each of the GIS layers for No-Go areas and settlement and infrastructure were added together to create a Potential Primary Industry Development Map.

TABLE 8: SETTLEMENT AND INFRASTRUCTURE FEATURES AND BUFFER - PRIMARY INDUSTRIAL

Settlement/Infrastructure Feature	Buffer in metres (m)
Low density residential	2000
Medium density residential	2000
Grouped country residential	1000
Commercial establishments	500
Light industrial parks	300
Transmission lines	19
Oil and Gas Infrastructure	8
Mineral extraction	0
Power plants	0
Landfills	50
Primary highways	7
Secondary highways	7
Highway 3 realignment	7
Paved roads	4
Gravel roads	4
Railways	5
Raw water / Water treatment plant	2000



MUNICIPALITY OF CROWSNEST PASS- POTENTIAL FOR PRIMARY INDUSTRY



Municipal stakeholders were asked to identify the highest valued lands from an ecological perspective. They scored the ecological features (listed in table below) and provided a Conflict Probability Rating based on values from 0 to 100; where higher values equate to a high ecological value. Once ecological features were assigned a Conflict Probability Rating, all features were converted into a grid roughly the size of a section, then overlaid and the maximum value was assigned to produce an Ecological Conflict Probability Rating Map for all development types.

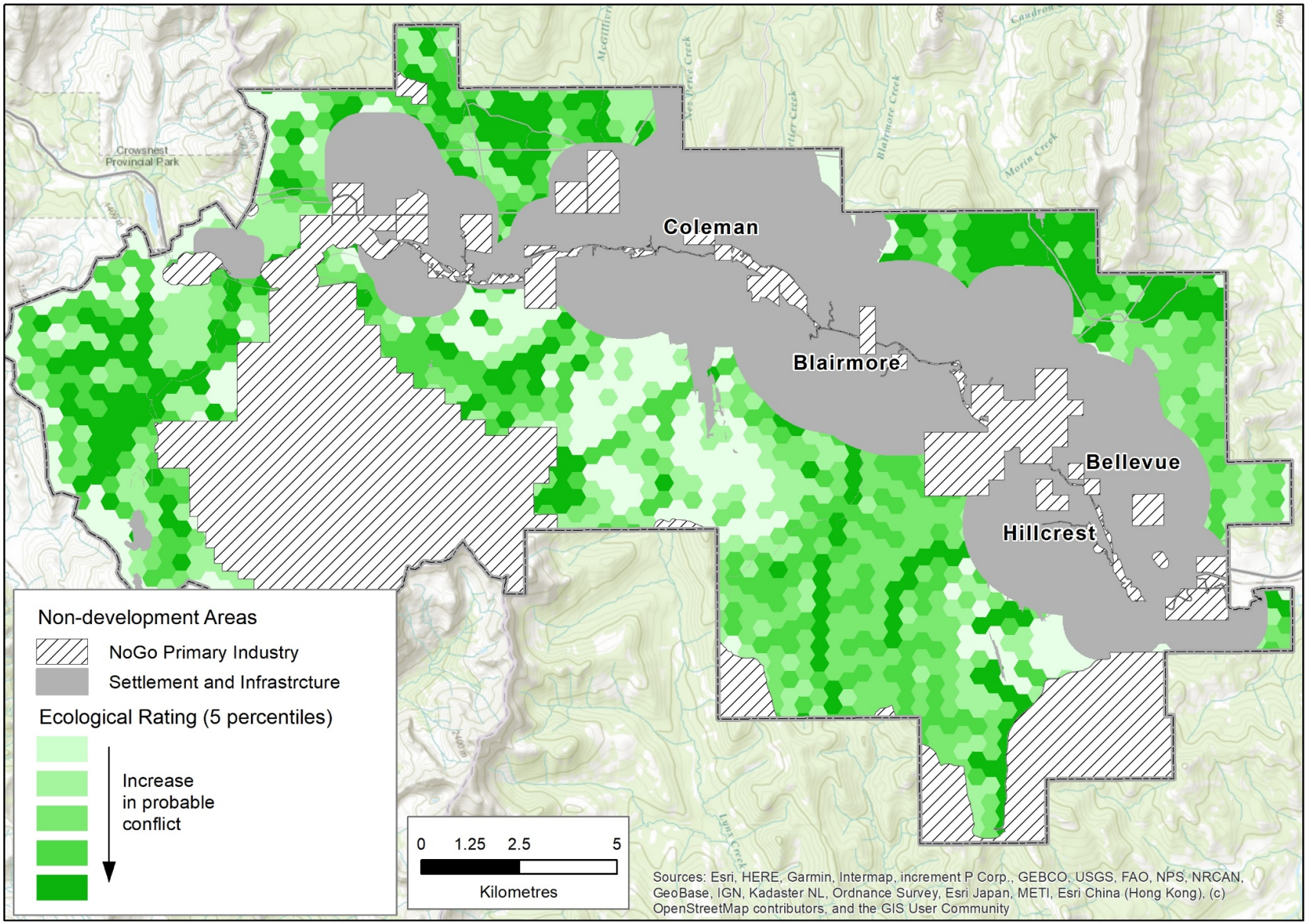
Many Ecological Theme features represent No-Go Areas and were not included in the Ecological Theme modeling. Wildlife movement areas were removed from modeling as this function is represented within the key wildlife and biodiversity zones. Features included in the modeling – wildlife habitat (key wildlife and biodiversity zones and grizzly bear core habitat, native prairie, riparian, waterways (rivers, streams and creeks), waterbodies (unnamed lakes and wetlands).

TABLE 9: ECOLOGICAL FEATURES AND CONFLICT PROBABILITY RATING - PRIMARY INDUSTRIAL

ECOLOGICAL THEME FEATURES	CONFLICT PROBABILITY RATING
Municipal conservation lands	67
Private conservation lands	50
Grizzly bear zones	64
Mountain goat and bighorn sheep range	64
Cutthroat trout	64
Elk winter range	66
Native grasslands	55
Wildlife movement areas	66
Riparian areas	71
Crowsnest River	85
Creeks	77
Lakes	74
Groundwater aquifer recharge areas	85

The Ecological layer then had the No-Go layer and the settlement and infrastructure overplayed to produce a map which indicated of the potentially available lands for development Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating the highest 20% or most conflict.

MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME - PRIMARY INDUSTRY CONFLICT PROBABILITY RATING



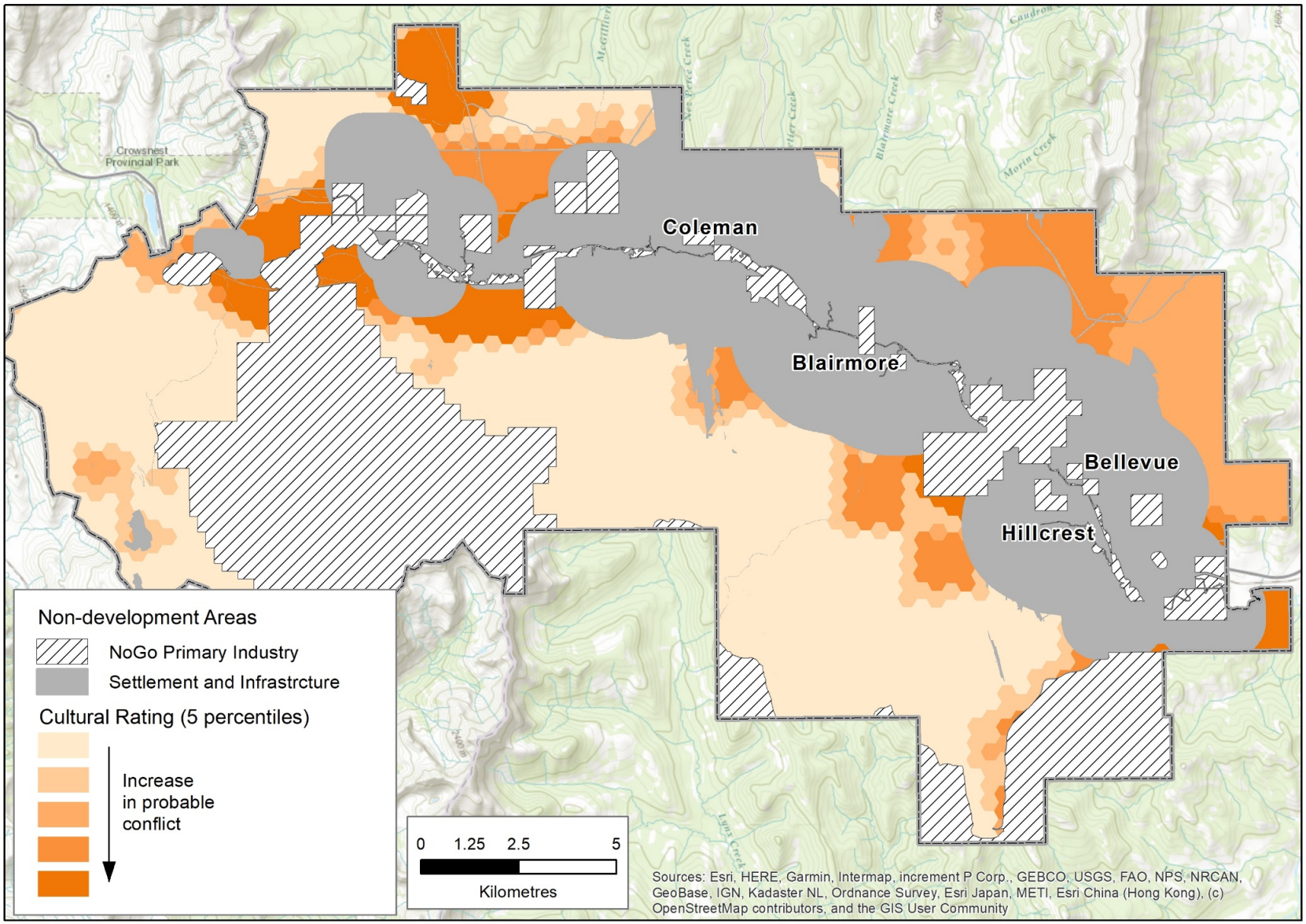
Municipal stakeholders were also asked to identify and score important scenic and tourism features within the municipality. The Conflict Probability Rating determined for each feature within the Cultural Theme were attributed to their respective GIS layers and the combined (averaged) CPR values are depicted on the 'Cultural Conflict Probability Map'. In addition, participants were asked to provide a buffer between the cultural feature and potential primary industry development. The table below is a summary of the final buffer determined through consensus built during Webinar 2 and represents the distances between new primary industrial development and other land uses or infrastructure features.

TABLE 10: SCENIC FEATURES AND CONFLICT PROBABILITY RATING AND BUFFER - PRIMARY INDUSTRIAL

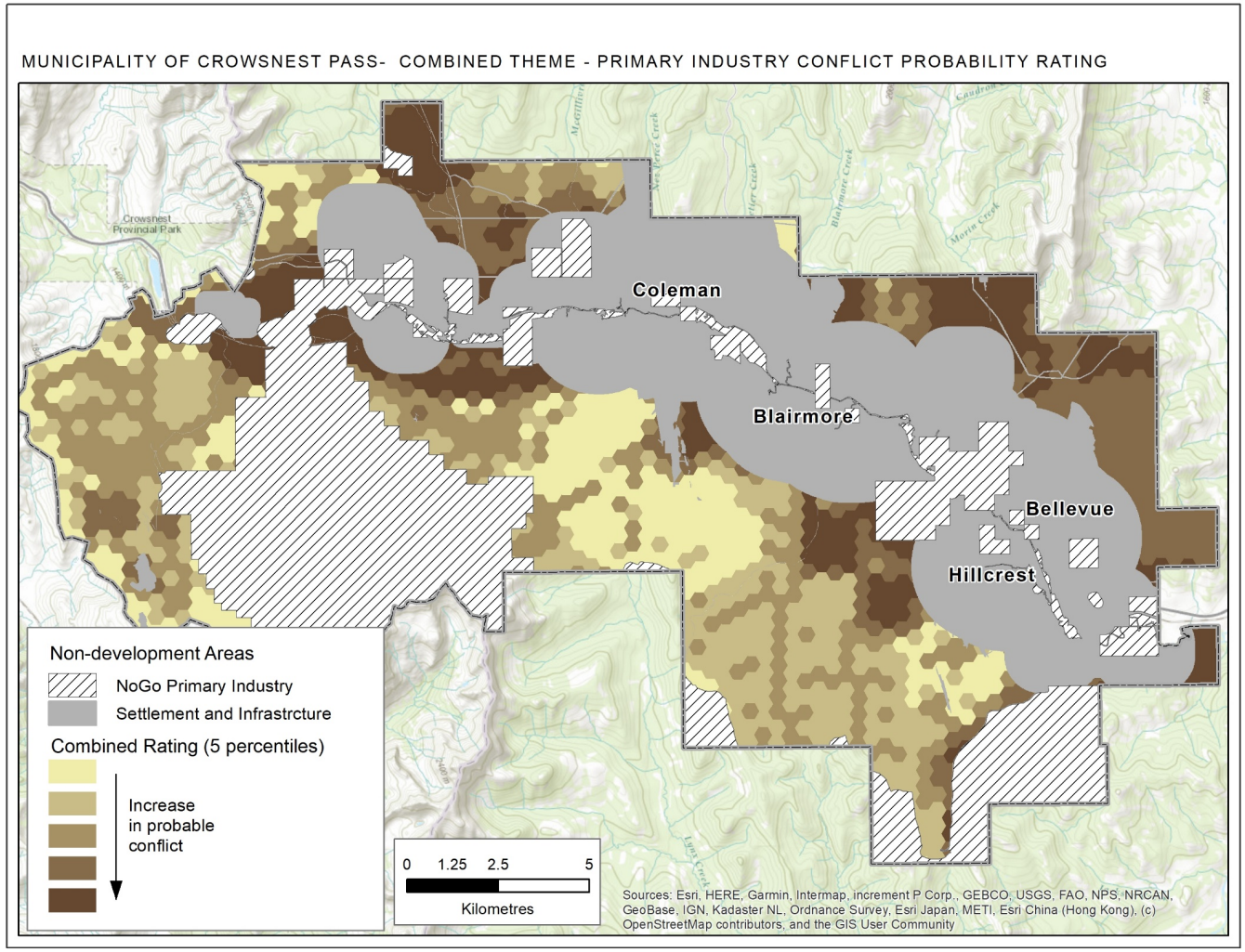
SCENIC FEATURES COMMUNITY/TOURISM FEATURES	CONFLICT PROBABILITY RATING	REFINED BUFFER (m)
Crowsnest River Valley	77	1000
Viewshed of Crowsnest Mountain	82	1200
Viewshed of South Coleman	69	900
Burmis Tree	63	1100
Frank Slide	93	1100
Bellevue Mine	79	800
Leitch Collieries	66	900
Mine cemeteries	68	100
Coke Ovens in Coleman	46	800
Sulphur Springs in Frank	52	900
Historic Town Site of Lille	63	1200
Historic Town Site of Frank	63	1100
McGilvary Falls	74	1500
Star Creek Falls	71	1500
Allison Creek Falls	74	1500

Historic Resource Value (HRV) Class 1 and 2 are not included in the No-Go Areas and while HRV Class 3, 4, and 5 were included in the Cultural Theme modeling. It was decided for modelling purposes that each of the cultural features identified would be represented as a point and would have the associated buffer applied to the point data. It was determined that the Viewshed of Crowsnest Mountain and South Coleman would be best represented as a buffer around the point at the 100 m. The Cultural layer then had the No-Go layer and the settlement and infrastructure overlaid to produce a map which indicated those lands that had the highest and lowest Cultural value of the potential lands available for development. Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating the highest 20% or most conflict.

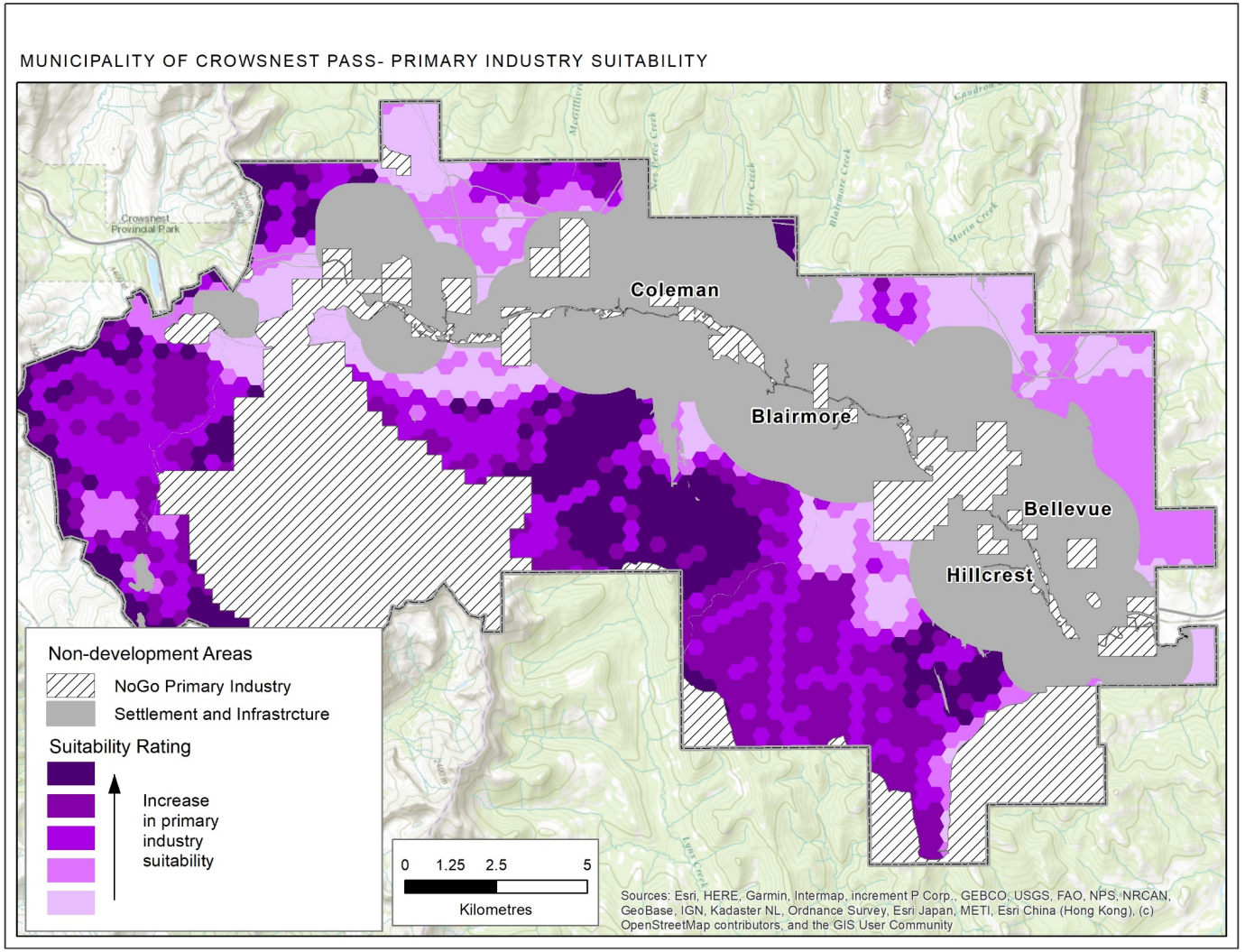
MUNICIPALITY OF CROWSNEST PASS- CULTURAL THEME - PRIMARY INDUSTRY CONFLICT PROBABILITY RATING



A combined map was developed by overlaying and summing the ecological and cultural Conflict Probability Rating maps. This approach highlighted areas of mutual high Conflict Probability Ratings and identifies on the landscape where primary industry development may be less suitable. Conflict Probability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicating the highest 20% or most conflict.

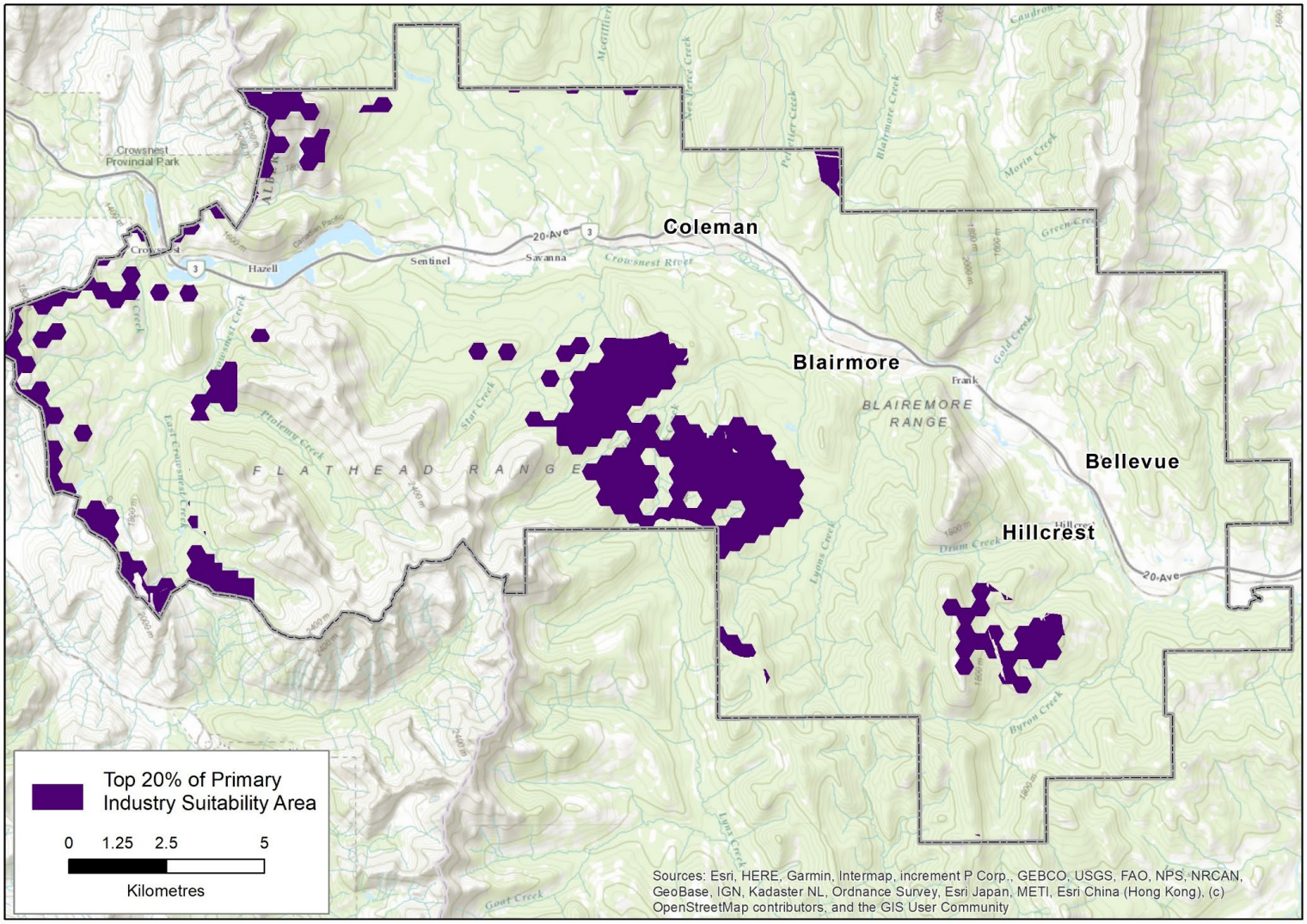


To determine the Primary Industry Suitability Areas we used the Combined Conflict Probability Rating Map and extracted the No-Go Areas and Settlement and Infrastructure Theme model to produce Development Suitability Areas. Suitability Rating values were converted into a range of 5 possible colours on a gradient, with the palest colour indicating a rating in the lowest 20%, and the darkest colour indicates the highest 20% or most the suitable.



The map was further refined to depict the top 20 percent of land most suitable for primary industry development.

MUNICIPALITY OF CROWSNEST PASS- PRIMARY INDUSTRY SUITABILITY AREA





APPENDIX A



APPENDIX A

Municipality of Crowsnest Pass
Municipal Land Use Suitability Tool
Feature Scoring Exercise

Municipal Land Use Suitability Tool Values Questionnaire

Thank you for helping score the features to be included in the Crowsnest Pass Municipal Land Use Suitability Tool (MLUST). This process aims to identify areas for urban developments while avoiding important ecological, and cultural/scenic resources and settlement and infrastructure at a municipal scale.

The survey is separated into three main themes:

1. Ecological
2. Cultural
3. Settlement and Infrastructure

Each theme contains a number of "features" which represent a component of the larger theme. You will be asked to provide a score, from "very high" to "very low", to represent how you personally value each individual feature. The feature scores from all participants will be integrated into a model to help identify high-value landscapes for each theme and the most suitable lands for development.

Municipality of Crowsnest Pass
Municipal Land Use Suitability Tool
Feature Scoring Exercise

Ecological Theme

The **ecological features** you will be asked to score include:

- Conservation lands
- Species management areas
- Important wildlife habitat
- Water resources

You are asked to score each feature in terms of their value to you. The scores will help us identify **high value ecological lands** in the Crowsnest Pass and will be used to produce a *Conflict Probability Rating Map* that will indicate areas where development may be most suitable.

The following land features have been determined to be non-developable based on Provincial/Federal regulations. The features will be included in the modelling, but are not required to be scored by you. The features include:

- Protected Areas
- Wetlands (with 100 m buffer)
- Large permanent rivers (with 100 m buffer)
- Smaller permanent watercourses (with 45 m buffer)
- Intermittent watercourses and springs (with 45 m buffer)
- Species at risk restricted areas

1. Please score **conservation lands** in terms of their value to the ecological theme.

For the purposes of this survey: '*municipal conservation lands*' refers to environmental easements, environmental/conservation reserves, and municipal natural area parks; '*private conservation lands*' refers to third-party conservation land holdings (i.e. NCC, SALTS, etc.).

	very high	high	medium	low	very low	do not include
municipal conservation lands	○	○	○	○	○	○
private conservation lands	○	○	○	○	○	○

Comments:

2. Please score the following **species management areas or designations** in terms of their value to the **ecological theme**.

	very high	high	medium	low	very low	do not include
grizzly bear zones	○	○	○	○	○	○
mountain goat and bighorn sheep range	○	○	○	○	○	○
cutthroat trout	○	○	○	○	○	○
elk winter range	○	○	○	○	○	○

Comments:

3. Please score the following **important wildlife habitat** or **vegetation areas** in terms of their value to the **ecological theme**.

	very high	high	medium	low	very low	do not include
native grasslands	○	○	○	○	○	○
wildlife movement areas	○	○	○	○	○	○
riparian areas	○	○	○	○	○	○

Comments:

4. Please score the following **waterways and waterbodies** in terms of their value to the **ecological theme**.

	very high	high	medium	low	very low	do not include
Crowsnest River	○	○	○	○	○	○
creeks	○	○	○	○	○	○
lakes (unnamed)	○	○	○	○	○	○
groundwater aquifer recharge areas	○	○	○	○	○	○

Comments:

5. Are there any features missing from the **Ecological Theme**?

☐ yes

☐ no

If 'yes', please list the missing features:

Municipality of Crowsnest Pass
Municipal Land Use Suitability Tool
Feature Scoring Exercise

Cultural Theme

During the kick-off Webinar, you were asked to identify **cultural resources (features)** throughout the municipality. These resources were then broken down into 2 subcategories: **scenic features** and **community/tourism features**. In this section, we ask that you score each feature in terms of value to the **cultural theme** and impacts from specific types of development.

The scores will help us to identify high value cultural resources, as well as a preferred buffer to mitigate impacts from **different categories of development** (if necessary). These scores will be used to produce a *Conflict Probability Rating Map* to identify areas where development may be most suitable.

6. Please score each **scenic feature** in terms of their value to the **cultural theme**.

	very high	high	medium	low	very low	do not include
Crowsnest River Valley	○	○	○	○	○	○
Viewshed of Crowsnest Mountain	○	○	○	○	○	○
Viewshed of South Coleman	○	○	○	○	○	○
Burmis Tree	○	○	○	○	○	○

Comments:

7. Please score each **community/tourism feature** in terms of their value to the **cultural theme**.

	very high	high	medium	low	very low	do not include
Frank Slide	○	○	○	○	○	○
Bellevue Mine	○	○	○	○	○	○
Leitch Collieries	○	○	○	○	○	○
mine cemeteries	○	○	○	○	○	○
Coke Ovens in Coleman	○	○	○	○	○	○
Sulphur Springs in Frank	○	○	○	○	○	○
Historic Town Site of Lille	○	○	○	○	○	○
Historic Town Site of Frank	○	○	○	○	○	○
McGilvary Falls	○	○	○	○	○	○
Star Creek Falls	○	○	○	○	○	○
Allison Creek Falls	○	○	○	○	○	○

Comments:

Please select a buffer to apply for each theme feature when considering a specific type of development. For the purposes of this section of the survey the following definitions shall apply:

Residential Development
permanent, developed habitations/dwellings which meet municipal servicing standards.

Commercial / Light Industrial Development
retail/business and smaller-scale industrial operations which primarily deal with the sale of personal and/or commercial goods and services and have minimal sound/odour emissions.

Primary (Heavy) Industrial Development
large-scale industrial operations which may potentially produce noxious emissions, undesirable noise and generate larger volumes of traffic.

8. Please select a buffer to apply for each feature when considering **residential development**.

	0 m	100 m	300 m	500 m	1000 m	2000 m
Crowsnest River Valley	○	○	○	○	○	○
Viewshed of Crowsnest Mountain	○	○	○	○	○	○
Viewshed of South Coleman	○	○	○	○	○	○
Burmis Tree	○	○	○	○	○	○
Frank Slide	○	○	○	○	○	○
Bellevue Mine	○	○	○	○	○	○
Leitch Collieries	○	○	○	○	○	○
mine cemeteries	○	○	○	○	○	○
Coke Ovens in Coleman	○	○	○	○	○	○
Sulphur Springs in Frank	○	○	○	○	○	○
Historic Town Site of Lille	○	○	○	○	○	○
Historic Town Site of Frank	○	○	○	○	○	○
McGilvary Falls	○	○	○	○	○	○
Star Creek Falls	○	○	○	○	○	○
Allison Creek Falls	○	○	○	○	○	○

Comments:

9. Please select a buffer to apply for each feature when considering **commercial / light industrial development** (the scores provided above will be applied to selected buffers).

	0 m	100 m	300 m	500 m	1000 m	2000 m
Crowsnest River Valley	○	○	○	○	○	○
Viewshed of Crowsnest Mountain	○	○	○	○	○	○
Viewshed of South Coleman	○	○	○	○	○	○
Burmis Tree	○	○	○	○	○	○
Frank Slide	○	○	○	○	○	○
Bellevue Mine	○	○	○	○	○	○
Leitch Collieries	○	○	○	○	○	○
mine cemeteries	○	○	○	○	○	○
Coke Ovens in Coleman	○	○	○	○	○	○
Sulphur Springs in Frank	○	○	○	○	○	○
Historic Town Site of Lille	○	○	○	○	○	○
Historic Town Site of Frank	○	○	○	○	○	○
McGilvary Falls	○	○	○	○	○	○
Star Creek Falls	○	○	○	○	○	○
Allison Creek Falls	○	○	○	○	○	○

Comments:

10. Please select a buffer to apply for each feature when considering **primary (heavy) industrial development** (the scores provided about will be applied to selected buffers).

	0 m	100 m	300 m	500 m	1000 m	2000 m
Crowsnest River Valley	○	○	○	○	○	○
Viewshed of Crowsnest Mountain	○	○	○	○	○	○
Viewshed of South Coleman	○	○	○	○	○	○
Burmis Tree	○	○	○	○	○	○
Frank Slide	○	○	○	○	○	○
Bellevue Mine	○	○	○	○	○	○
Leitch Collieries	○	○	○	○	○	○
mine cemeteries	○	○	○	○	○	○
Coke Ovens in Coleman	○	○	○	○	○	○
Sulphur Springs in Frank	○	○	○	○	○	○
Historic Town Site of Frank	○	○	○	○	○	○
Historic Town Site of Lille	○	○	○	○	○	○
McGilvary Falls	○	○	○	○	○	○
Star Creek Falls	○	○	○	○	○	○
Allison Creek Falls	○	○	○	○	○	○

Comments:

11. A Historic Resource Values (HRV) layer is provided by the Government of Alberta to help developers, industry representatives, and regulators determine if a proposed development might affect historic resources. There are five resource classes. HRV 1 and 2 are regulated as non-developable and you are not asked to score them. Please score HRV class 3 to 5 based on their level of importance to the cultural theme.

	very high	high	medium	low	very low	do not include
HRV class 3: contains a significant historic resource that will likely require avoidance	○	○	○	○	○	○
HRV class 4: contains a historic resource that may require avoidance	○	○	○	○	○	○
HRV class 5: high potential to contain a historic resource	○	○	○	○	○	○

Comments:

Municipality of Crowsnest Pass
Municipal Land Use Suitability Tool
Feature Scoring Exercise

Settlement and Infrastructure

In this section, we have provided a series of existing **settlement and infrastructure features** that may influence future development. These features have been broken down into four subcategories: urbanized areas, industrial infrastructure, transportation, and water management features. We ask that you provide desired buffers between the listed features and the **different categories of development** to identify desirable proximity between these uses. Some of the following features have specific rights-of-way/setbacks:

- roadways
- railways
- transmission lines
- pipelines

If the feature is linear, please gauge the distance from the features centre-line. These scores will be used to produce *Conflict Probability Rating Maps* which will identify areas where **development** may be most suitable. Please note that some of the features listed have municipal, provincial or federal setback regulations which will be considered in the modelling.

The same description of specific development from the previous section still applies as follows:

Residential Development
permanent, developed habitations/dwellings which meet municipal servicing standards.

Commercial / Light Industrial Development
retail/business and smaller-scale industrial operations which primarily deal with the sale of personal and/or commercial goods and services and have minimal sound/odour emissions.

Primary (Heavy) Industrial Development
large-scale industrial operations which may potentially produce noxious emissions, undesirable noise and generate larger volumes of traffic.

12. Please provide a buffer for the following features in relation to **residential development**.

	0 m	50 m	100 m	300 m	500 m	>500 m
low density residential	○	○	○	○	○	○
medium density residential	○	○	○	○	○	○
grouped country residential	○	○	○	○	○	○
commercial establishments	○	○	○	○	○	○
light industrial parks	○	○	○	○	○	○
transmission lines	○	○	○	○	○	○
oil and gas infrastructure	○	○	○	○	○	○
mineral extraction	○	○	○	○	○	○
power plants	○	○	○	○	○	○
landfills	○	○	○	○	○	○
primary highways	○	○	○	○	○	○
secondary highways	○	○	○	○	○	○
Highway 3 realignment	○	○	○	○	○	○
paved roads	○	○	○	○	○	○
gravel roads	○	○	○	○	○	○
railways	○	○	○	○	○	○
raw water reservoirs	○	○	○	○	○	○
water treatment plants	○	○	○	○	○	○

Comments:

13. Please provide a buffer for the following features in relation to **commercial / light industrial development**.

	0 m	50 m	100 m	300 m	500 m	>500 m
low density residential	○	○	○	○	○	○
medium density residential	○	○	○	○	○	○
grouped country residential	○	○	○	○	○	○
commercial establishments	○	○	○	○	○	○
light industrial parks	○	○	○	○	○	○
transmission lines	○	○	○	○	○	○
oil and gas infrastructure	○	○	○	○	○	○
mineral extraction	○	○	○	○	○	○
power plants	○	○	○	○	○	○
landfills	○	○	○	○	○	○
primary highways	○	○	○	○	○	○
secondary highways	○	○	○	○	○	○
Highway 3 realignment	○	○	○	○	○	○
paved roads	○	○	○	○	○	○
gravel roads	○	○	○	○	○	○
railways	○	○	○	○	○	○
raw water reservoirs	○	○	○	○	○	○
water treatment plants	○	○	○	○	○	○

Comments:

14. Please provide a buffer for the following features in relation to **primary (heavy) industrial development**.

	0 m	50 m	100 m	300 m	500 m	>500 m
low density residential	○	○	○	○	○	○
medium density residential	○	○	○	○	○	○
grouped country residential	○	○	○	○	○	○
commercial establishments	○	○	○	○	○	○
light industrial parks	○	○	○	○	○	○
transmission lines	○	○	○	○	○	○
oil and gas infrastructure	○	○	○	○	○	○
mineral extraction	○	○	○	○	○	○
power plants	○	○	○	○	○	○
landfills	○	○	○	○	○	○
primary highways	○	○	○	○	○	○
secondary highways	○	○	○	○	○	○
Highway 3 realignment	○	○	○	○	○	○
paved roads	○	○	○	○	○	○
gravel roads	○	○	○	○	○	○
railways	○	○	○	○	○	○
raw water reservoirs	○	○	○	○	○	○
water treatment plants	○	○	○	○	○	○

Comments:

15. Please provide your **first name** so we are able to determine who has completed the survey.



APPENDIX B



APPENDIX B

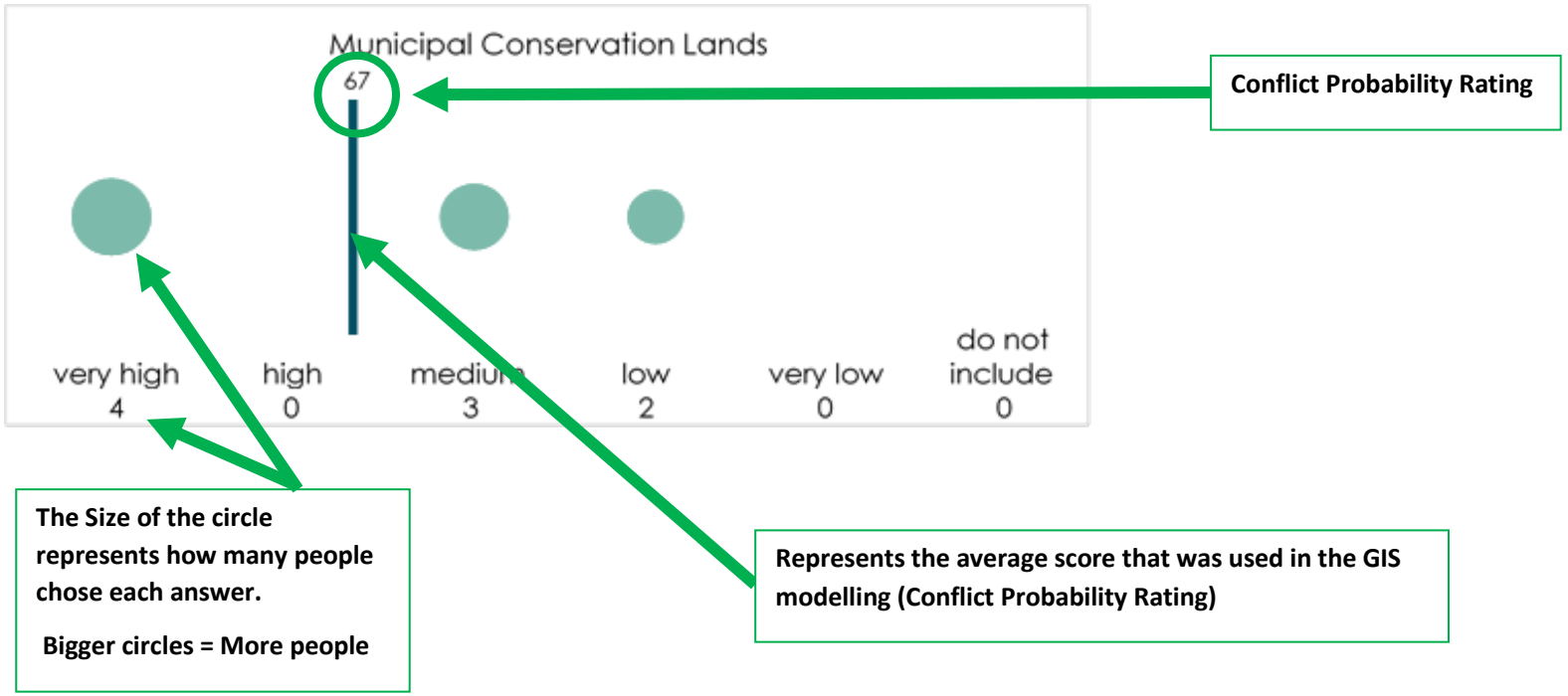
Here we present collated results of each survey question participants were asked to *score* from very low to very high for the three themes areas: ecological, cultural and settlement/infrastructure.

In each table, the percent represents the participants who selected that *score*. *Scores* were *Quantified* from (low<-->high) to a number (0-100) and averaged to produce a *Conflict Probability Rating* per feature, which can be seen in the second table.

Bubble charts were used as a visual aid for the process. In the bubble charts, the **placement** of each circle (aligned with the scores from *Very Low* to *Very High*) and the **size** of the circle represents how many people chose each answer (bigger circles = more people).

The **dark blue line** represents the *Conflict Probability Rating* (average score) that was used in the GIS modelling.

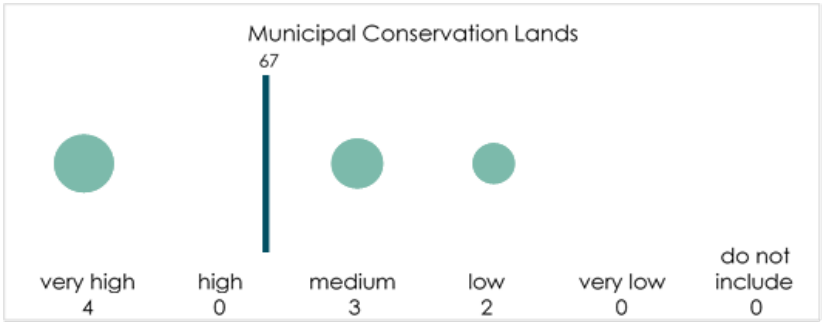
Example Bubble Chart:

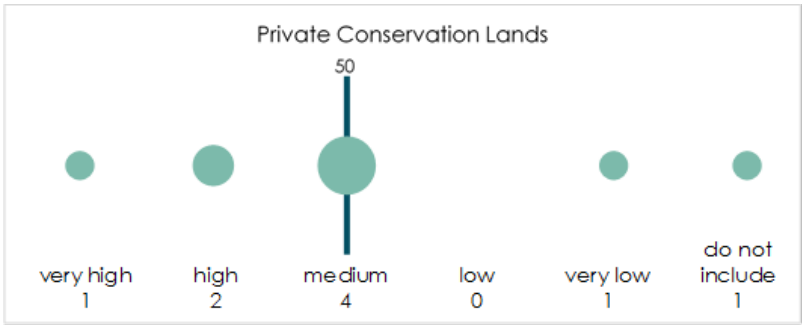


Ecological Theme

1. *Please score **conservation lands** in terms of their value to the ecological theme.*

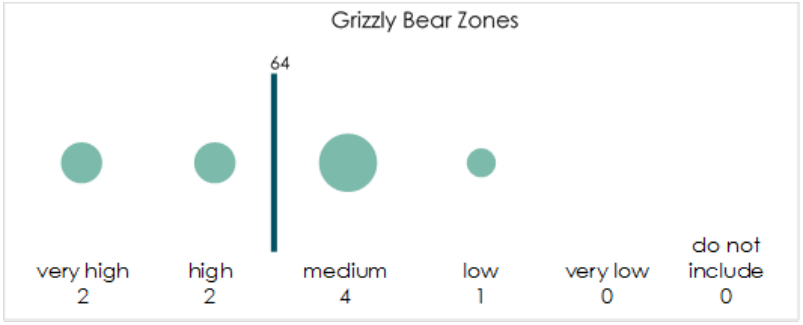
Conservation lands	VERY HIGH	HIGH	MEDIUM	LOW	VERY LOW	DO NOT INCLUDE		Conflict Probability Rating
Municipal conservation lands	44%	0%	33%	22%	0%	0%		67
Private conservation lands	11%	22%	44%	0%	11%	11%		50

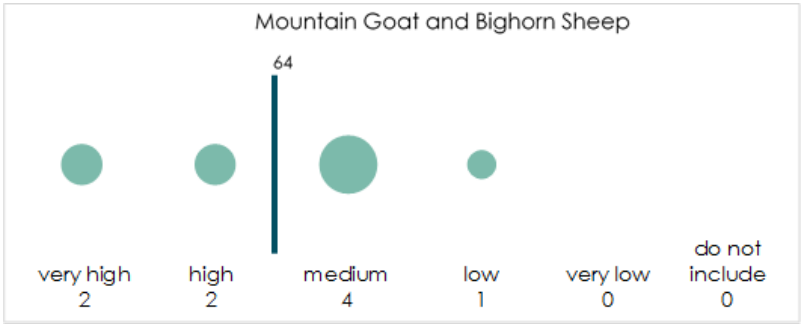


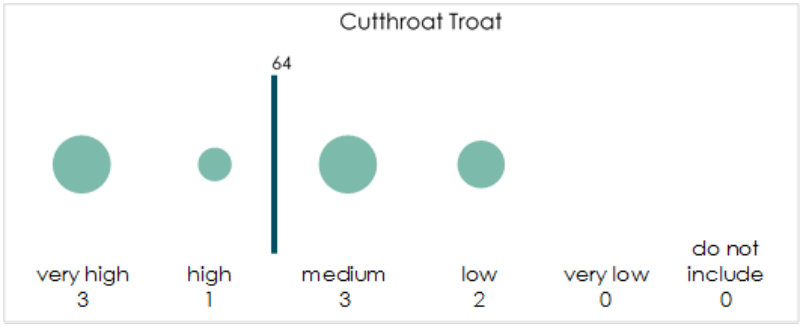


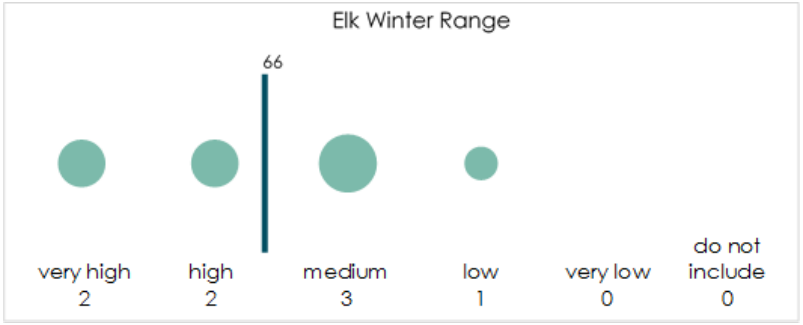
2. *Please score **species management areas or designations** in terms of their value to the ecological theme.*

Species management areas or designations	VERY HIGH	HIGH	MEDIUM	LOW	VERY LOW	DO NOT INCLUDE		Conflict Probability Rating
grizzly bear zones	22%	22%	44%	11%	0%	0%		64
mountain goat and bighorn sheep range	22%	22%	44%	11%	0%	0%		64
cutthroat trout	33%	11%	33%	22%	0%	0%		64
elk winter range	25%	25%	38%	12%	0%	0%		66



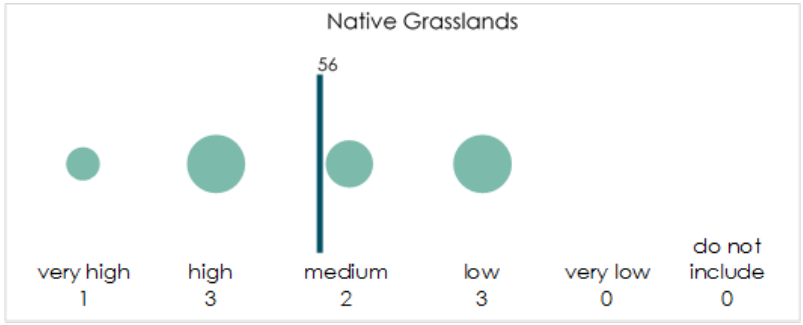


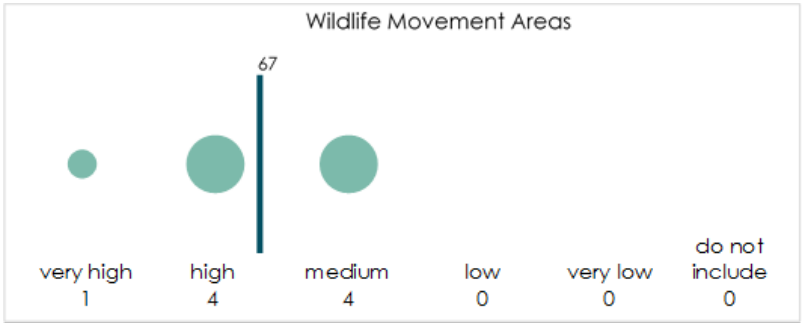


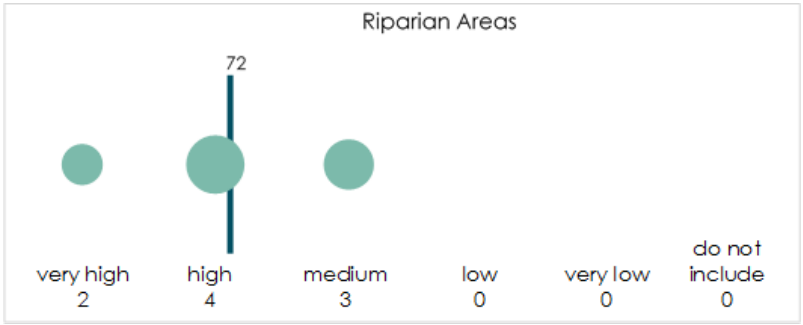


3. *Please score **important wildlife habitat or vegetation areas** in terms of their value to the ecological theme.*

Important wildlife habitat or vegetation areas	VERY HIGH	HIGH	MEDIUM	LOW	VERY LOW	DO NOT INCLUDE		Conflict Probability Rating
Native grasslands	11%	33%	22%	33%	0%	0%		55
Wildlife movement areas	11%	44%	44%	0%	0%	0%		66
Riparian areas	22%	44%	33%	0%	0%	0%		71

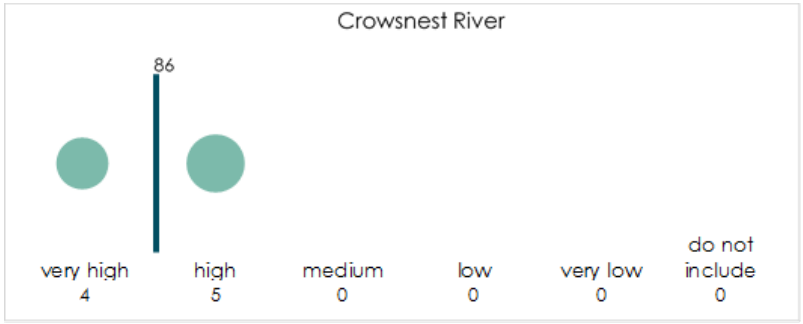


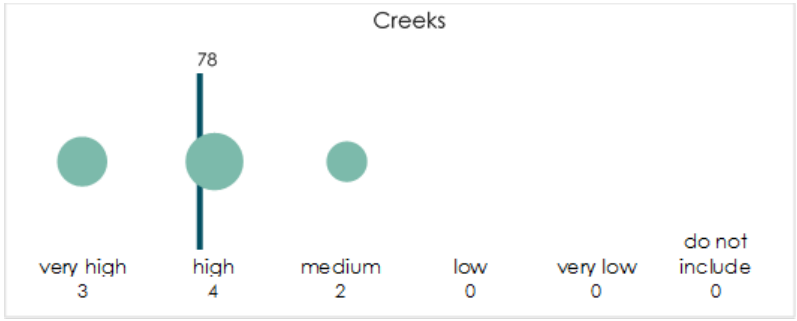


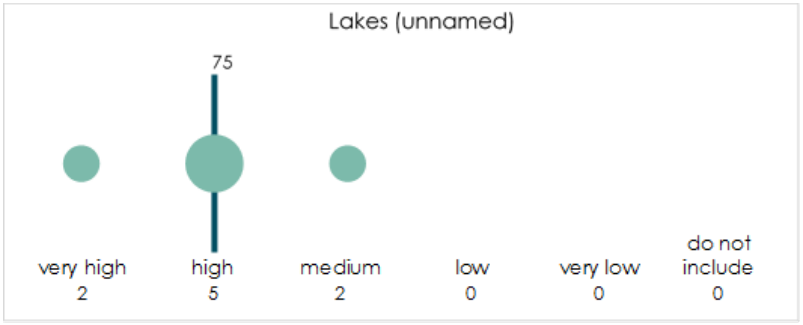


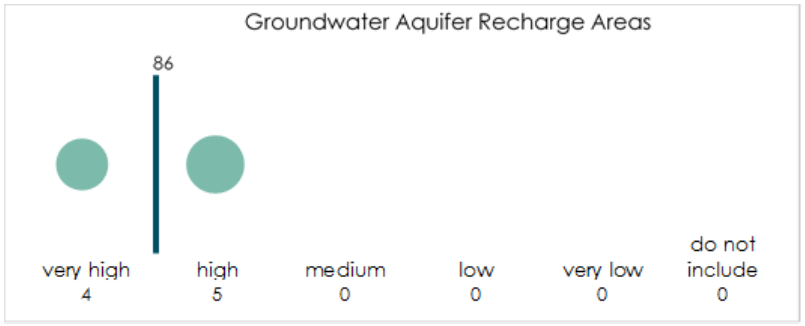
4. *Please score **waterways and waterbodies** in terms of their value to the ecological theme.*

Waterways and waterbodies	VERY HIGH	HIGH	MEDIUM	LOW	VERY LOW	DO NOT INCLUDE		Conflict Probability Rating
Crowsnest River	44%	55%	0%	0%	0%	0%		85
Creeks	33%	44%	22%	0%	0%	0%		77
Lakes (unnamed)	22%	55%	22%	0%	0%	0%		74
Groundwater aquifer recharge areas	44%	55%	0%	0%	0%	0%		85

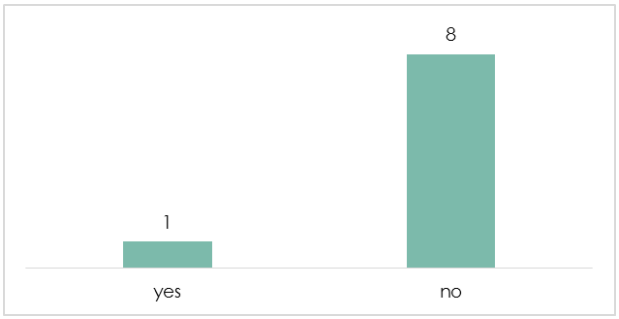








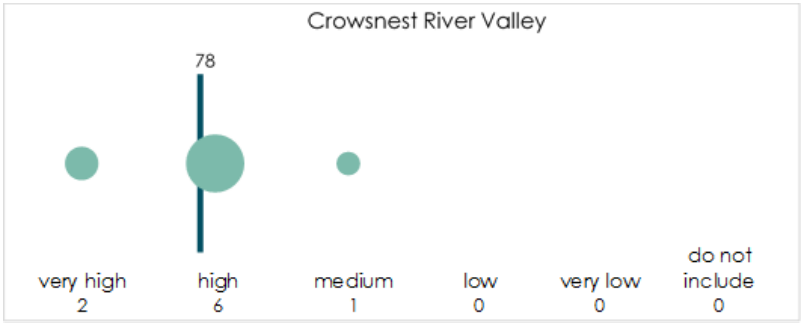
5. *Are there any missing features from the ecological theme?*

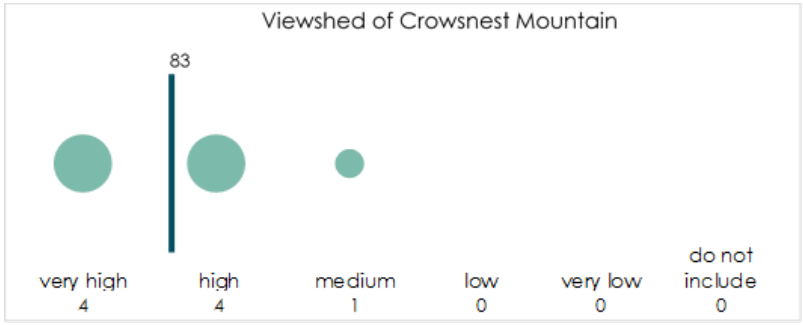


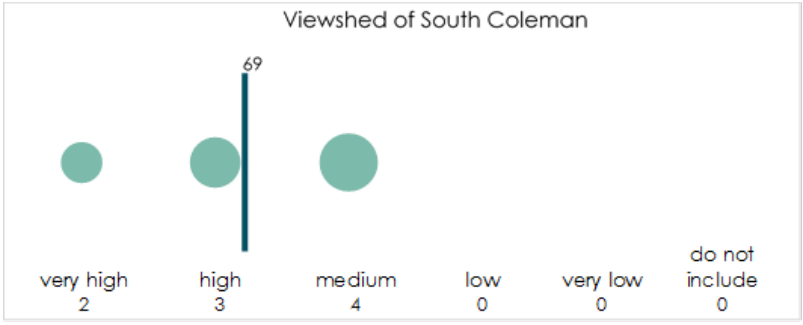
Cultural Theme

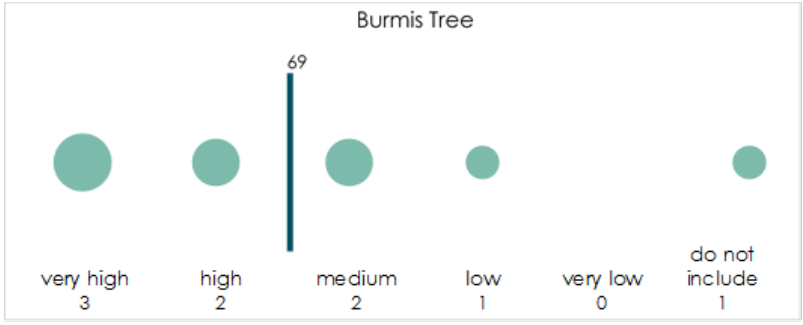
1. *Please score each **scenic feature** in terms of their value to the cultural theme.*

Scenic Features	VERY HIGH	HIGH	MEDIUM	LOW	VERY LOW	DO NOT INCLUDE		Conflict Probability Rating
Crowsnest River Valley	22%	66%	11%	0%	0%	0%		77
Viewshed of Crowsnest Mountain	44%	44%	11%	0%	0%	0%		82
Viewshed of South Coleman	22%	33%	44%	0%	0%	0%		69
Burmis Tree	33%	22%	22%	11%	0%	11%		63



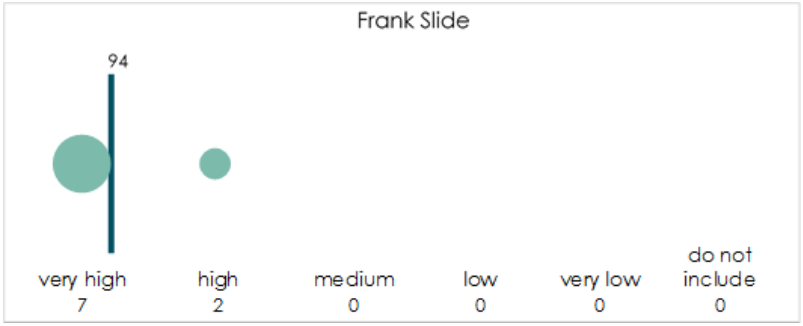


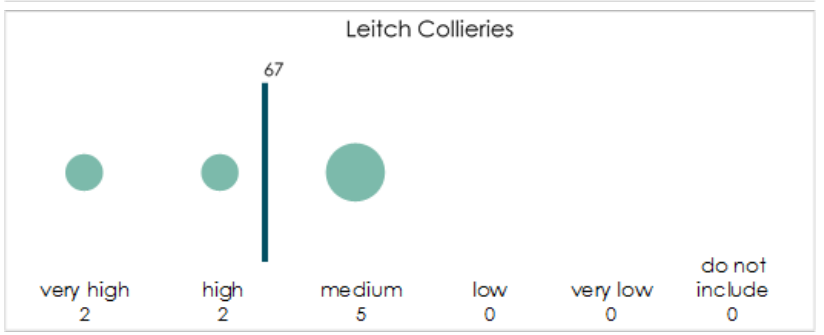


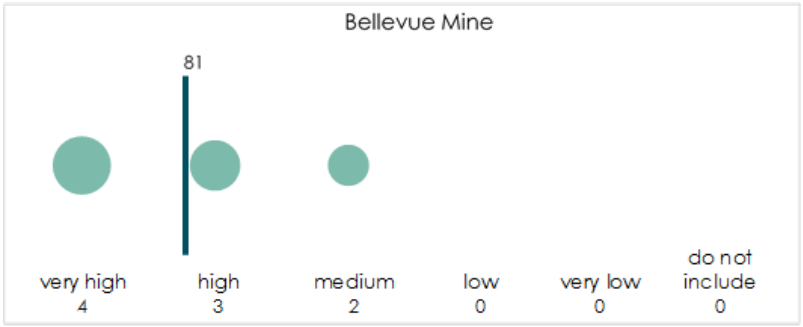


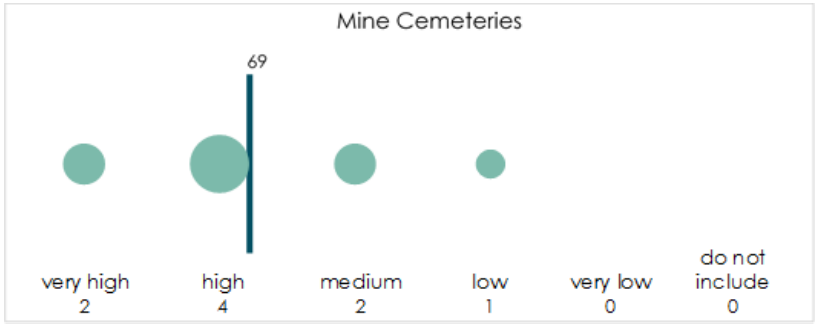
2. *Please score each **community/tourism feature** in terms of their value to the cultural theme.*

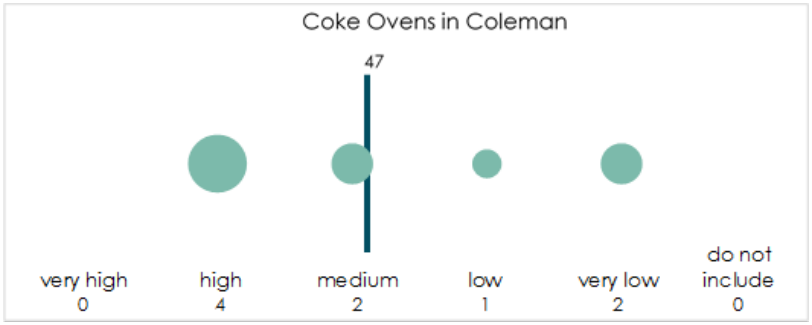
Community/Tourism Features	VERY HIGH	HIGH	MEDIUM	LOW	VERY LOW	DO NOT INCLUDE		Conflict Probability Rating
Frank Slide	77%	22%	0%	0%	0%	0%		93
Bellevue Mine	44%	33%	22%	0%	0%	0%		79
Leitch Collieries	22%	22%	55%	0%	0%	0%		66
Mine cemeteries	22%	44%	22%	11%	0%	0%		68
Coke Ovens in Coleman	0%	44%	22%	11%	22%	0%		46
Sulphur Springs in Frank	0%	33%	55%	0%	11%	0%		52
Historic Town Site of Lille	11%	55%	22%	0%	11%	0%		63
Historic Town Site of Frank	0%	66%	22%	11%	0%	0%		63
McGilvary Falls	11%	77%	11%	0%	0%	0%		74
Star Creek Falls	11%	66%	22%	0%	0%	0%		71
Allison Creek Falls	11%	77%	11%	0%	0%	0%		74

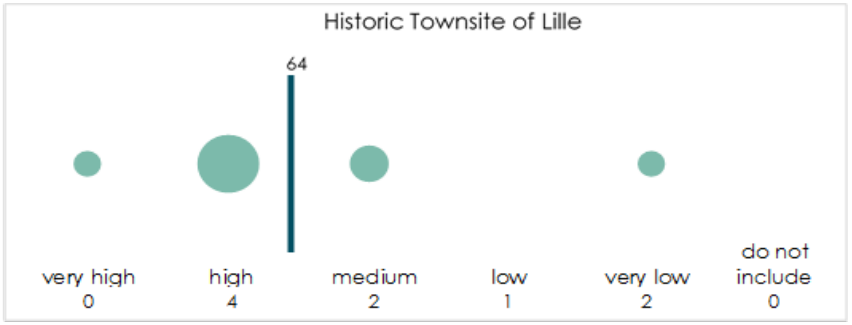


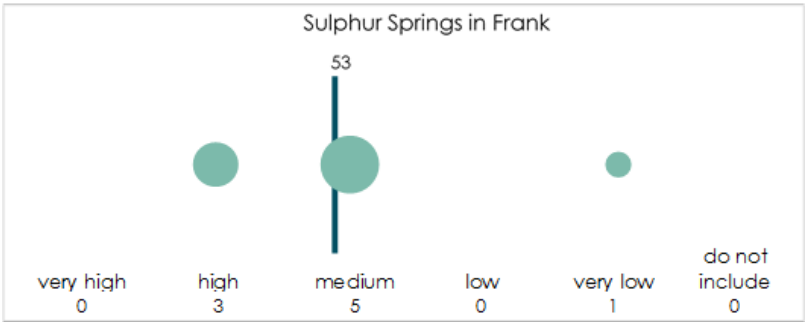


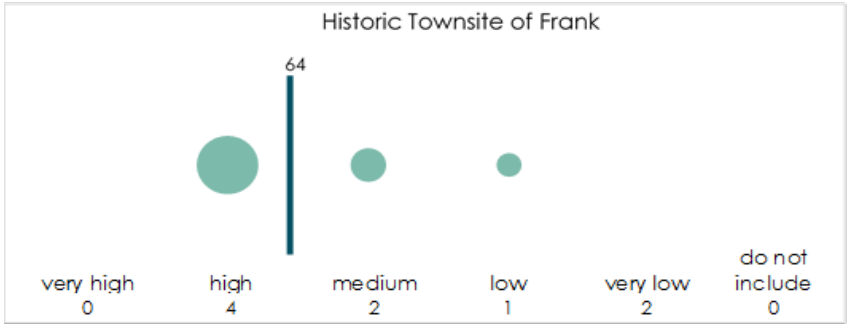


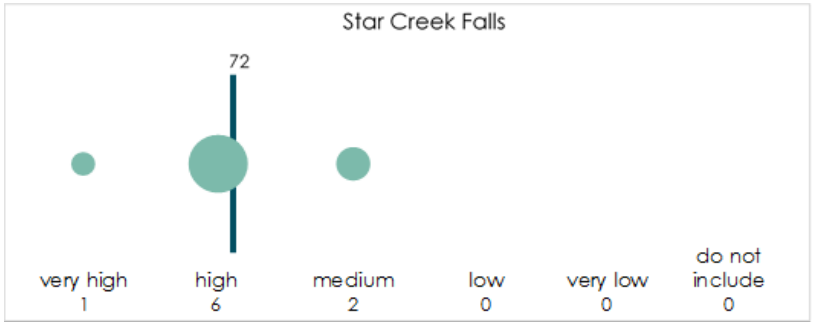


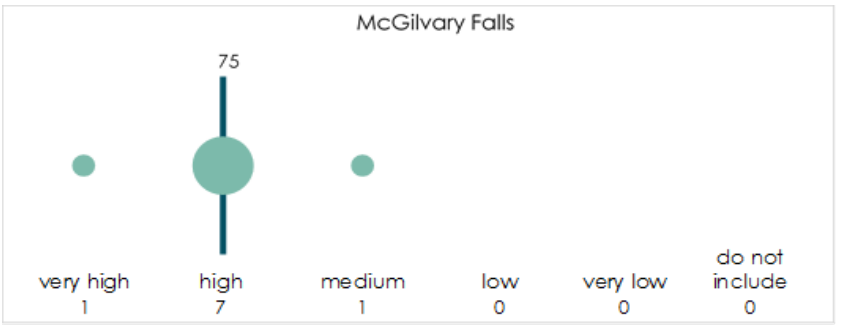

Coke Ovens in Coleman
47
very high 0
high 4
medium 2
low 1
very low 2
do not include 0

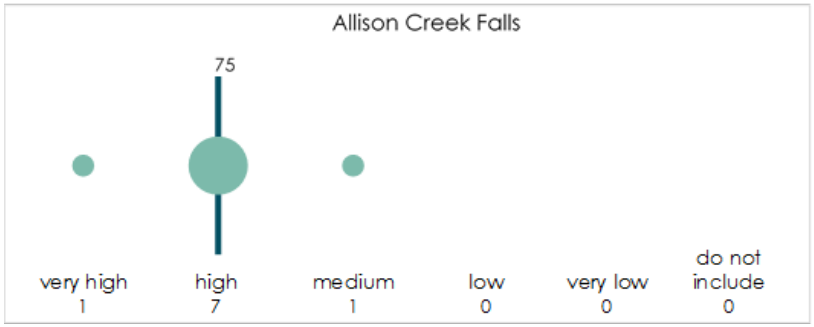

Historic Townsite of Lille
64
very high 0
high 4
medium 2
low 1
very low 2
do not include 0


Sulphur Springs in Frank
53
very high 0
high 3
medium 5
low 0
very low 1
do not include 0


Historic Townsite of Frank
64
very high 0
high 4
medium 2
low 1
very low 2
do not include 0


Star Creek Falls
72
very high 1
high 6
medium 2
low 0
very low 0
do not include 0

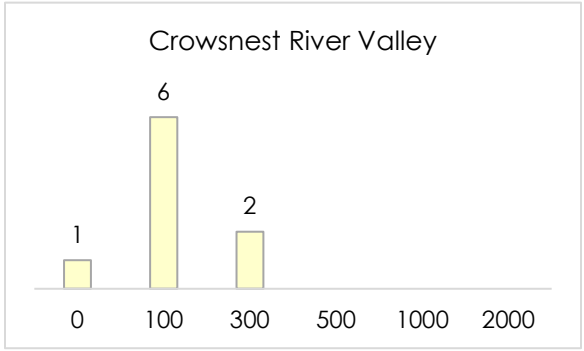

McGilvary Falls
75
very high 1
high 7
medium 1
low 0
very low 0
do not include 0

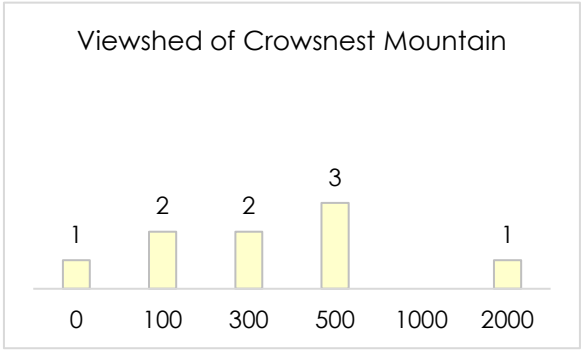

Allison Creek Falls
75
very high 1
high 7
medium 1
low 0
very low 0
do not include 0

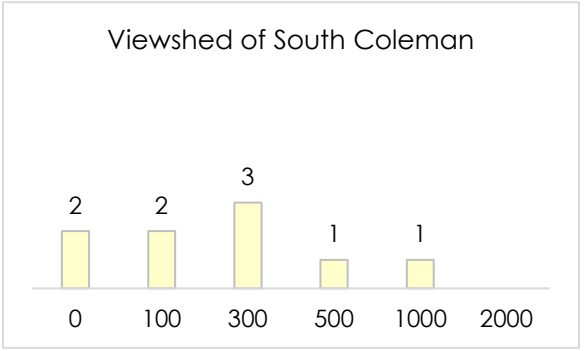
3. *Please select a buffer to apply to each feature when considering* ***residential development.***

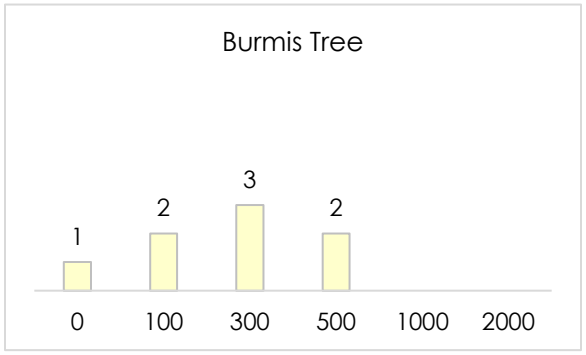
Cultural Feature	0m	100m	300m	500m	1000m	2000m	BUFFER (m)	REFINED BUFFER*(m)
Crowsnest River Valley	11%	66%	22%	0%	0%	0%	133	100
Viewshed of Crowsnest Mountain*	11%	22%	22%	33%	0%	11%	478	500
Viewshed of South Coleman*	22%	22%	33%	11%	11%	0%	286	300
Burmis Tree	12%	25%	38%	25%	0%	0%	263	300
Frank Slide*	11%	22%	11%	22%	22%	11%	611	600
Bellevue Mine	33%	33%	22%	0%	11%	0%	211	200
Leitch Collieries*	11%	33%	33%	11%	11%	0%	300	300
Mine cemeteries	22%	22%	33%	22%	0%	0%	233	200
Coke Ovens in Coleman	33%	44%	22%	0%	0%	0%	111	100
Sulphur Springs in Frank	22%	44%	33%	0%	0%	0%	144	100
Historic Town Site of Lille	22%	55%	22%	0%	0%	0%	122	100
Historic Town Site of Frank	22%	11%	44%	22%	0%	0%	256	300
McGilvary Falls*	11%	11%	33%	33%	11%	0%	389	400
Star Creek Falls*	11%	11%	33%	33%	11%	0%	389	400
Allison Creek Falls*	11%	11%	22%	44%	11%	0%	411	400

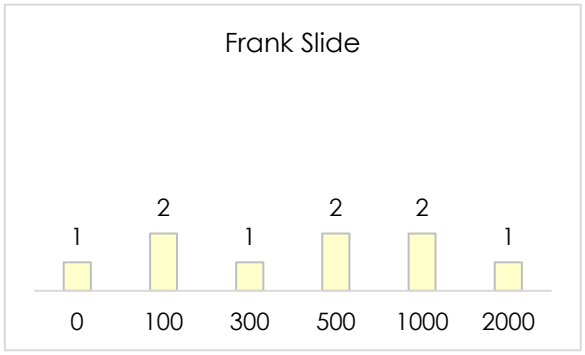
**Refined buffers were determined at Webinar 2 through discussion and consensus.*

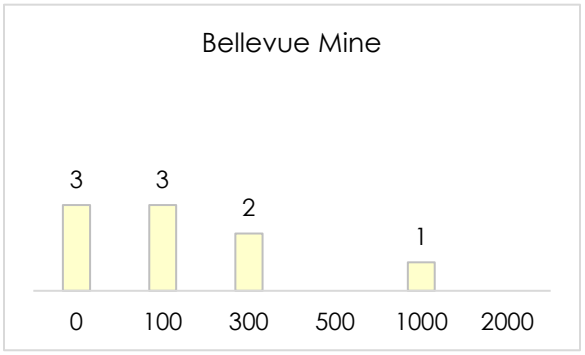


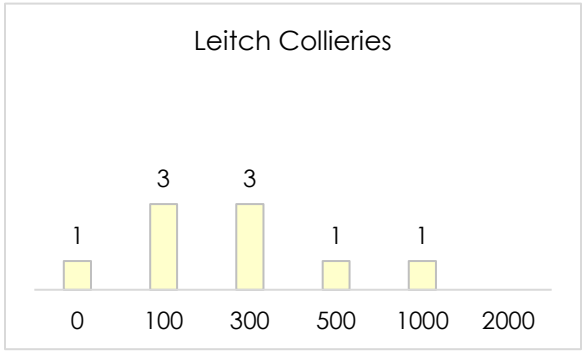


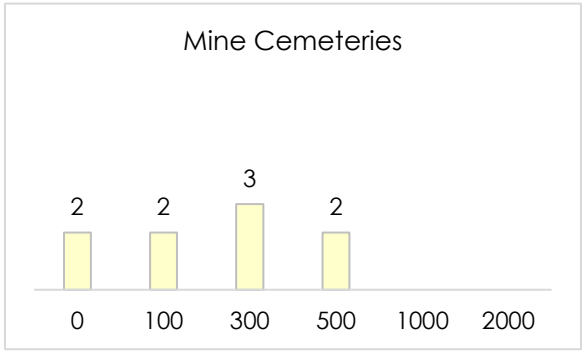


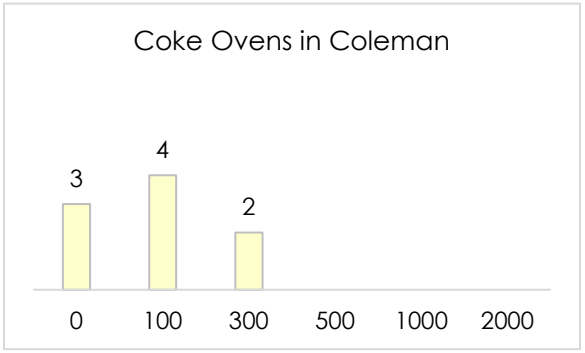

Burmis Tree
1
2
3
2
0
100
300
500
1000
2000

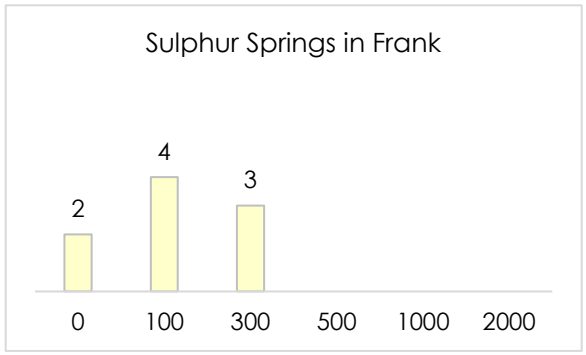

Frank Slide
1
2
1
2
2
1
0
100
300
500
1000
2000

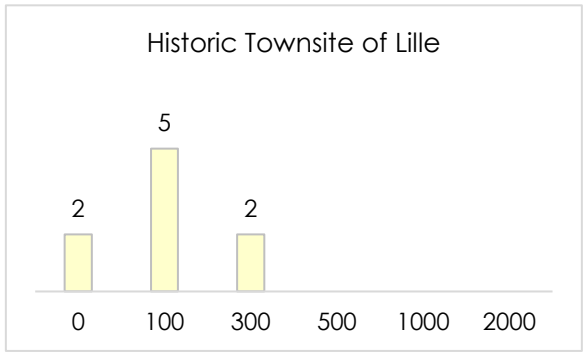

Bellevue Mine
3
3
2
1
0
100
300
500
1000
2000

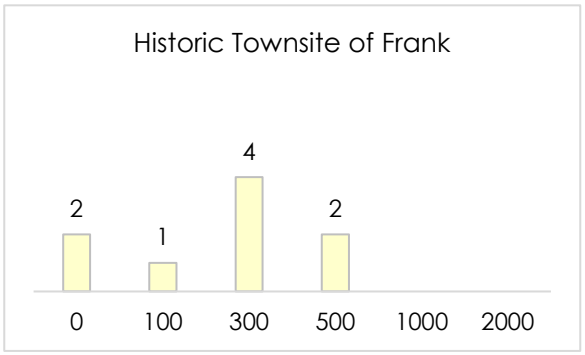

Leitch Collieries
1
3
3
1
1
0
100
300
500
1000
2000

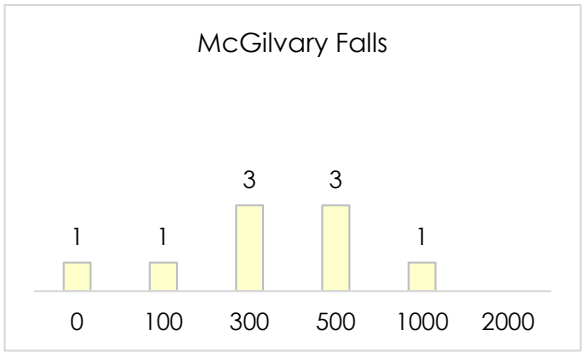

Mine Cemeteries
2
2
3
2
0
100
300
500
1000
2000

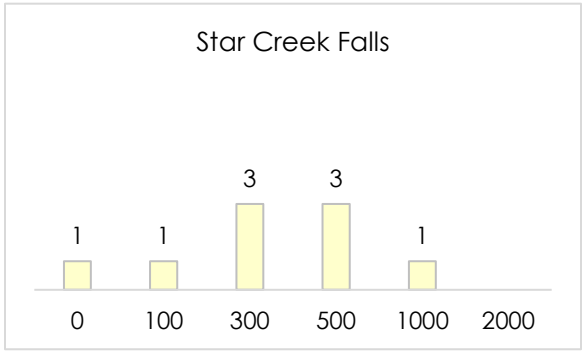

Coke Ovens in Coleman
3
4
2
0
100
300
500
1000
2000

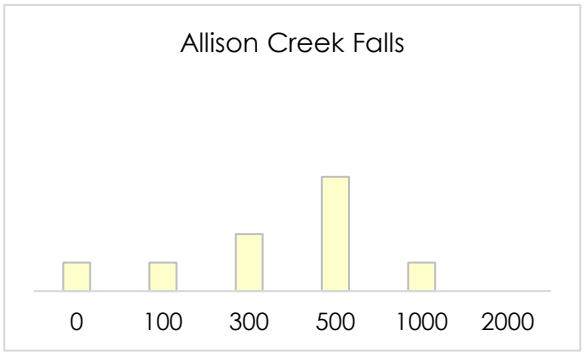

Sulphur Springs in Frank
2
4
3
0
100
300
500
1000
2000


Historic Townsite of Lille
2
5
2
0
100
300
500
1000
2000


Historic Townsite of Frank
2
1
4
2
0
100
300
500
1000
2000

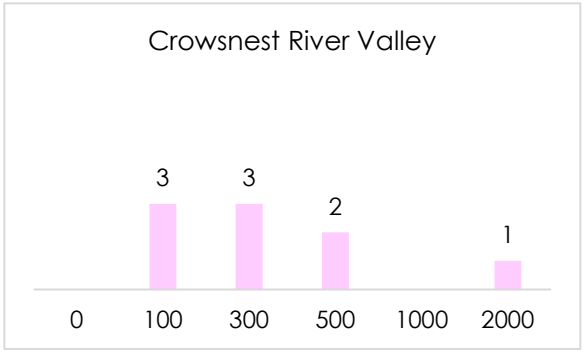

McGilvary Falls
1
1
3
3
1
0
100
300
500
1000
2000

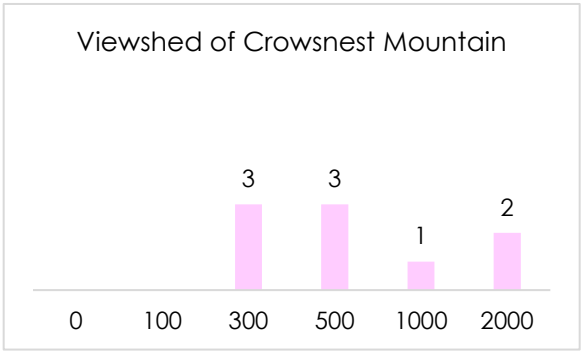

Star Creek Falls
1
1
3
3
1
0
100
300
500
1000
2000

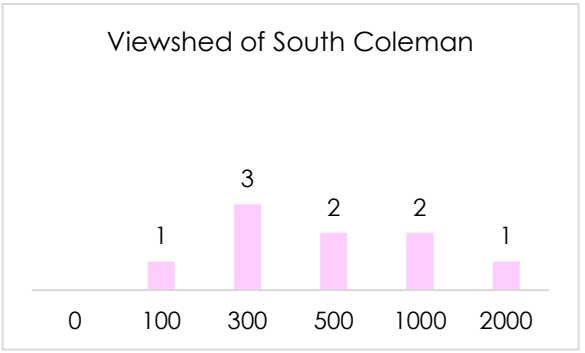

Allison Creek Falls
0
100
300
500
1000
2000

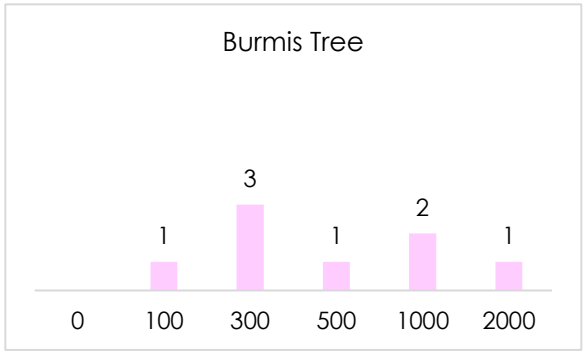
4. *Please select a buffer to apply for each feature when considering* ***commercial/Light Industrial development.***

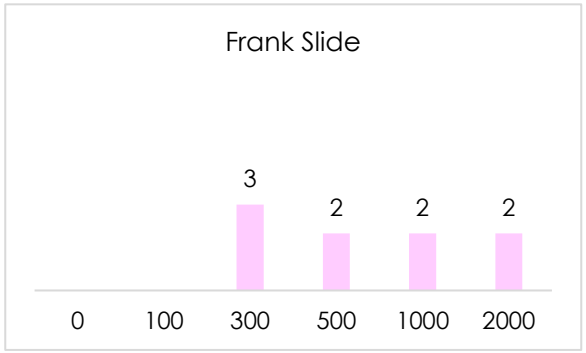
Cultural Feature	0m	100m	300m	500m	1000m	2000m	BUFFER (m)	REFINED BUFFER*(m)
Crowsnest River Valley	0%	33%	33%	22%	0%	11%	467	500
Viewshed of Crowsnest Mountain	0%	0%	33%	33%	11%	22%	822	800
Viewshed of South Coleman*	0%	11%	33%	22%	22%	11%	667	700
Burmis Tree*	0%	12%	38%	12%	25%	12%	688	700
Frank Slide	0%	0%	33%	22%	22%	22%	878	900
Bellevue Mine*	12%	25%	12%	25%	12%	12%	563	600
Leitch Collieries*	0%	22%	22%	33%	11%	11%	589	600
Mine cemeteries	11%	11%	11%	55%	0%	11%	544	500
Coke Ovens in Coleman	11%	33%	33%	11%	0%	11%	411	400
Sulphur Springs in Frank	11%	33%	22%	22%	0%	11%	433	400
Historic Town Site of Lille	11%	0%	22%	33%	22%	11%	678	700
Historic Town Site of Frank	11%	11%	0%	44%	22%	11%	678	700
McGilvary Falls	11%	0%	0%	44%	33%	11%	778	800
Star Creek Falls	11%	0%	0%	44%	33%	11%	778	800
Allison Creek Falls	11%	0%	0%	44%	33%	11%	778	800

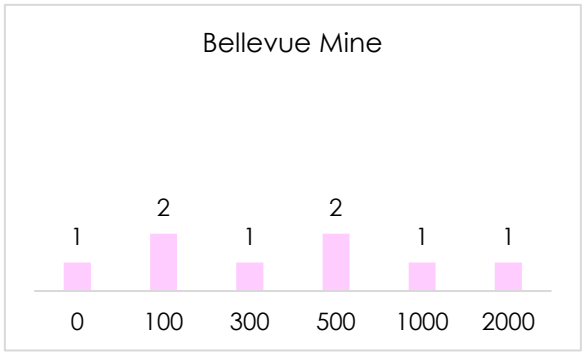


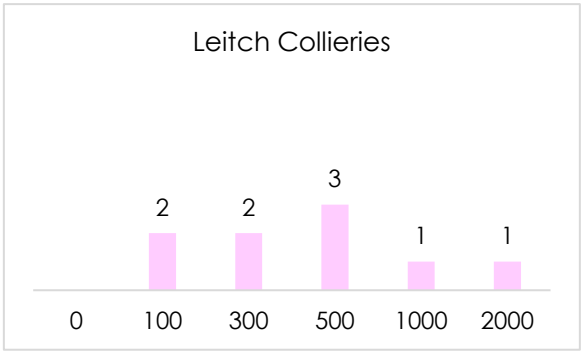


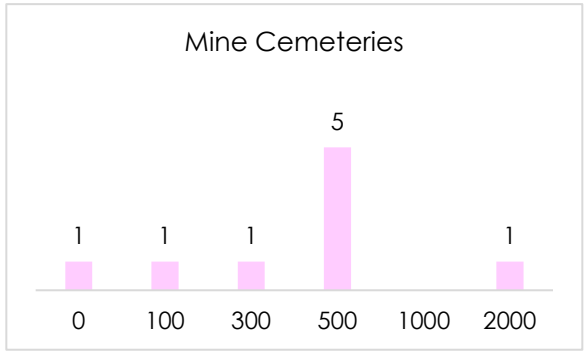


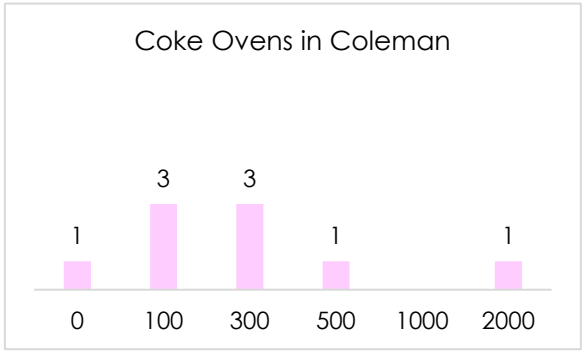

Burmis Tree
0
1
3
1
2
1
0
100
300
500
1000
2000

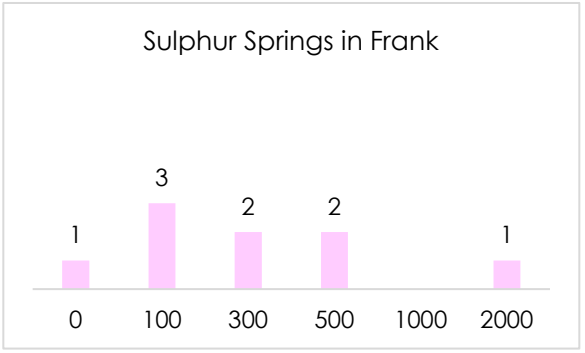

Frank Slide
0
3
2
2
2
0
100
300
500
1000
2000

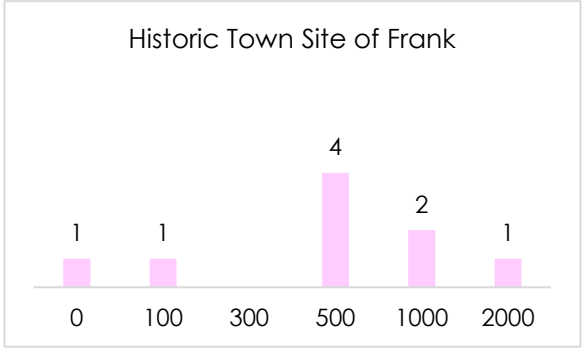

Bellevue Mine
1
2
1
2
1
1
0
100
300
500
1000
2000

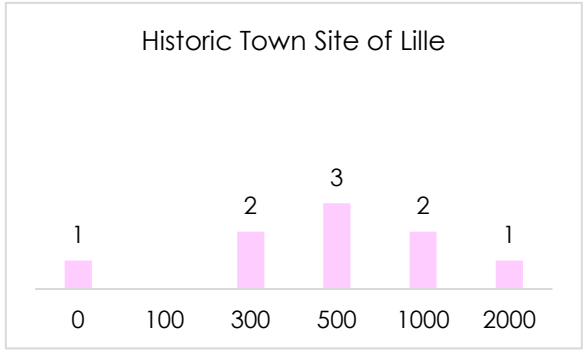

Leitch Collieries
0
2
2
3
1
1
0
100
300
500
1000
2000

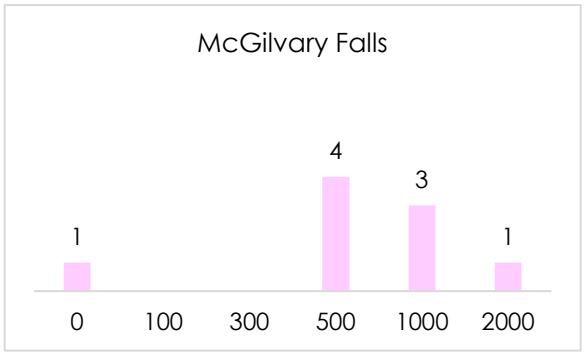

Mine Cemeteries
1
1
1
5
1
0
100
300
500
1000
2000

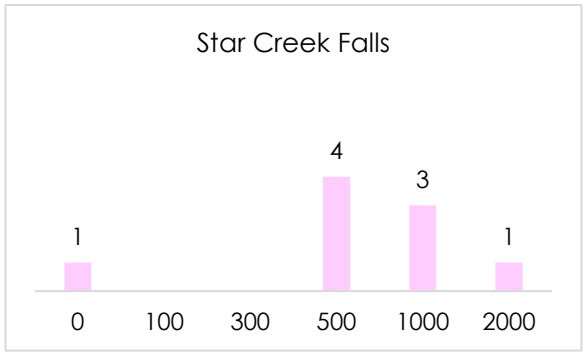

Coke Ovens in Coleman
1
3
3
1
1
0
100
300
500
1000
2000

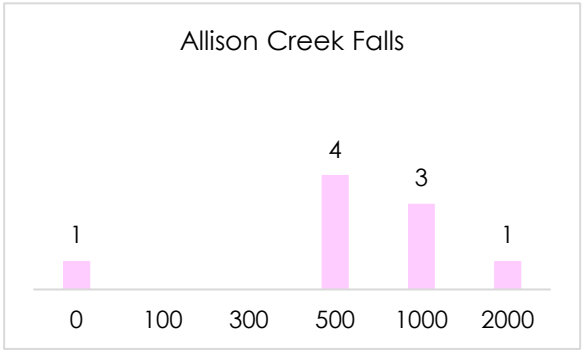

Sulphur Springs in Frank
1
3
2
2
1
0
100
300
500
1000
2000


Historic Town Site of Frank
1
1
4
2
1
0
100
300
500
1000
2000


Historic Town Site of Lille
1
2
3
2
1
0
100
300
500
1000
2000

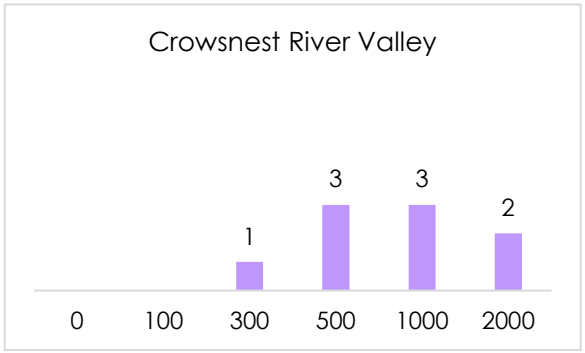

McGilvary Falls
1
4
3
1
0
100
300
500
1000
2000

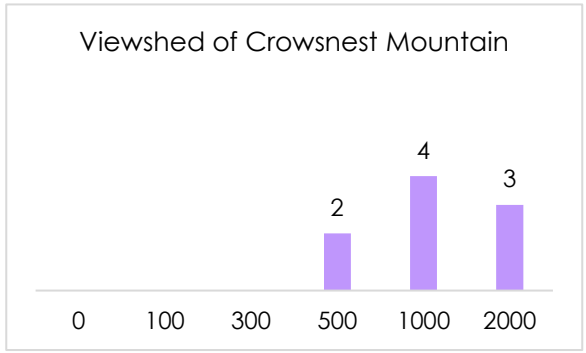

Star Creek Falls
1
4
3
1
0
100
300
500
1000
2000

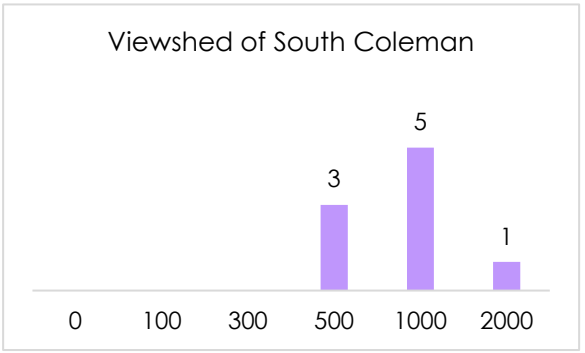

Allison Creek Falls
1
4
3
1
0
100
300
500
1000
2000

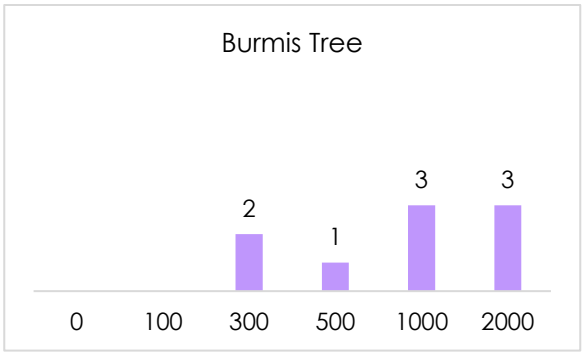
5. *Please select a buffer for each feature when considering* ***primary (heavy) industrial development.***

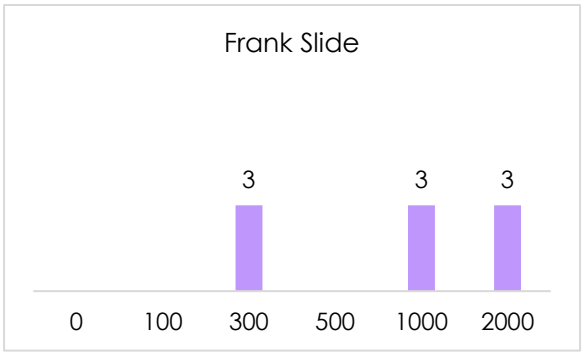
Cultural Feature	0m	100m	300m	500m	1000m	2000m	buffer	refined buffer
Crowsnest River Valley	0%	0%	11%	33%	33%	22%	978	1000
Viewshed of Crowsnest Mountain	0%	0%	0%	22%	44%	33%	1222	1200
Viewshed of South Coleman	0%	0%	0%	33%	55%	11%	944	900
Burmis Tree	0%	0%	22%	11%	33%	33%	1122	1100
Frank Slide*	0%	0%	33%	0%	33%	33%	1100	1100
Bellevue Mine*	11%	0%	33%	11%	22%	22%	822	800
Leitch Collieries	11%	0%	0%	22%	55%	11%	889	900
Mine cemeteries	11%	0%	0%	11%	55%	22%	1056	1000
Coke Ovens in Coleman*	11%	0%	33%	11%	22%	22%	822	800
Sulphur Springs in Frank*	11%	0%	33%	0%	33%	22%	878	900
Historic Town Site of Lille	11%	0%	11%	11%	33%	33%	1167	1200
Historic Town Site of Frank	11%	0%	0%	11%	44%	33%	1089	1100
McGilvary Falls	0%	0%	11%	0%	33%	55%	1478	1500
Star Creek Falls	0%	0%	11%	0%	33%	55%	1478	1500
Allison Creek Falls	0%	0%	11%	0%	33%	55%	1478	1500

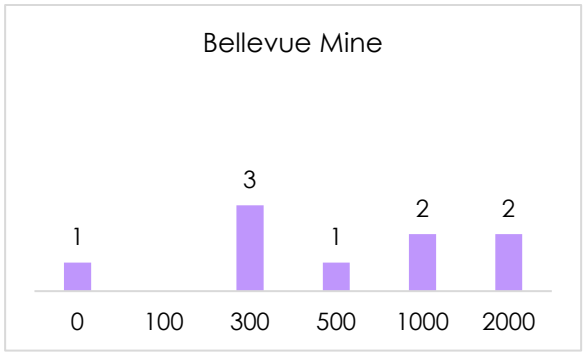


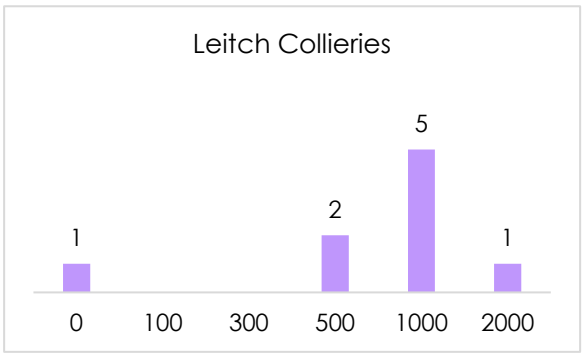


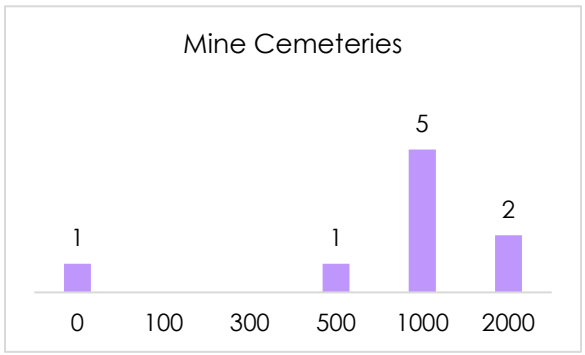


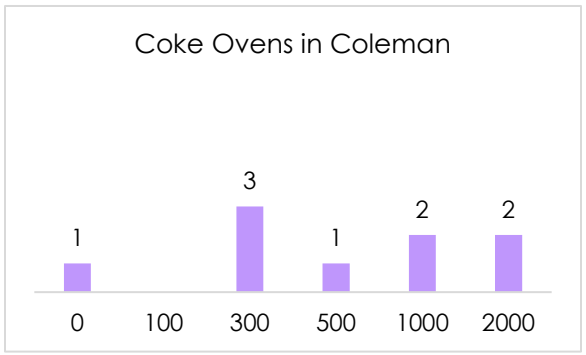

Burmis Tree
0
100
300
500
1000
2000
2
1
3
3

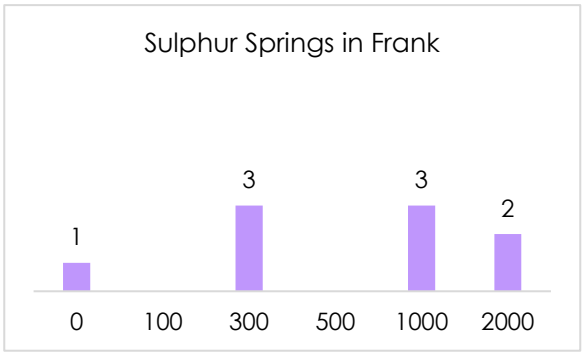

Frank Slide
0
100
300
500
1000
2000
3
3
3

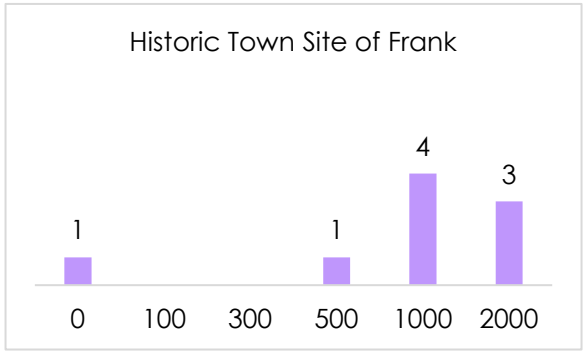

Bellevue Mine
0
100
300
500
1000
2000
1
3
1
2
2

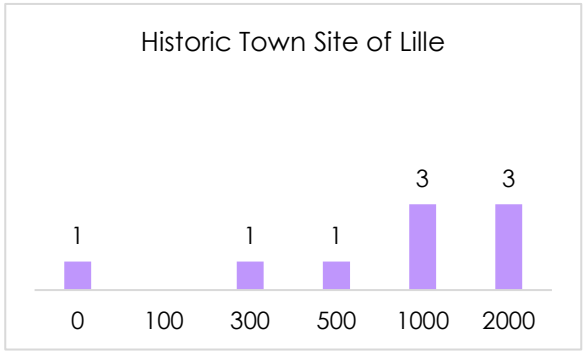

Leitch Collieries
0
100
300
500
1000
2000
1
2
5
1

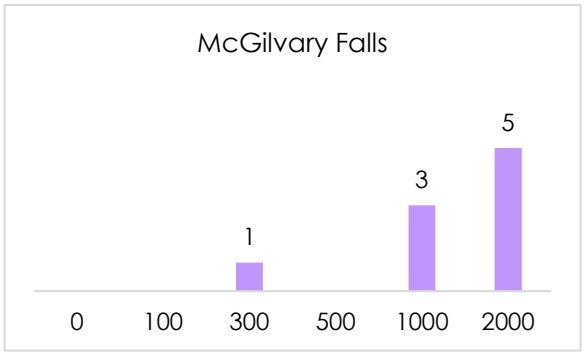

Mine Cemeteries
0
100
300
500
1000
2000
1
1
5
2

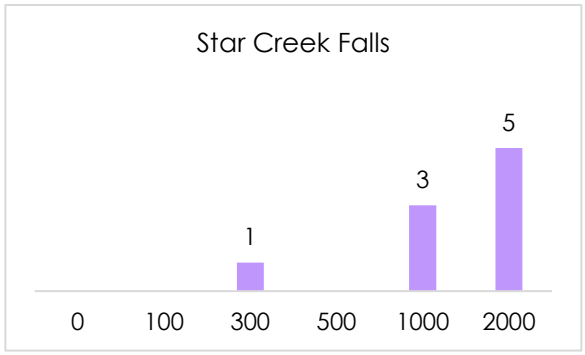

Coke Ovens in Coleman
0
100
300
500
1000
2000
1
3
1
2
2

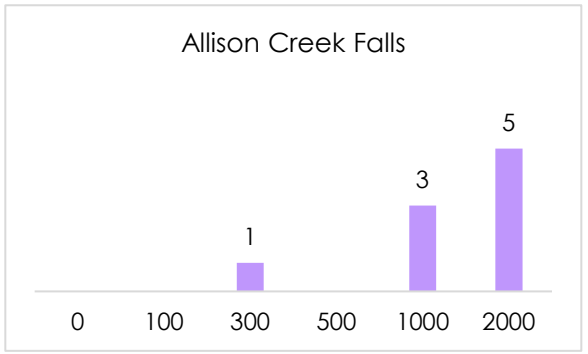

Sulphur Springs in Frank
0
100
300
500
1000
2000
1
3
3
2


Historic Town Site of Frank
0
100
300
500
1000
2000
1
1
4
3


Historic Town Site of Lille
0
100
300
500
1000
2000
1
1
1
3
3


McGilvary Falls
1
3
5
0
100
300
500
1000
2000

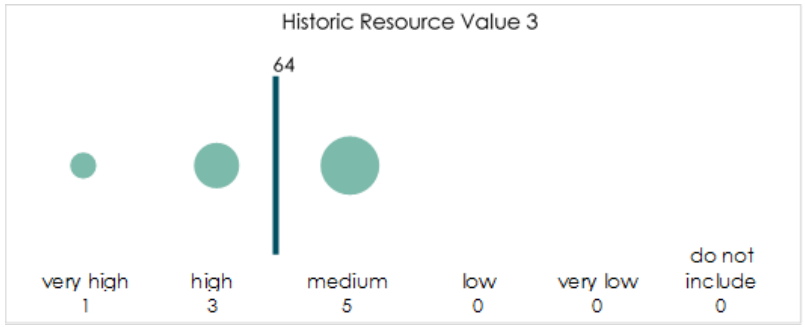

Star Creek Falls
1
3
5
0
100
300
500
1000
2000

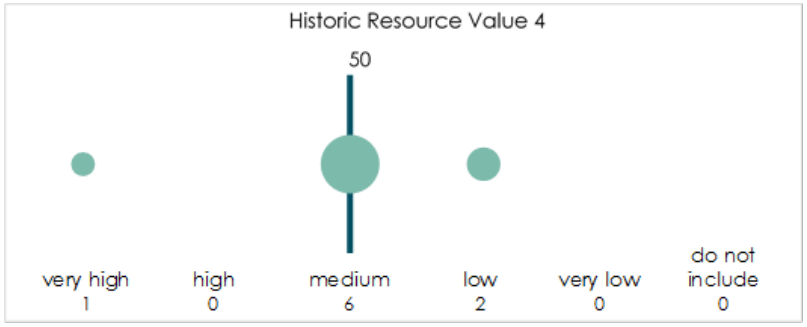

Allison Creek Falls
1
3
5
0
100
300
500
1000
2000

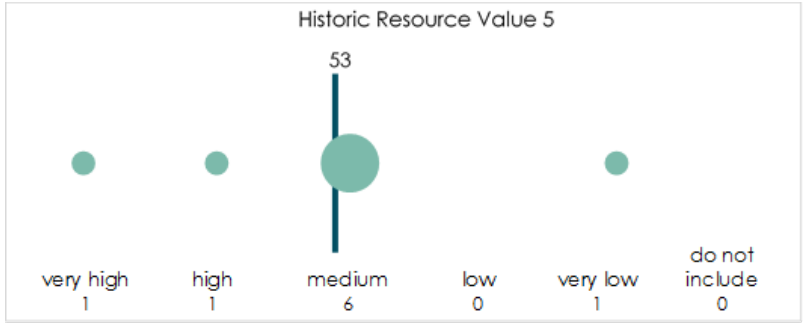
6. *A Historic Resource Values (HRV) layer is provided by the Government of Alberta to help developers, industry representatives, and regulators determine if a proposed development might affect historic resources. There are five resource classes. HRV 1 and HRV 2 are regulated as non-developable and you are not asked to score them. Please score HRV class 3 to 5 based on their level of importance to the cultural theme.*

Historic Resource Values (HRV)	very high	high	medium	low	very low	do not include
HRV Class 3: contains a significant historic resource that will likely require avoidance	11%	33%	55%	0%	0%	0%
HRV Class 4: contains a historic resource that may require avoidance	11%	0%	66%	22%	0%	0%
HRV Class 5: high potential to contain a historic resource	11%	11%	66%	0%	11%	0%

Historic Resource Values (HRV)	Conflict Probability Rating
HRV Class 3: contains a significant historic resource that will likely require avoidance	63
HRV Class 4: contains a historic resource that may require avoidance	49
HRV Class 5: high potential to contain a historic resource	52







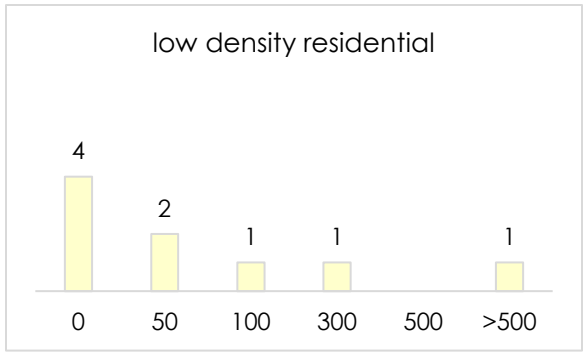
Settlement and Infrastructure Theme

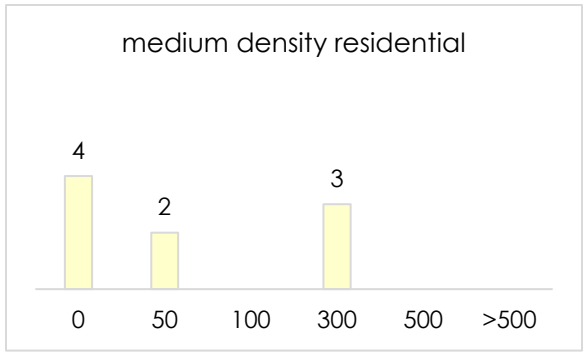
For calculations, ">500m" buffer was replaced by a value of 700. Resultantly, any 'buffer' that exceeded 500, was identified as *">500m"*.

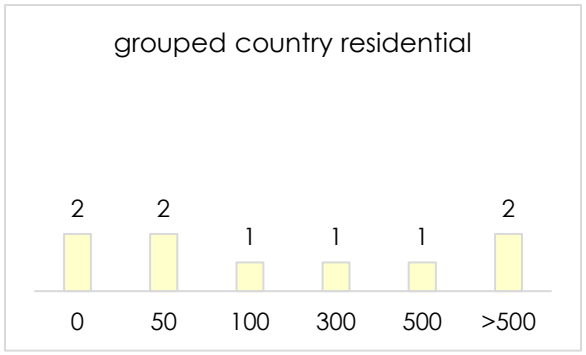
1. *Please provide a buffer for the following features in relation to* ***residential development.***

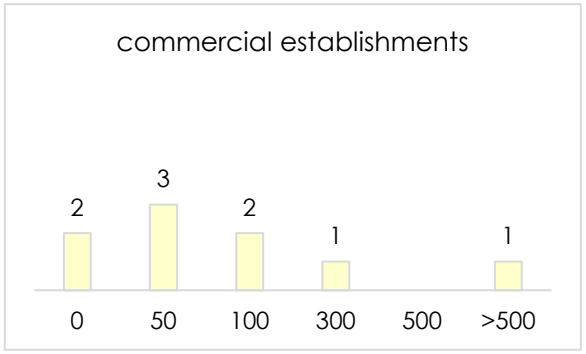
Settlement/Infrastructure Feature	0m	50m	100m	300m	500m	>500m	Average buffer	Refined buffer	Final Buffer with Consensus
Low density residential	44%	22%	11%	11%	0%	11%	133	100	0
Medium density residential	44%	22%	0%	33%	0%	0%	111	100	100
Grouped country residential	22%	22%	11%	11%	11%	22%	267	300	300
Commercial establishments	22%	33%	22%	11%	0%	11%	150	100	50
Light industrial parks	0%	22%	22%	22%	11%	22%	311	300	300
Transmission lines	11%	0%	22%	22%	11%	33%	378	300	300
Oil and Gas Infrastructure	0%	0%	0%	44%	11%	44%	500	500	500
Mineral extraction	0%	0%	0%	0%	25%	75%	650	>500	2000
Power plants	0%	0%	0%	11%	22%	66%	611	>500	2000
Landfills	0%	0%	0%	0%	11%	88%	678	>500	1500
Primary highways	0%	0%	11%	55%	22%	11%	367	300	300
Secondary highways	0%	22%	33%	22%	22%	0%	222	300	300
Highway 3 realignment	0%	0%	11%	66%	0%	22%	367	300	300
Paved roads	22%	22%	11%	22%	22%	0%	200	100	0
Gravel roads	22%	11%	33%	11%	22%	0%	183	100	0
Railways	0%	11%	33%	22%	11%	22%	317	300	50
Raw water reservoirs*	0%	22%	22%	11%	11%	33%	356	300	50*
Water treatment plants*	11%	0%	22%	11%	11%	44%	422	500	50*

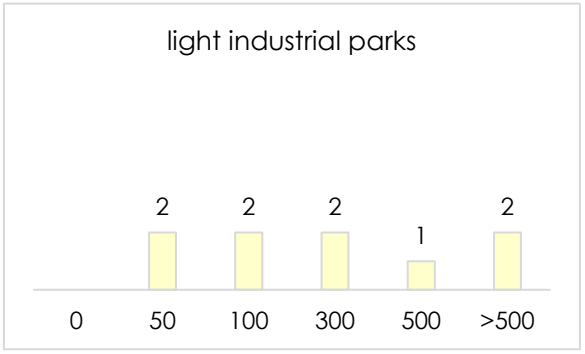
* During Webinar 2, participants determined that the Buffers for raw water reservoirs and water treatment plants be combined.

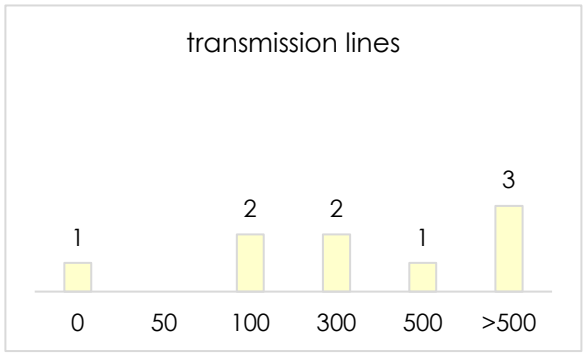

low density residential
4
2
1
1
1
0
50
100
300
500
>500

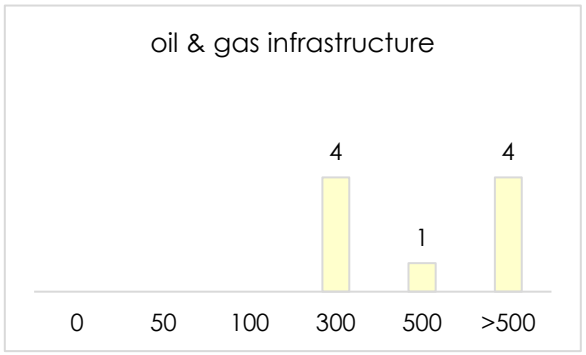

medium density residential
4
2
3
0
50
100
300
500
>500

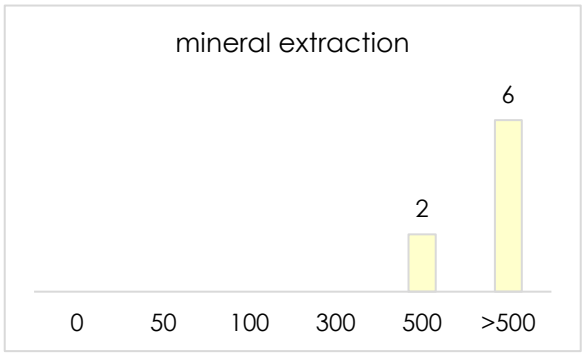

grouped country residential
2
2
1
1
1
2
0
50
100
300
500
>500

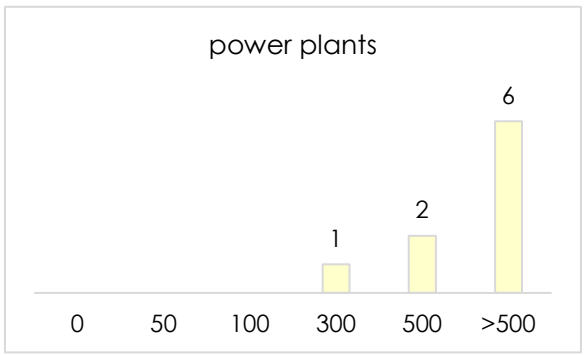

commercial establishments
2
3
2
1
1
0
50
100
300
500
>500

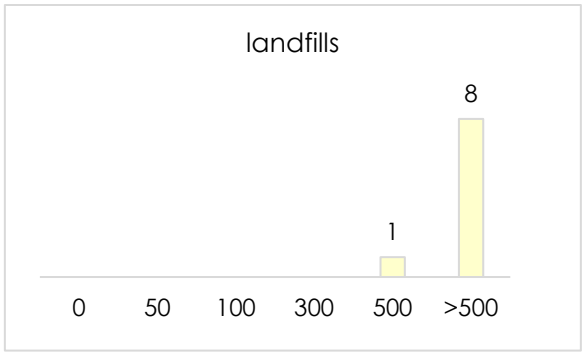

light industrial parks
2
2
2
1
2
0
50
100
300
500
>500

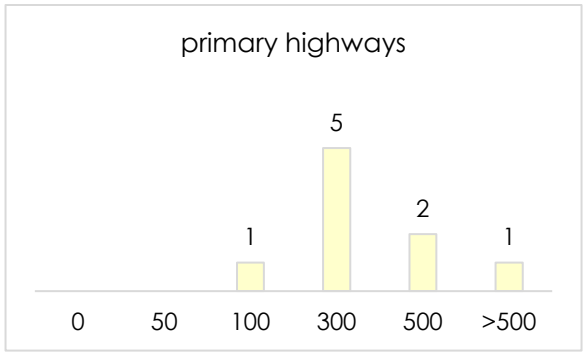

transmission lines
1
2
2
1
3
0
50
100
300
500
>500

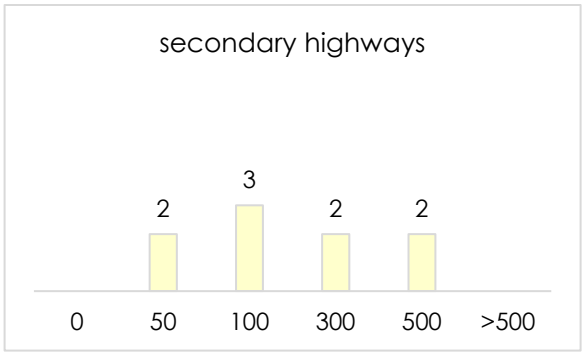

oil & gas infrastructure
4
1
4
0
50
100
300
500
>500


mineral extraction
2
6
0
50
100
300
500
>500

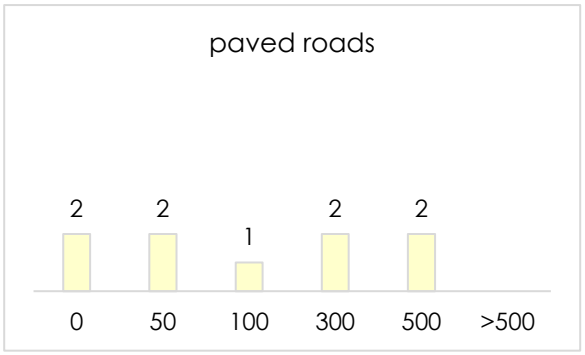

power plants
1
2
6
0
50
100
300
500
>500

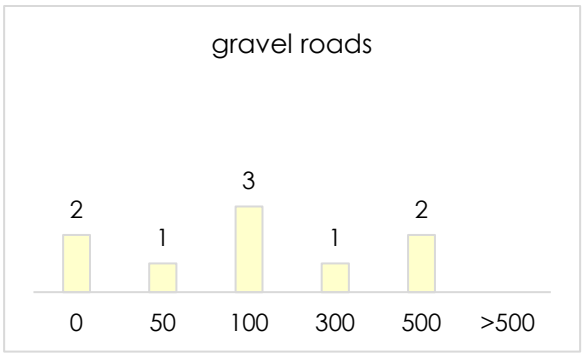

landfills
0
50
100
300
500
>500
1
8

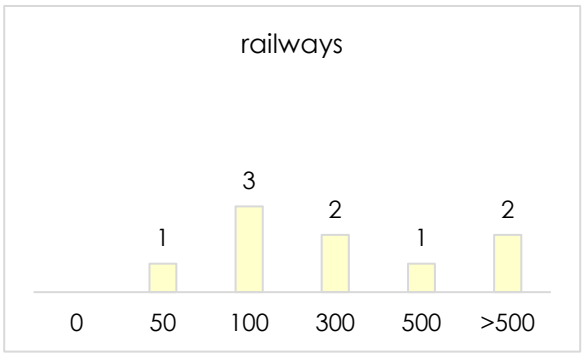

primary highways
0
50
100
300
500
>500
1
5
2
1

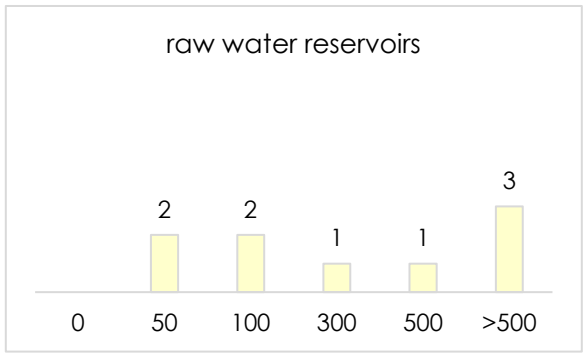

secondary highways
0
50
100
300
500
>500
2
3
2
2

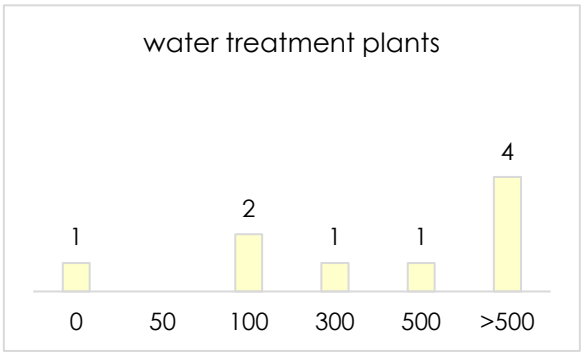

Highway 3 realignment
0
50
100
300
500
>500
1
6
2


paved roads
0
50
100
300
500
>500
2
2
1
2
2


gravel roads
0
50
100
300
500
>500
2
1
3
1
2


railways
0
50
100
300
500
>500
1
3
2
1
2

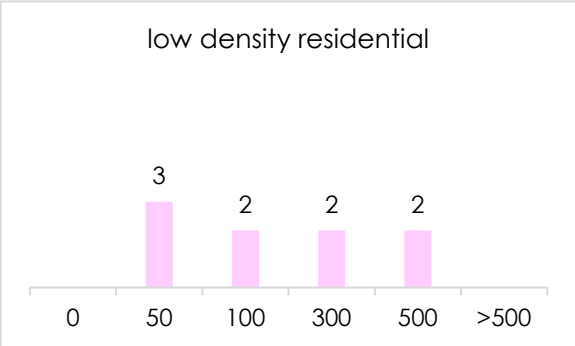

raw water reservoirs
0
50
100
300
500
>500
2
2
1
1
3

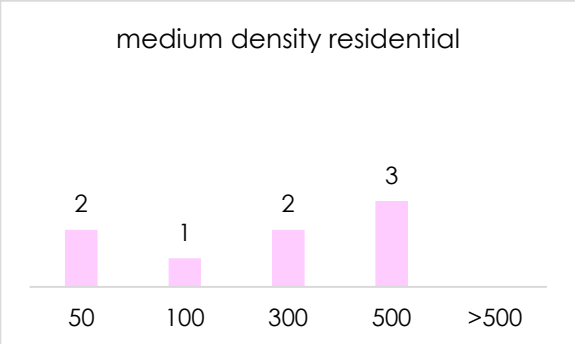

water treatment plants
0
50
100
300
500
>500
1
2
1
1
4

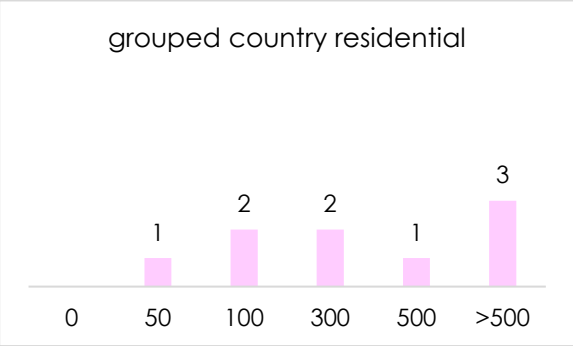
2. *Please provide a buffer for the following features in relation to **commercial/light industrial** development.*

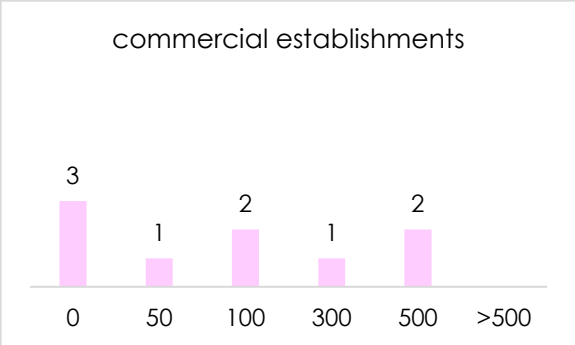
Settlement/Infrastructure Feature	0m	50m	100m	300m	500m	>500m	Average buffer	Refined buffer	Final Buffer with Consensus
Low density residential	0%	33%	22%	22%	22%	0%	217	300	300
Medium density residential	11%	22%	11%	22%	33%	0%	256	300	300
Grouped country residential	0%	11%	22%	22%	11%	33%	383	300	300
Commercial establishments	33%	11%	22%	11%	22%	0%	172	100	0
Light industrial parks	33%	11%	0%	11%	22%	22%	306	300	0
Transmission lines	0%	11%	44%	0%	0%	44%	361	300	100
Oil and Gas Infrastructure	0%	0%	22%	33%	0%	44%	433	500	500
Mineral extraction	0%	0%	0%	25%	25%	50%	550	>500	2000
Power plants	0%	0%	0%	22%	33%	55%	544	>500	2000
Landfills	0%	0%	0%	0%	33%	66%	633	>500	1000
Primary highways	11%	22%	11%	22%	22%	11%	278	300	0
Secondary highways	11%	22%	11%	33%	11%	11%	256	300	0
Highway 3 realignment	11%	0%	33%	11%	22%	22%	333	300	0
Paved roads	33%	22%	11%	11%	22%	0%	167	100	0
Gravel roads	22%	22%	22%	22%	11%	0%	156	100	0
Railways	11%	33%	22%	0%	11%	22%	250	300	50
Raw water reservoirs*	0%	0%	33%	0%	22%	44%	456	500	100*
Water treatment plants*	0%	0%	11%	0%	33%	55%	567	>500	100*

* During Webinar 2, participants determined that the Buffers for raw water reservoirs and water treatment plants be combined.

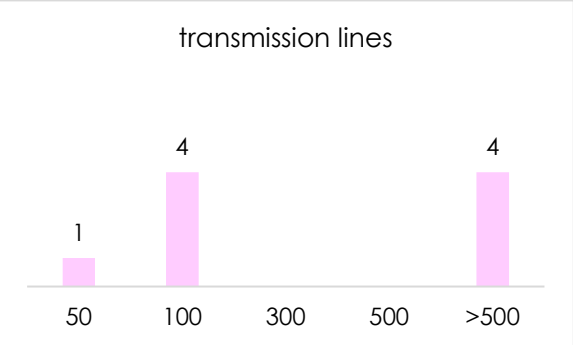

low density residential
3
2
2
2
0
50
100
300
500
>500

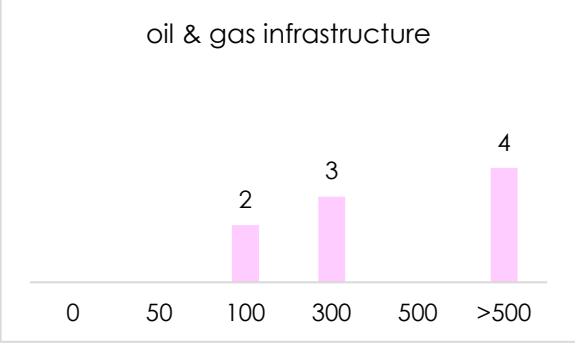

medium density residential
2
1
2
3
50
100
300
500
>500

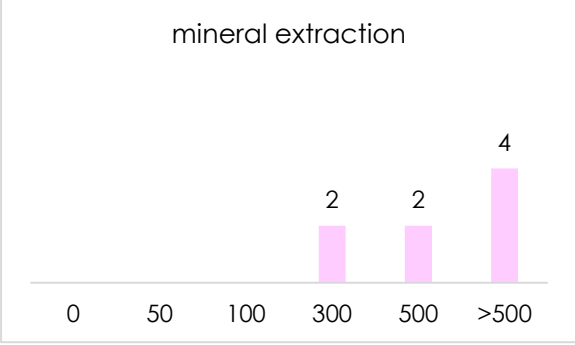

grouped country residential
1
2
2
1
3
0
50
100
300
500
>500

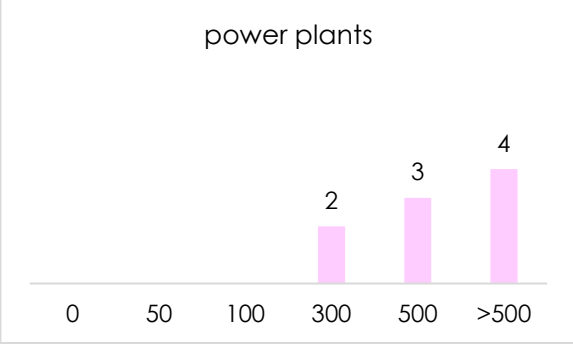

commercial establishments
3
1
2
1
2
0
50
100
300
500
>500

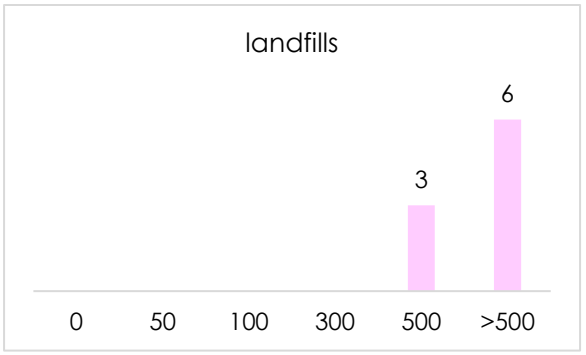

light industrial parks
3
1
1
2
2
0
50
100
300
500
>500

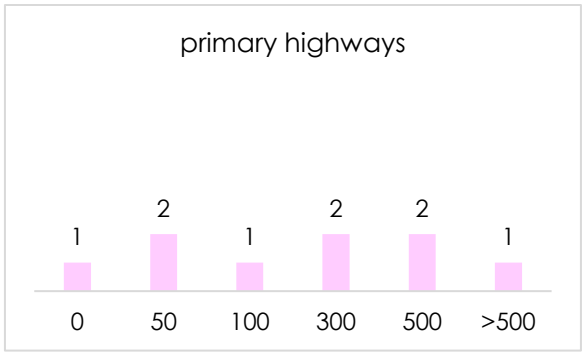

transmission lines
1
4
4
50
100
300
500
>500

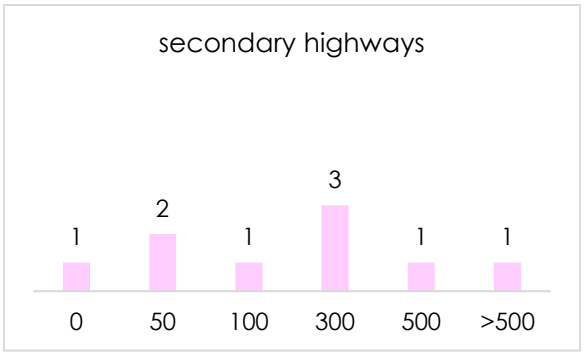

oil & gas infrastructure
2
3
4
0
50
100
300
500
>500


mineral extraction
2
2
4
0
50
100
300
500
>500

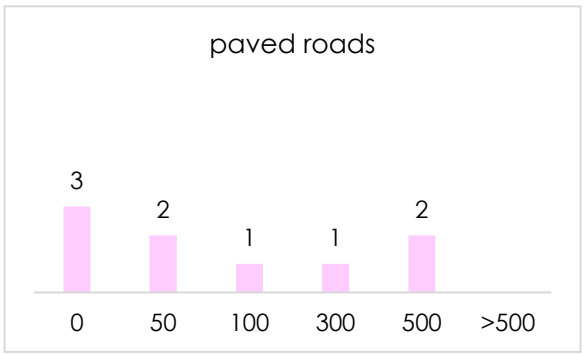

power plants
2
3
4
0
50
100
300
500
>500

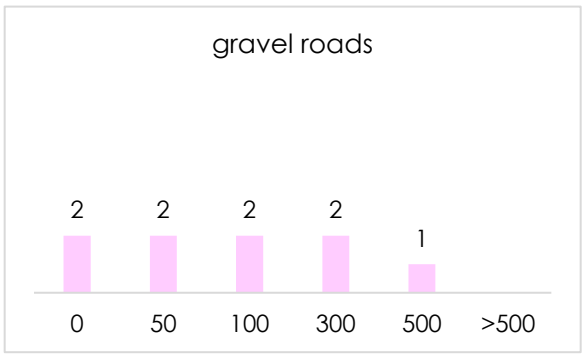

landfills
0
50
100
300
500
>500
3
6

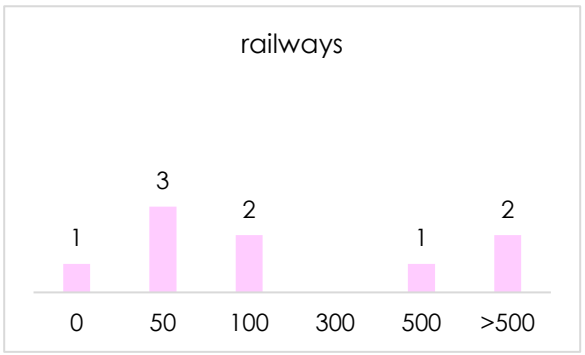

primary highways
1
2
1
2
2
1
0
50
100
300
500
>500

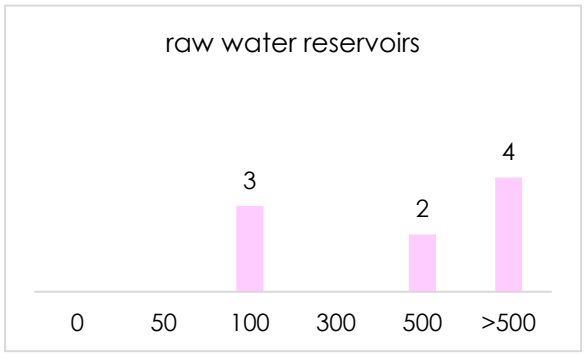

secondary highways
1
2
1
3
1
1
0
50
100
300
500
>500

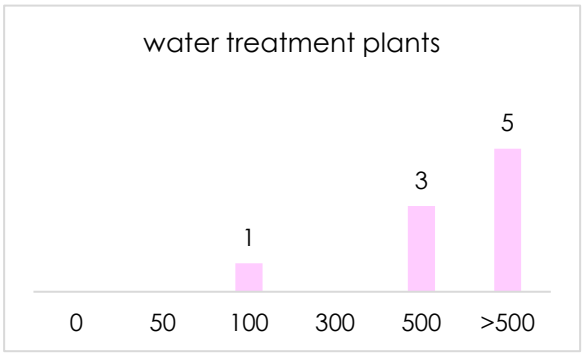

Highway 3 realignment
1
3
1
2
2
0
50
100
300
500
>500


paved roads
3
2
1
1
2
0
50
100
300
500
>500


gravel roads
2
2
2
2
1
0
50
100
300
500
>500


railways
1
3
2
1
2
0
50
100
300
500
>500

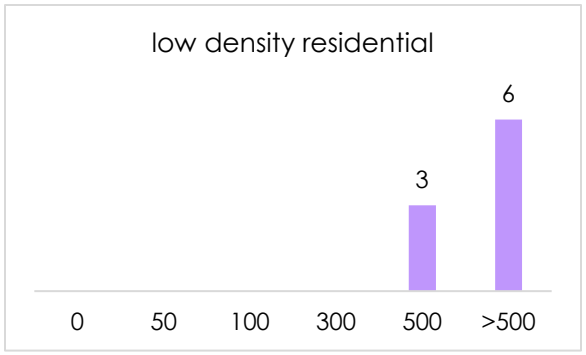

raw water reservoirs
3
2
4
0
50
100
300
500
>500

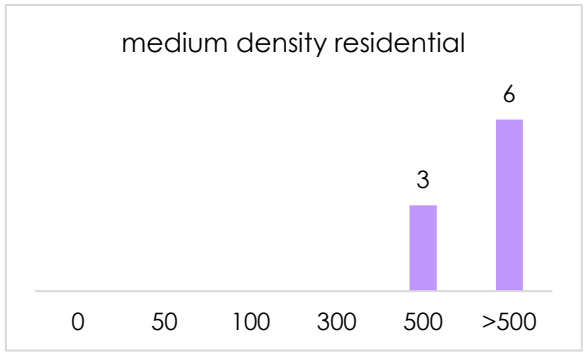

water treatment plants
1
3
5
0
50
100
300
500
>500

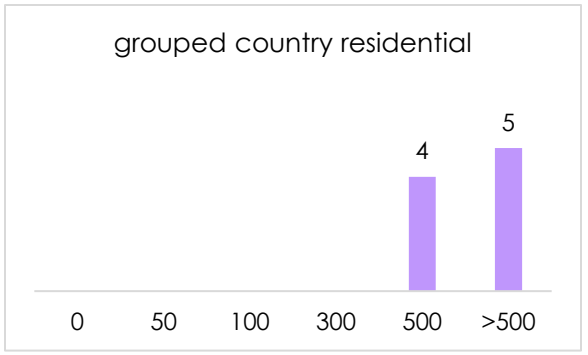
3. *Please provide a buffer for the following features in relation to **primary (heavy) industrial** development.*

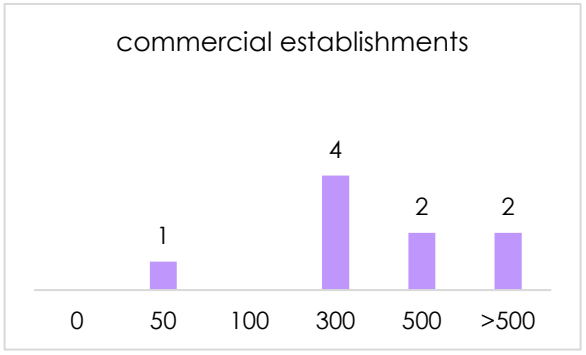
Settlement/Infrastructure Feature	0m	50m	100m	300m	500m	>500m	Average buffer	Refined buffer	Final Buffer with Consensus
Low density residential	0%	0%	0%	0%	33%	66%	633	>500	2000
Medium density residential	0%	0%	0%	0%	33%	66%	633	>500	2000
Grouped country residential	0%	0%	0%	0%	44%	55%	611	>500	1000
Commercial establishments	0%	11%	0%	44%	22%	22%	406	500	500
Light industrial parks	0%	11%	33%	11%	22%	22%	339	300	300
Transmission lines	22%	22%	11%	11%	0%	33%	289	300	0
Oil and Gas Infrastructure	22%	22%	11%	11%	0%	33%	289	300	0
Mineral extraction	22%	11%	22%	11%	0%	33%	294	300	0
Power plants	22%	11%	22%	11%	0%	33%	294	300	0
Landfills	22%	0%	0%	11%	66%	0%	367	300	50
Primary highways	11%	11%	33%	11%	11%	22%	283	300	0
Secondary highways	11%	22%	22%	11%	11%	22%	278	300	0
Highway 3 realignment	11%	0%	33%	22%	11%	22%	311	300	0
Paved roads	33%	11%	22%	11%	11%	11%	194	100	0
Gravel roads	33%	11%	22%	11%	11%	11%	194	100	0
Railways	11%	22%	33%	0%	0%	33%	278	300	300
Raw water reservoirs*	0%	0%	11%	0%	22%	66%	633	>500	2000*
Water treatment plants*	0%	0%	0%	11%	11%	77%	633	>500	2000*

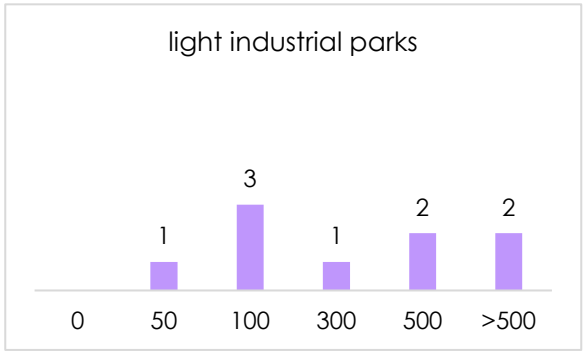
* During Webinar 2, participants determined that the Buffers for raw water reservoirs and water treatment plants be combined.

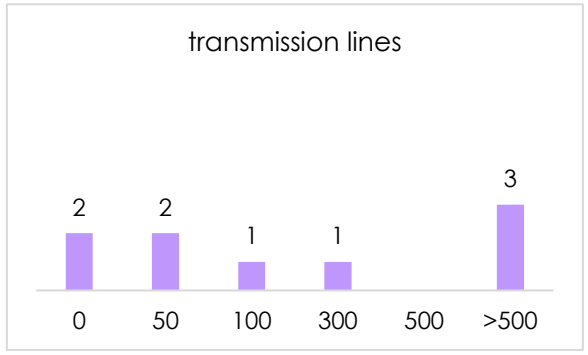

low density residential
0
50
100
300
500
>500
3
6

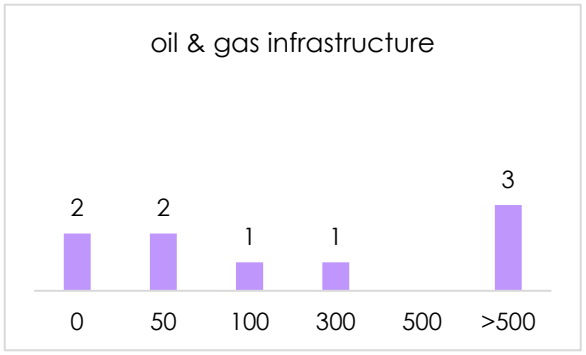

medium density residential
0
50
100
300
500
>500
3
6

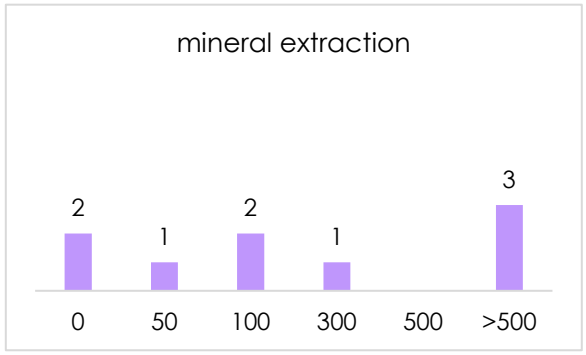

grouped country residential
0
50
100
300
500
>500
4
5

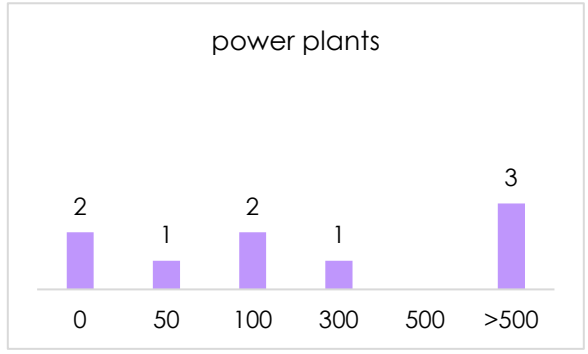

commercial establishments
0
50
100
300
500
>500
1
4
2
2

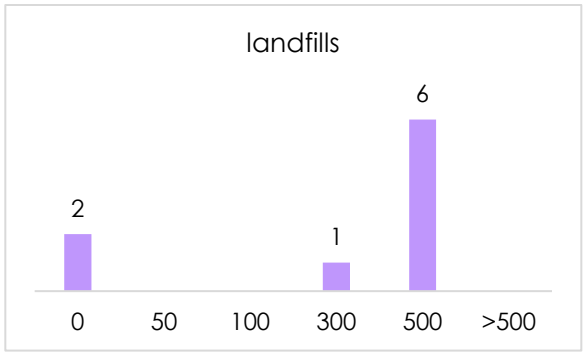

light industrial parks
0
50
100
300
500
>500
1
3
1
2
2

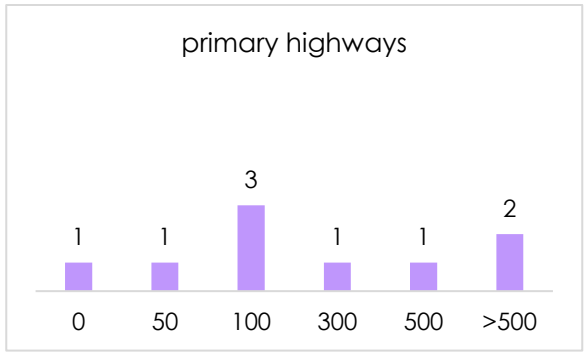

transmission lines
0
50
100
300
500
>500
2
2
1
1
3

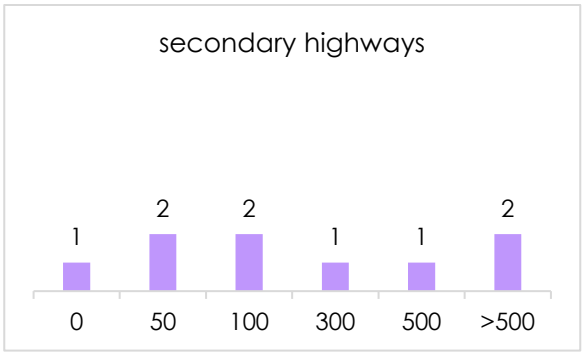

oil & gas infrastructure
0
50
100
300
500
>500
2
2
1
1
3


mineral extraction
0
50
100
300
500
>500
2
1
2
1
3

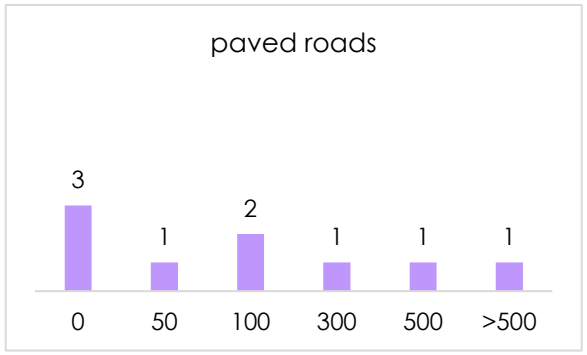

power plants
0
50
100
300
500
>500
2
1
2
1
3

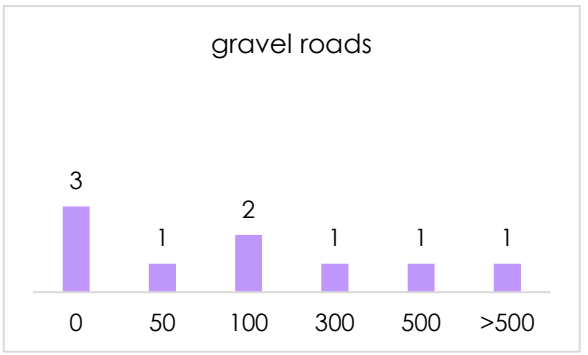

landfills
2
1
6
0
50
100
300
500
>500

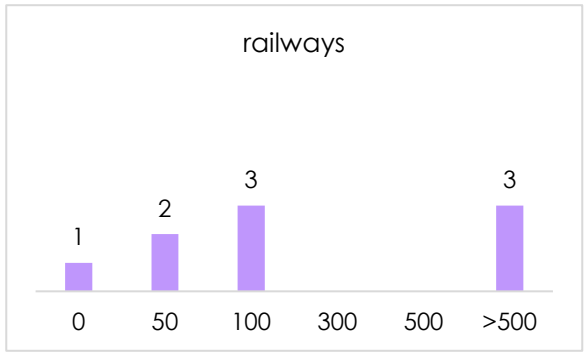

primary highways
1
1
3
1
1
2
0
50
100
300
500
>500

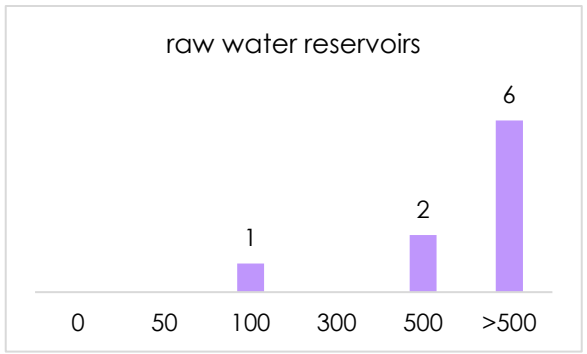

secondary highways
1
2
2
1
1
2
0
50
100
300
500
>500

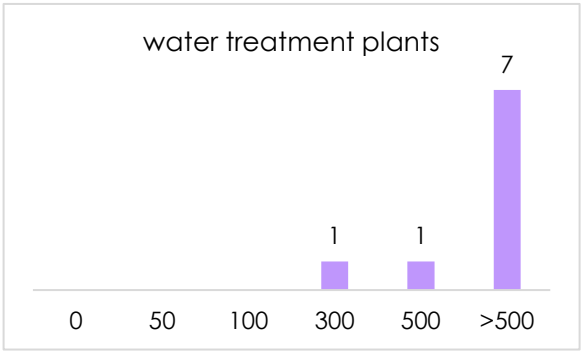

Highway 3 realignment
1
3
2
1
2
0
50
100
300
500
>500


paved roads
3
1
2
1
1
1
0
50
100
300
500
>500


gravel roads
3
1
2
1
1
1
0
50
100
300
500
>500


railways
1
2
3
3
0
50
100
300
500
>500


raw water reservoirs
1
2
6
0
50
100
300
500
>500

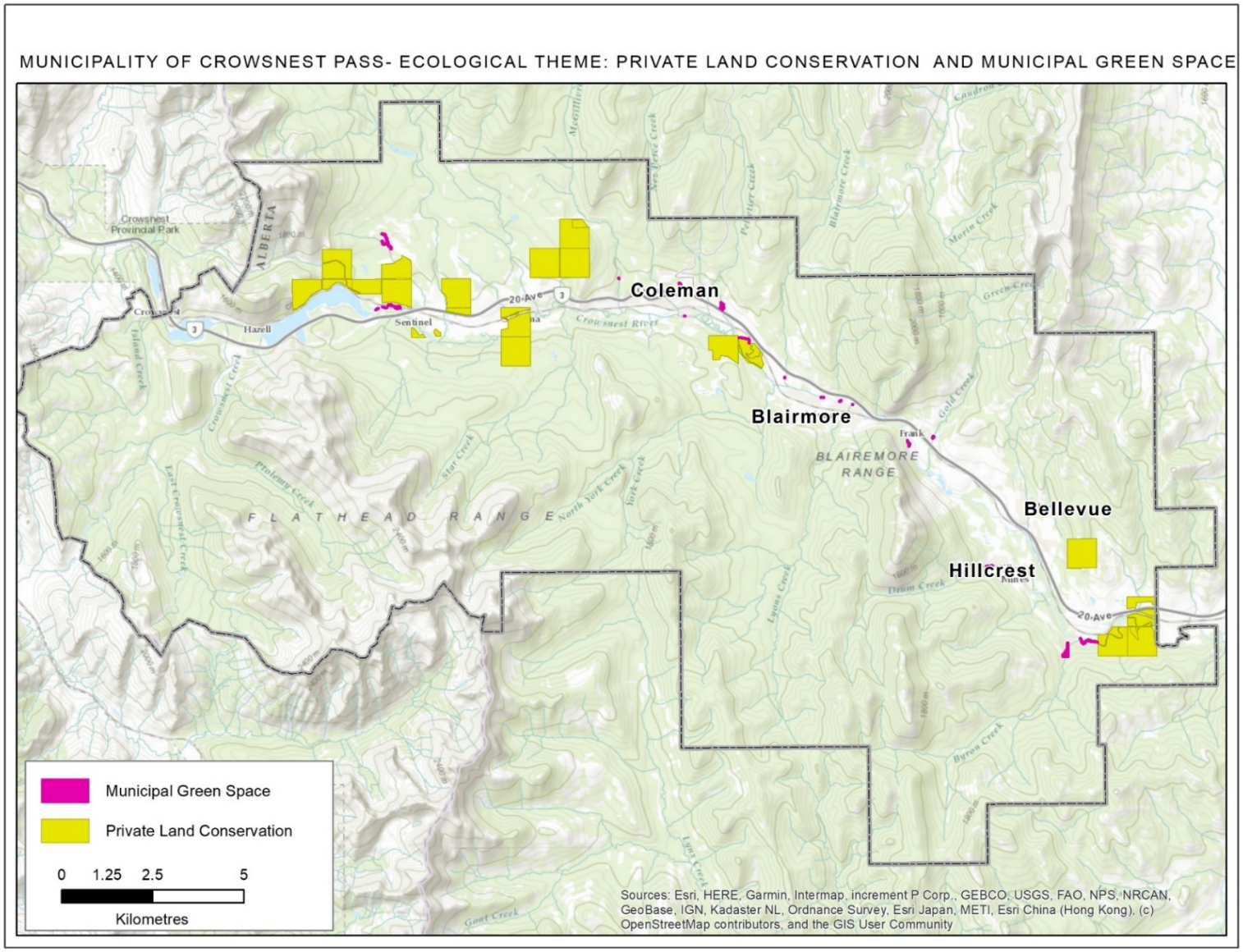

water treatment plants
1
1
7
0
50
100
300
500
>500



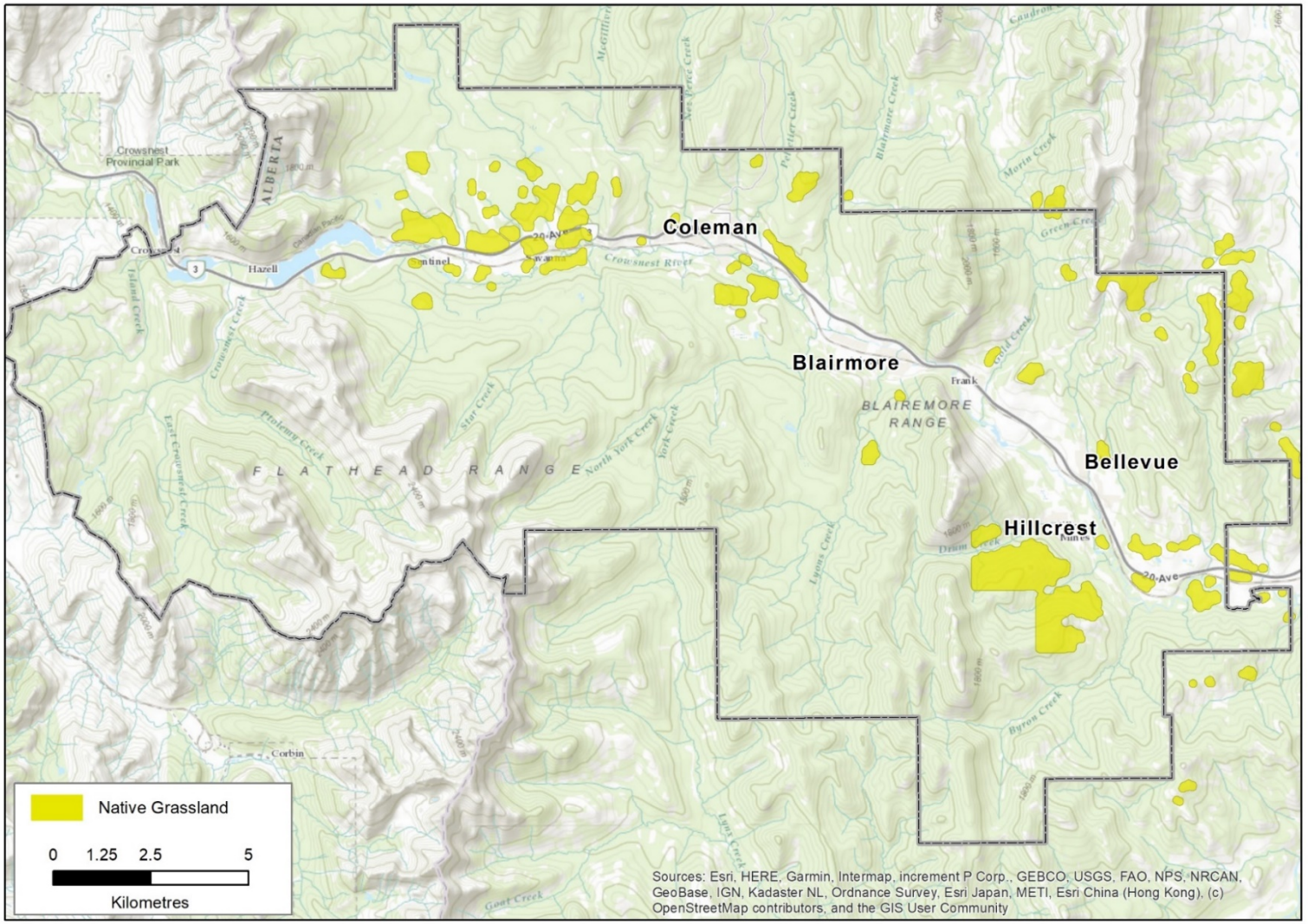
APPENDIX C



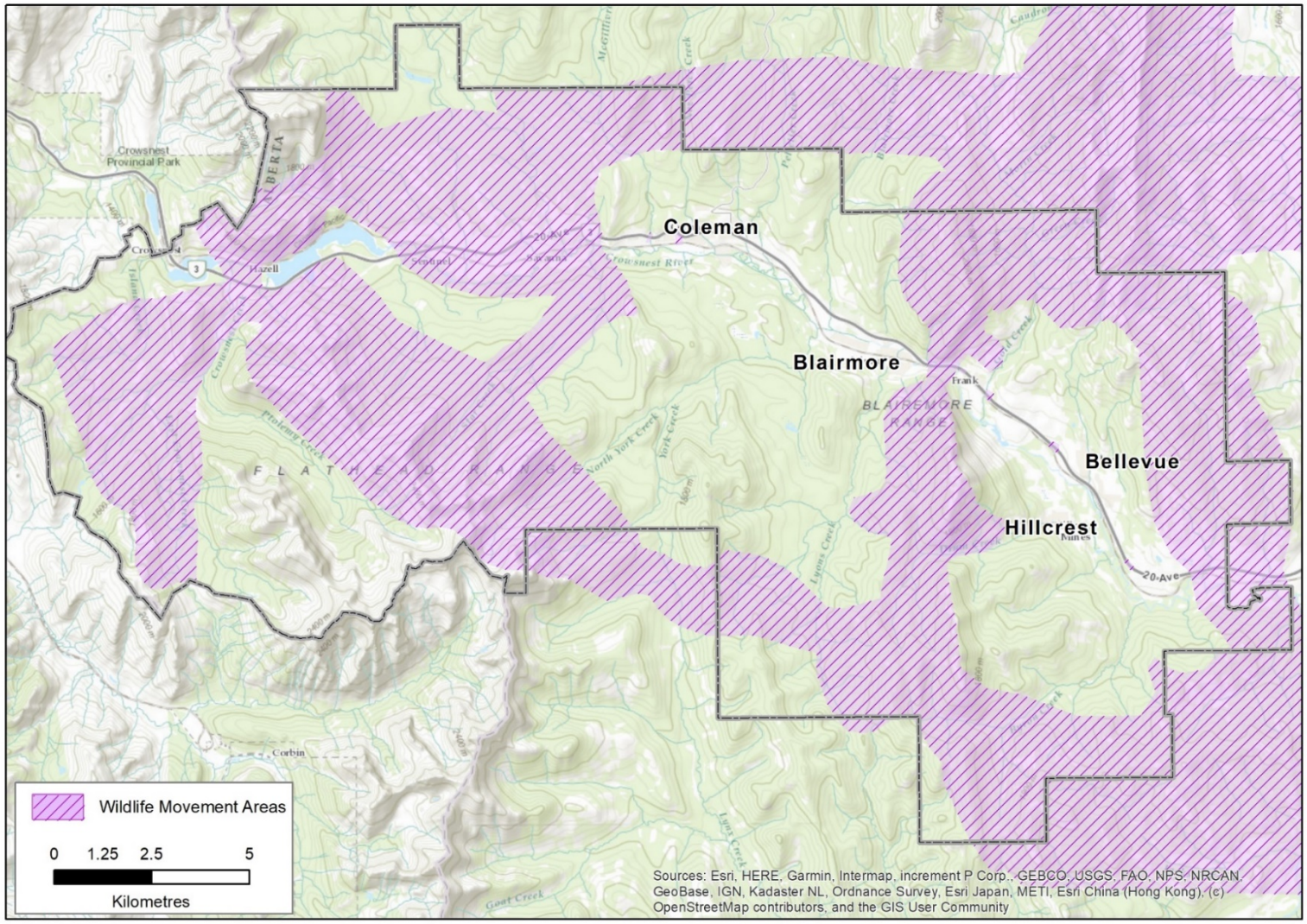
APPENDIX C

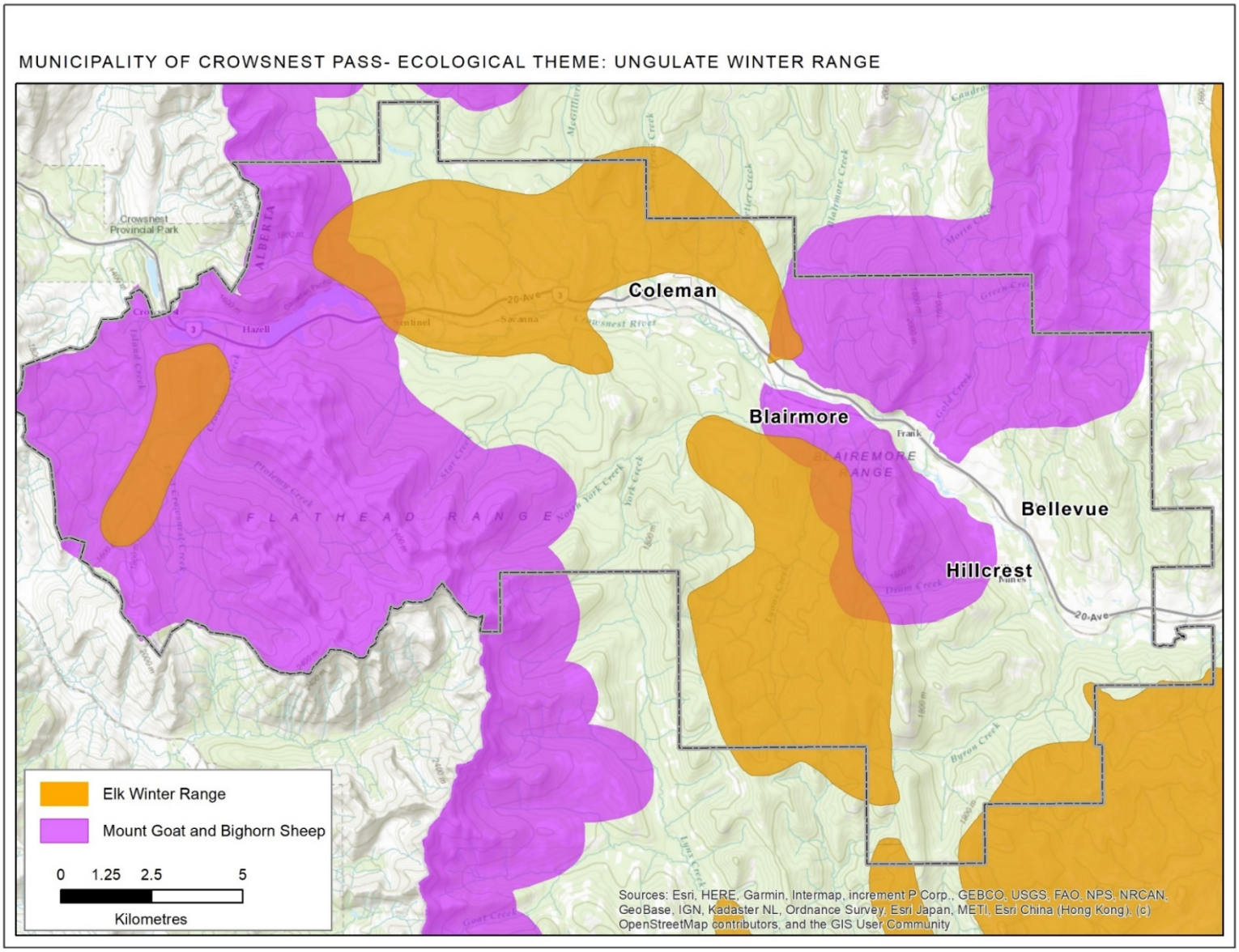

MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME: PRIVATE LAND CONSERVATION AND MUNICIPAL GREEN SPACE
Coleman
Blairmore
Bellevue
Hillcrest
Sentinel
Hazell
Frank
Crowsnest Provincial Park
ALBERTA
20 Ave
Crowsnest River
BLAIREMORE RANGE
FLATHEAD RANGE
Municipal Green Space
Private Land Conservation
0 1.25 2.5 5
Kilometres
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME: NATIVE GRASSLAND

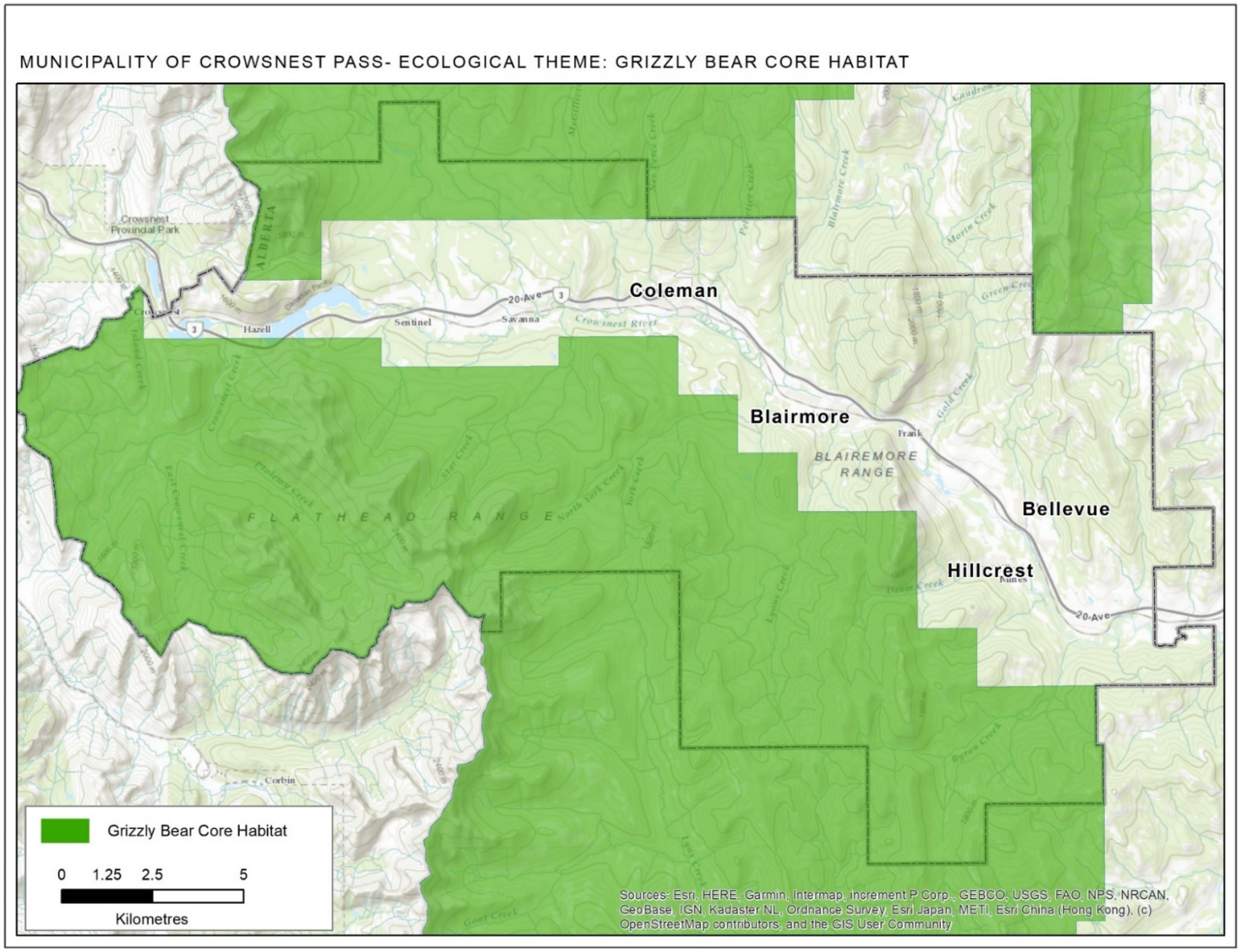


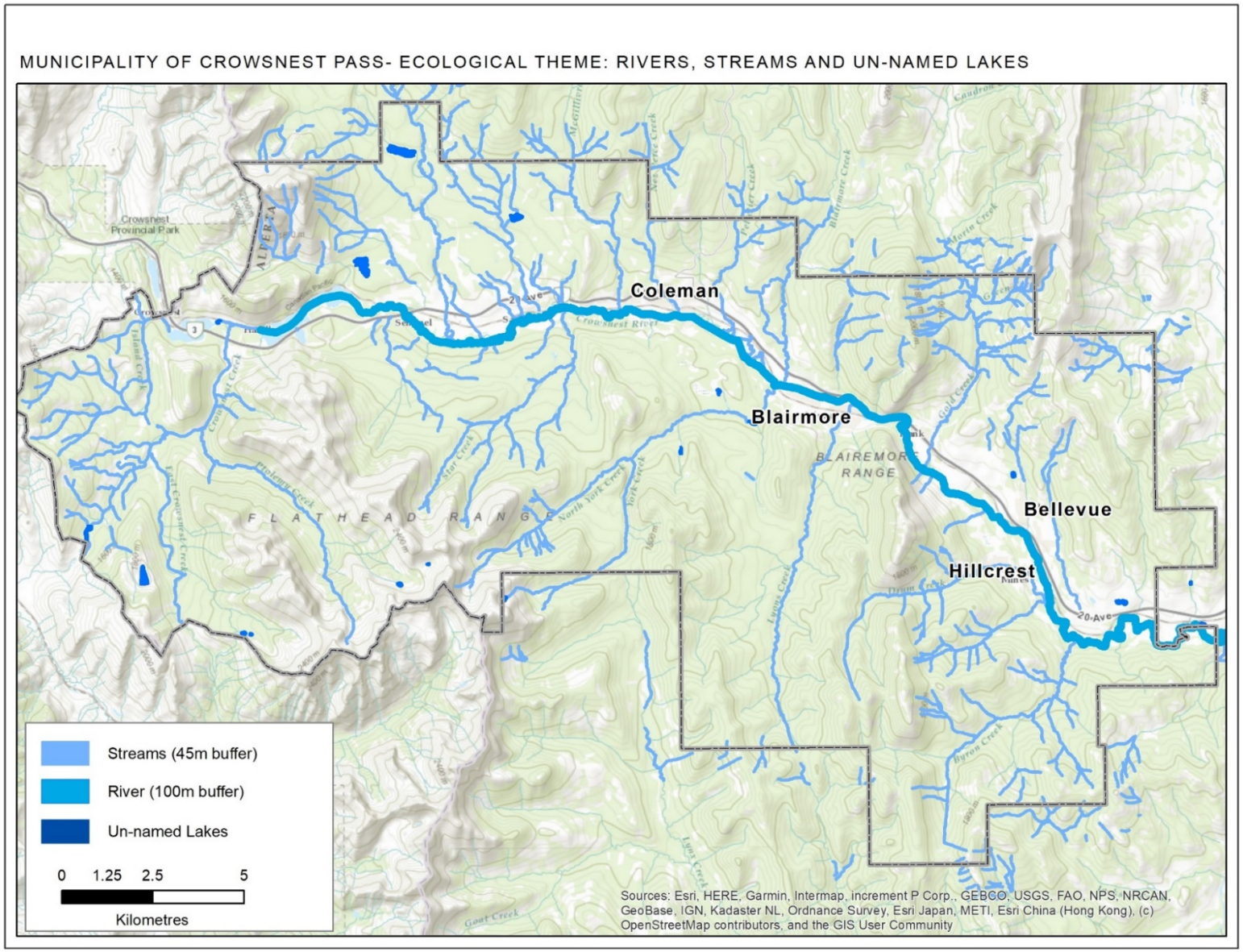
MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME: WIDLIFE MOVEMENT AREAS



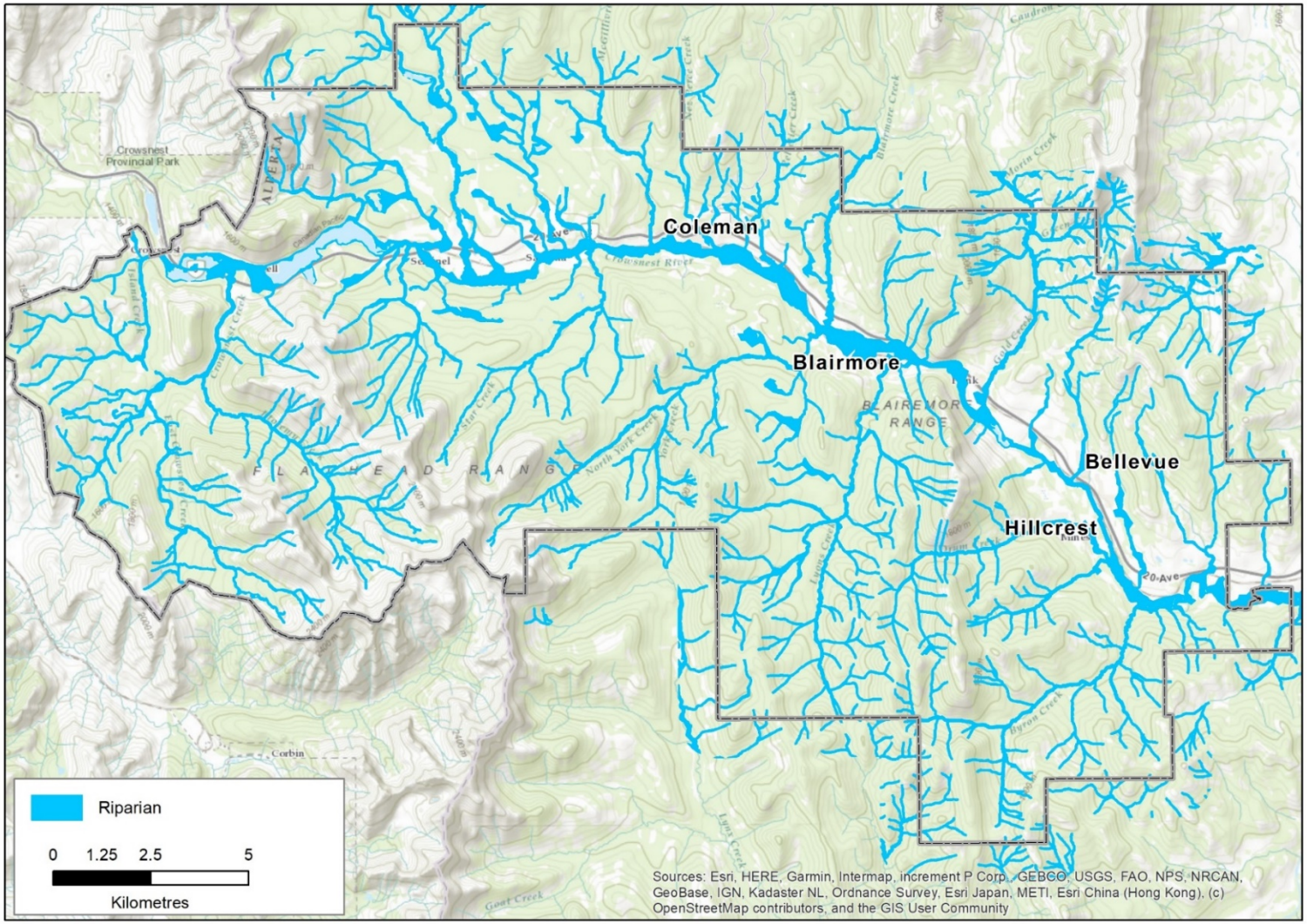

MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME: UNGULATE WINTER RANGE
Coleman
Blairmore
Bellevue
Hillcrest
Crowsnest Provincial Park
ALBERTA
Hazell
Sentinel
Savanna
20-Ave
Crowsnest River
FLATHEAD RANGE
BLAIRMORE RANGE
Frank
Elk Winter Range
Mount Goat and Bighorn Sheep
0 1.25 2.5 5
Kilometres
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

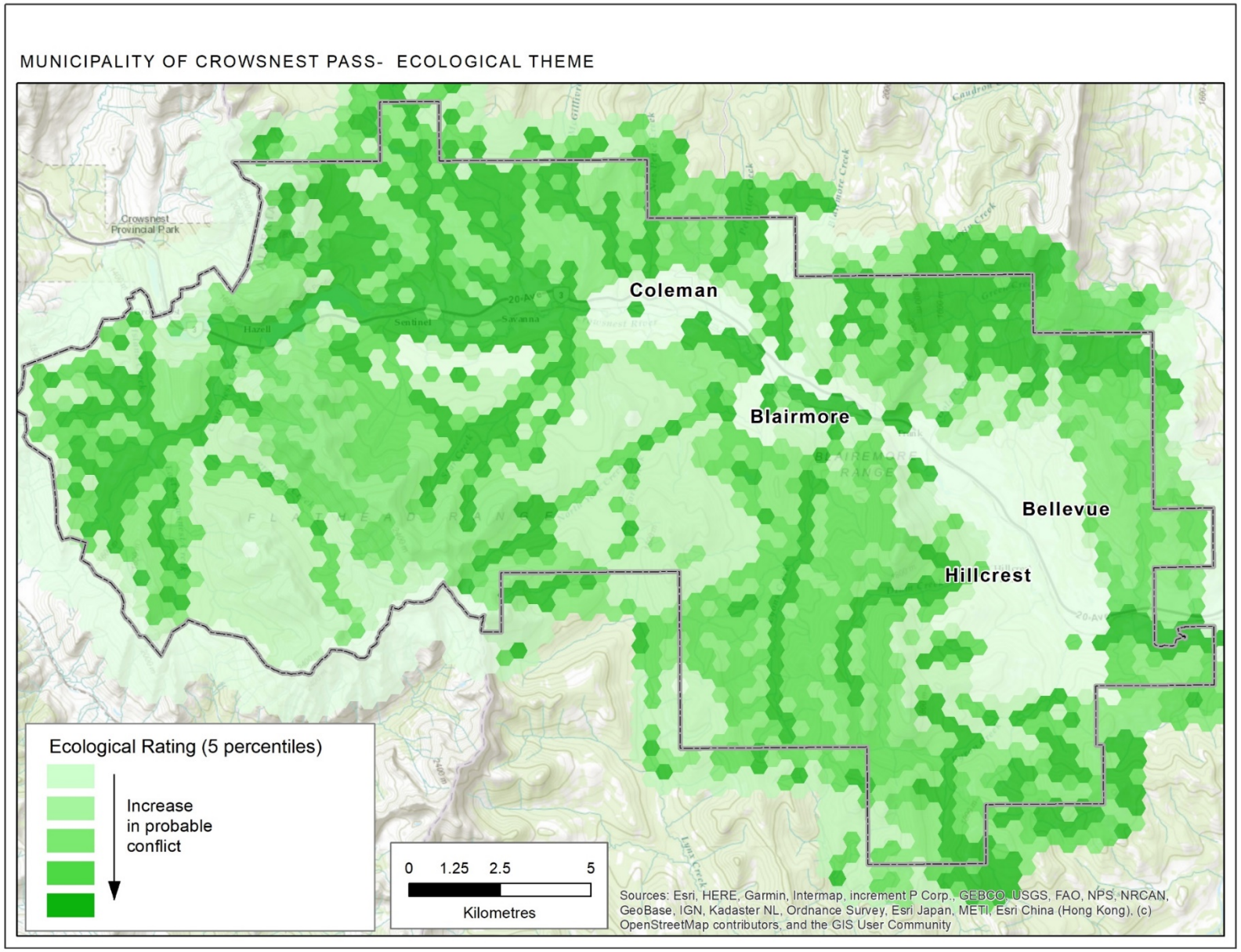
MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME: GRIZZLY BEAR CORE HABITAT




MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME: RIVERS, STREAMS AND UN-NAMED LAKES
Coleman
Blairmore
Bellevue
Hillcrest
Crowsnest Provincial Park
FLATHEAD RANGE
BLAIREMORE RANGE
Crowsnest River
20 Ave
Streams (45m buffer)
River (100m buffer)
Un-named Lakes
0 1.25 2.5 5
Kilometres
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME: RIPARIAN




MUNICIPALITY OF CROWSNEST PASS- ECOLOGICAL THEME
Crowsnest Provincial Park
Coleman
Blairmore
Bellevue
Hillcrest
Hazell
Sentinel
Savanna
Ecological Rating (5 percentiles)
Increase in probable conflict
0 1.25 2.5 5
Kilometres
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

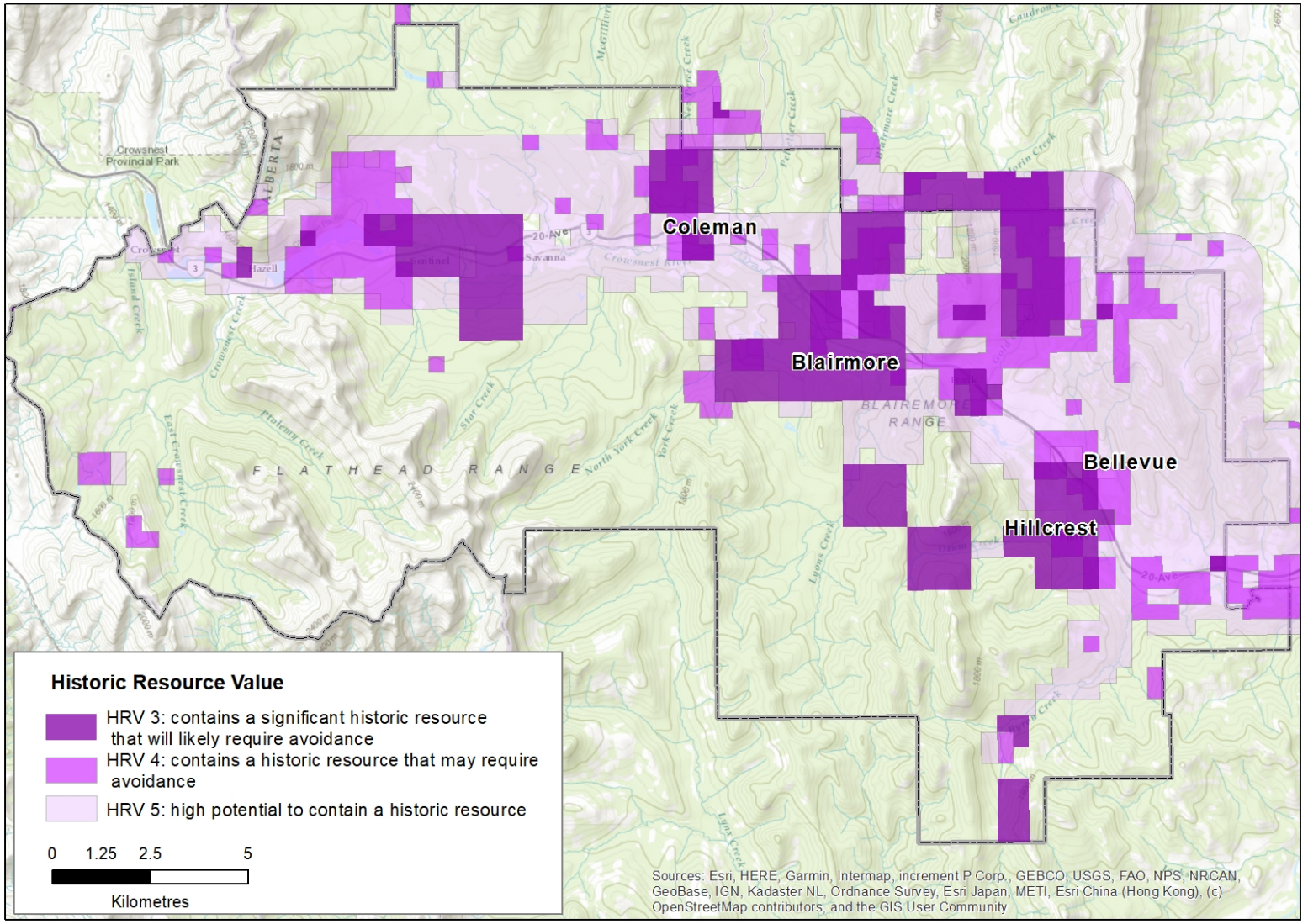


APPENDIX D

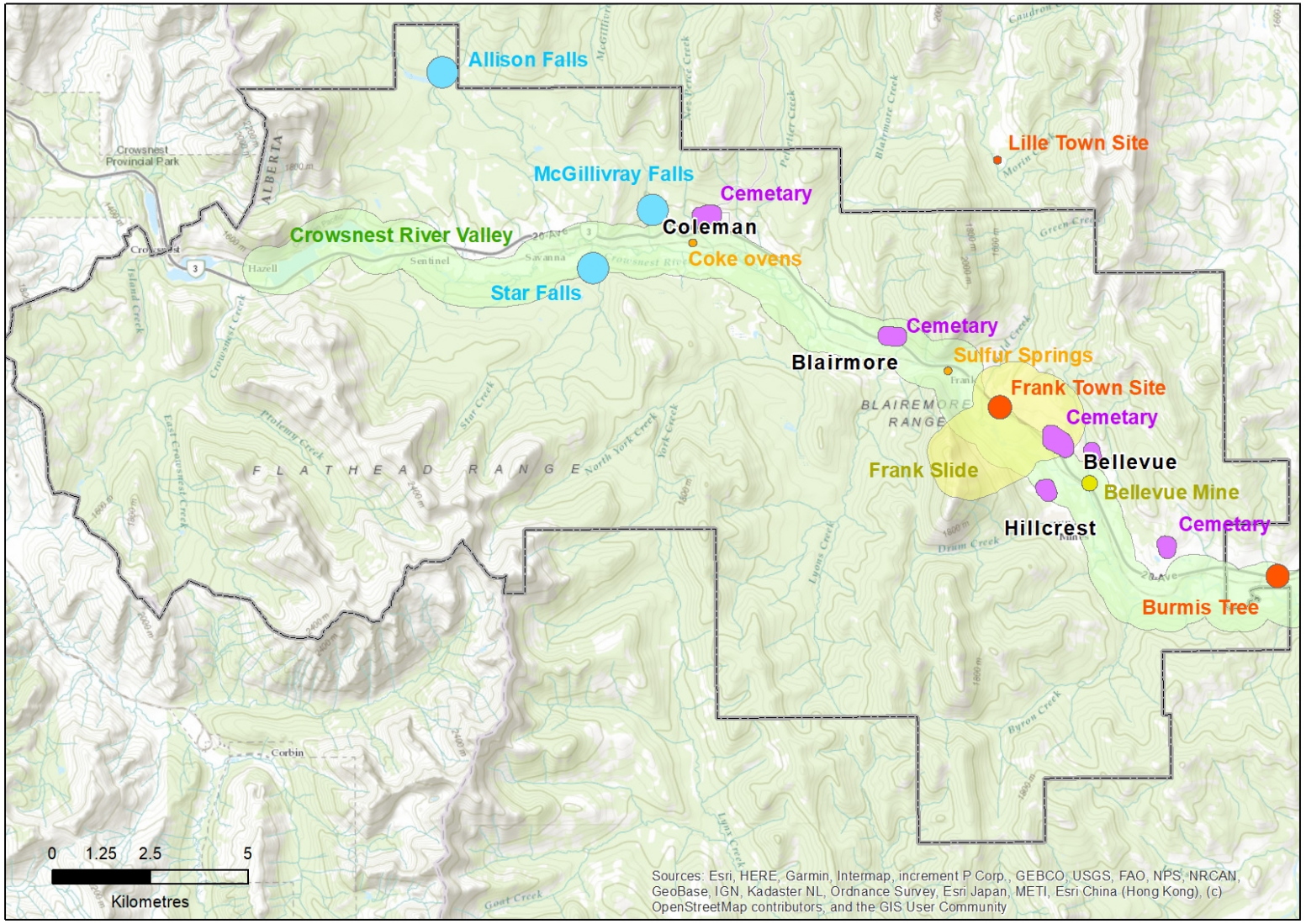


APPENDIX D

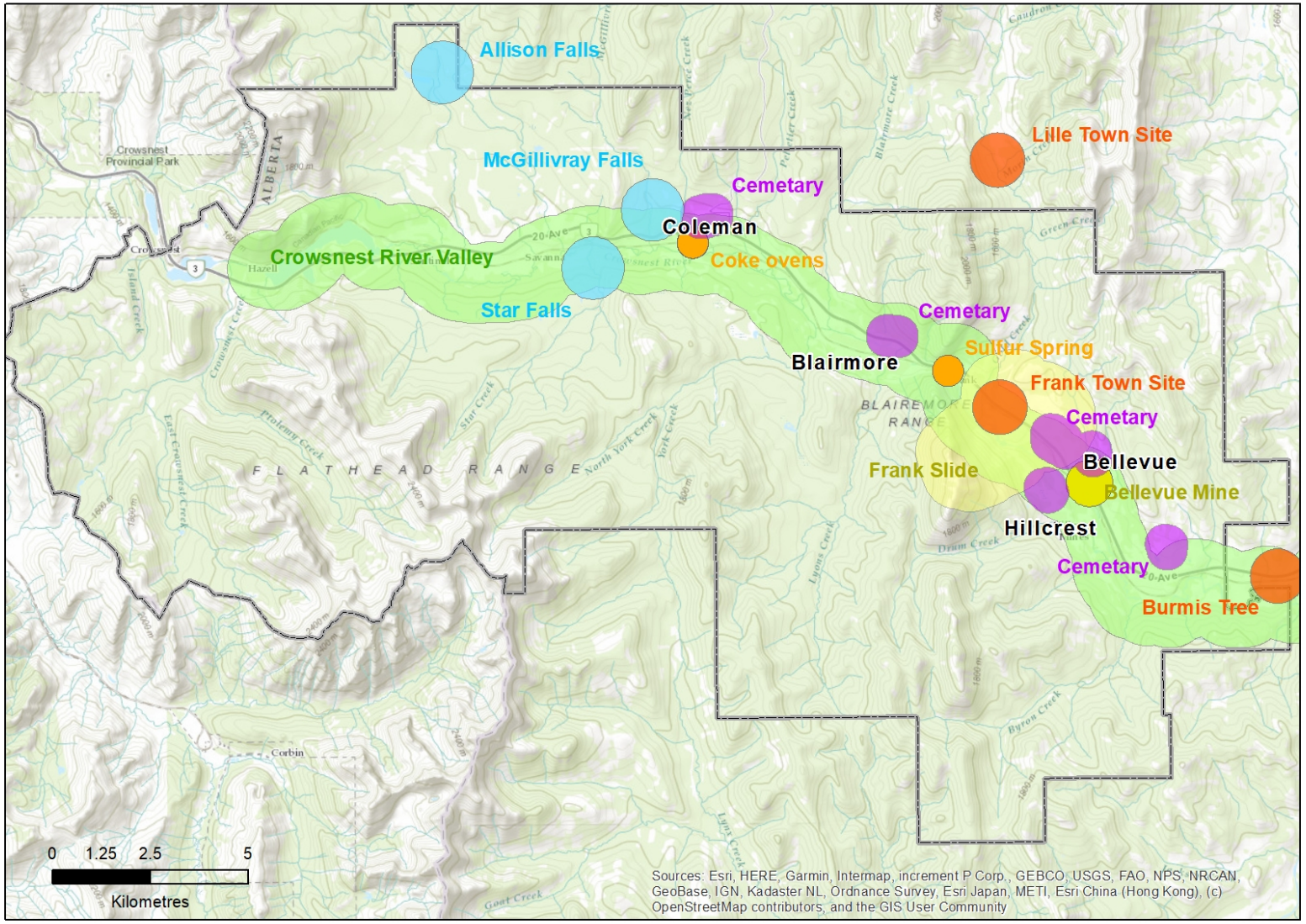
MUNICIPALITY OF CROWSNEST PASS- CULTURAL THEME FEATURE APPLIED TO ALL DEVELOPMENT TYPES



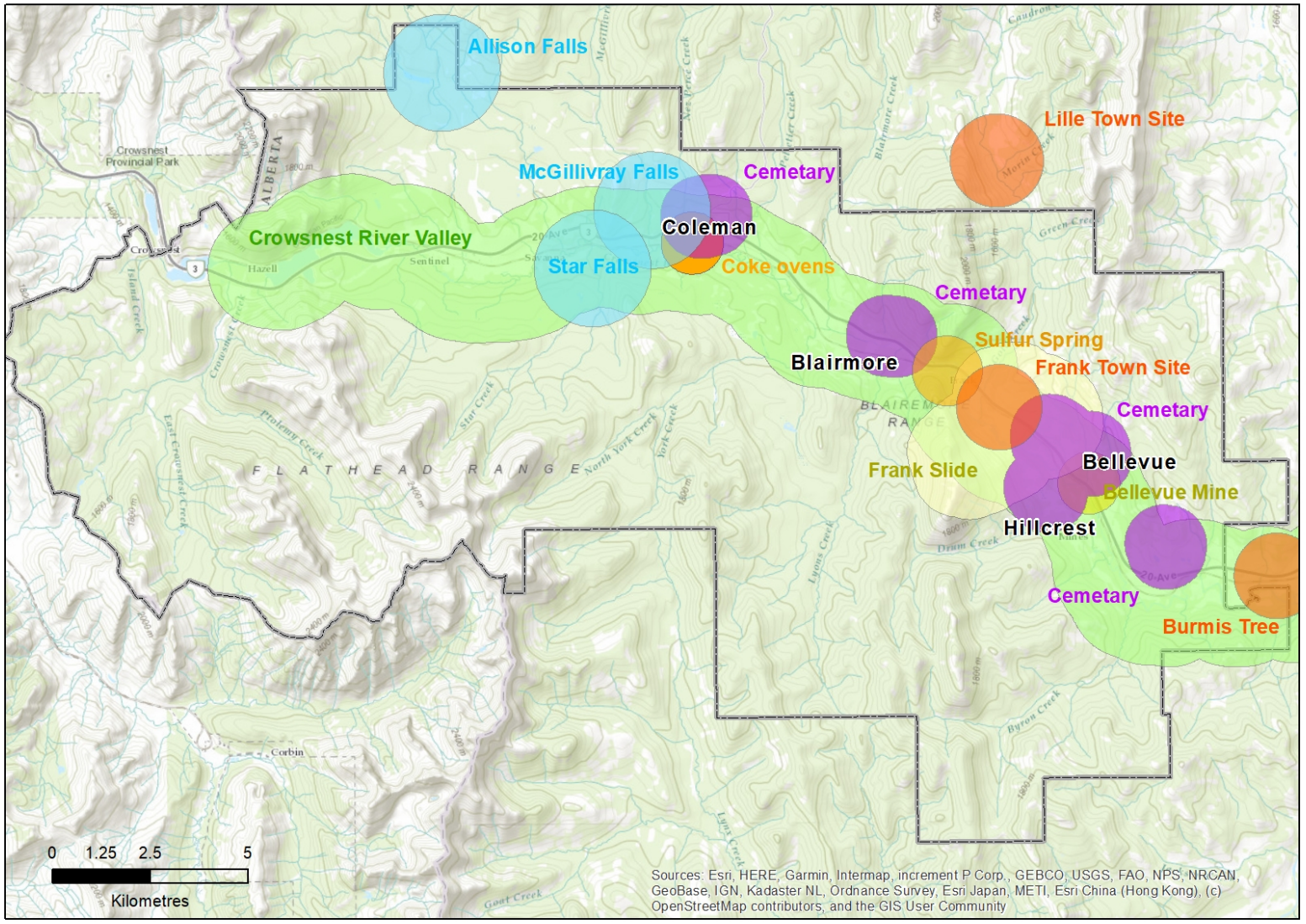
MUNICIPALITY OF CROWSNEST PASS- CULTURAL THEME FEATURES WITH RESIDENTIAL DEVELOPMENT BUFFERS



MUNICIPALITY OF CROWSNEST PASS- CULTURAL THEME FEATURES WITH COMMERCIAL AND LIGHT INDUSTRIAL BUFFERS



MUNICIPALITY OF CROWSNEST PASS- CULTURAL THEME FEATURES WITH PRIMARY INDUSTRY BUFFERS



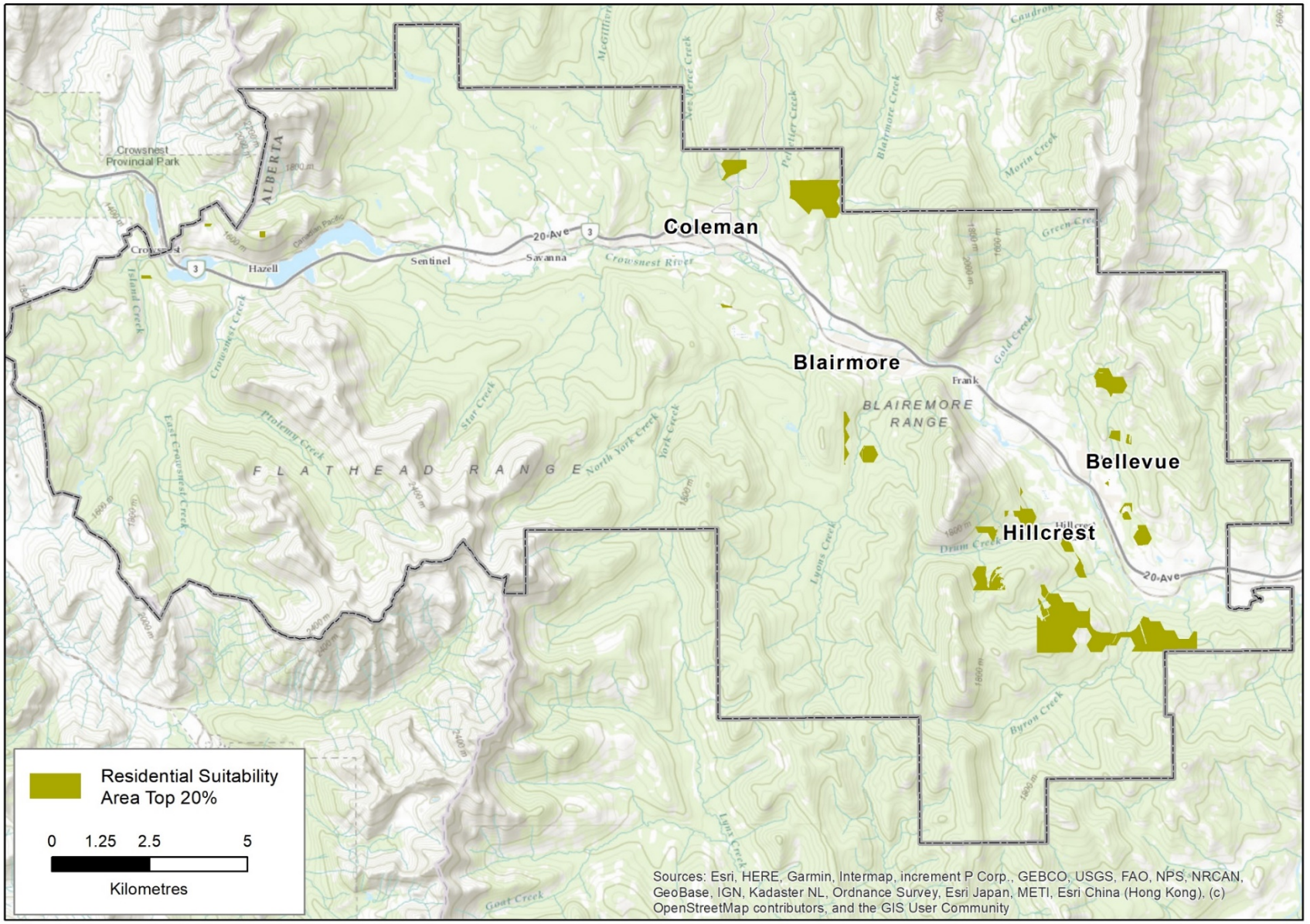


APPENDIX E

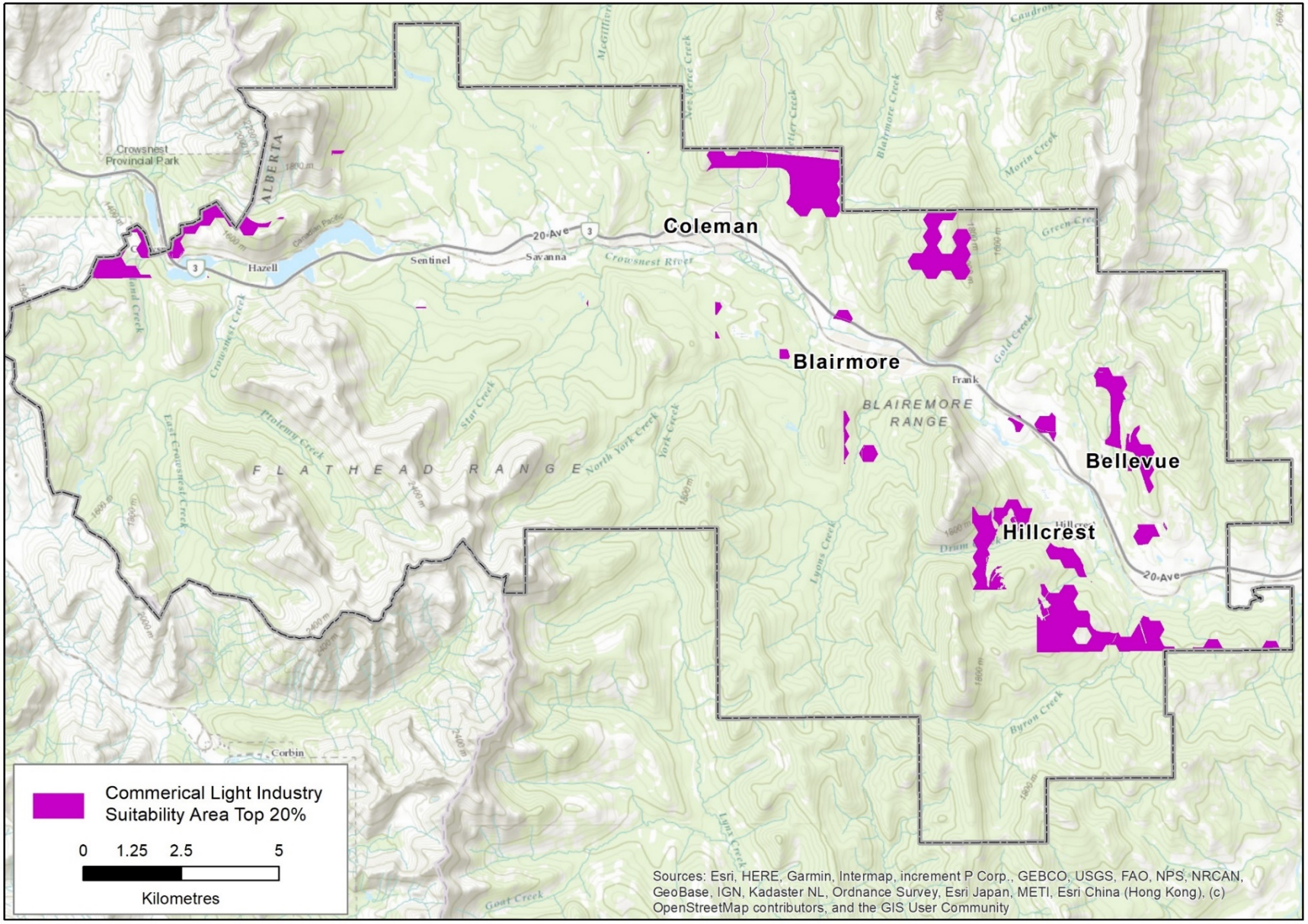


APPENDIX E

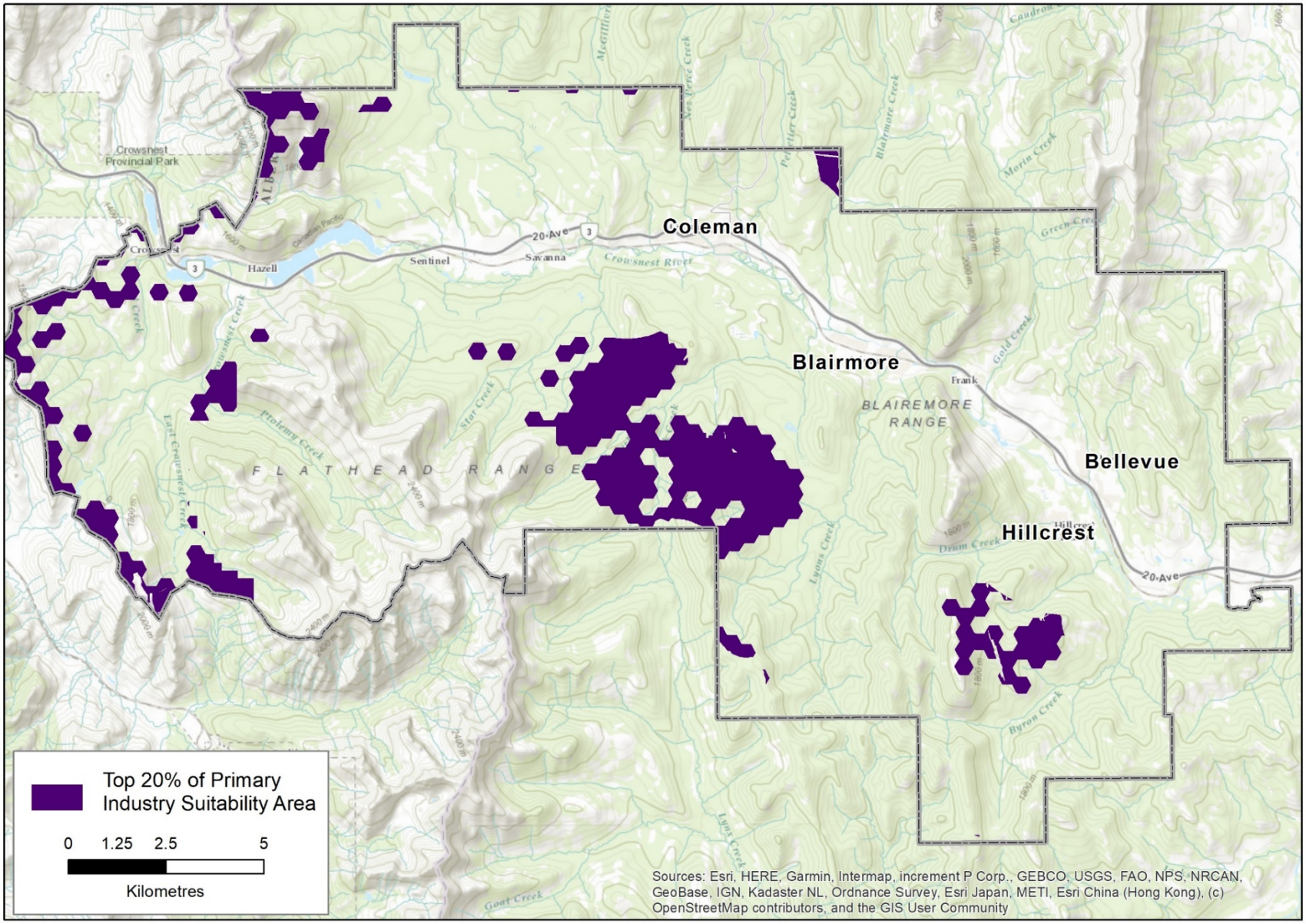
MUNICIPALITY OF CROWSNEST PASS- RESIDENTIAL SUITABILITY AREAS



MUNICIPALITY OF CROWSNEST PASS- COMMERCIAL LIGHT INDUSTRY SUITABILITY



MUNICIPALITY OF CROWSNEST PASS- PRIMARY INDUSTRY SUITABILITY AREA



MUNICIPALITY OF CROWSNEST PASS- SUITABILITY AREAS TOP 20%

