

Blindman River Riparian Assessment

FINAL REPORT



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Agroforestry & Woodlot Extension Society

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Project 1834



FIERA
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Front Cover Photo:

View of the Blindman River in central Alberta. Credit: Agroforestry & Woodlot Extension Society.

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Red Deer River Watershed Alliance
Lacombe County
Ponoka County
Red Deer County
Alberta Riparian Habitat Management Society - Cows and Fish
Landowners in the Blindman River Watershed



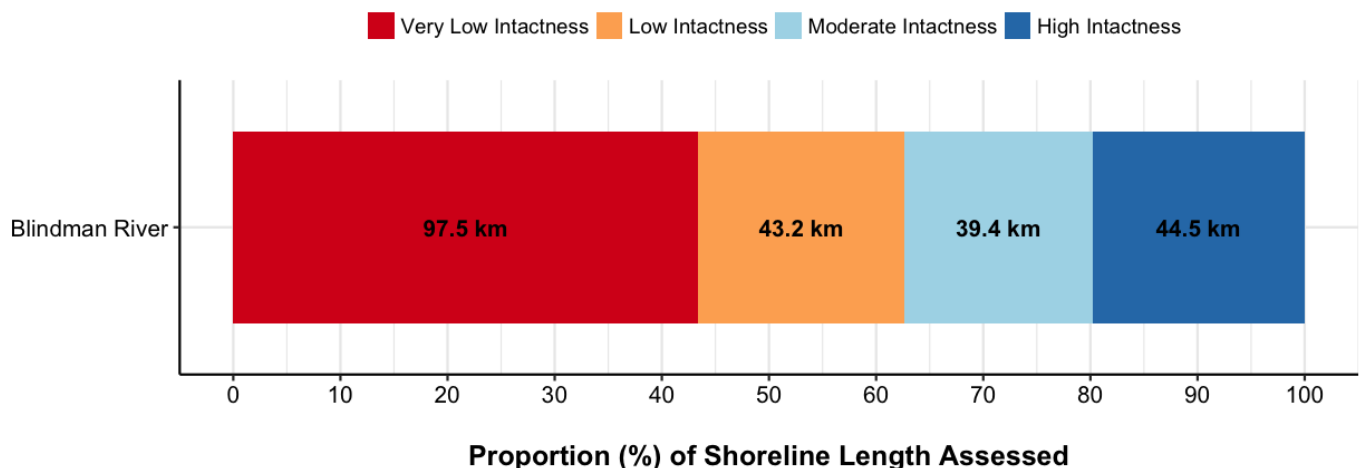


Executive Summary

The Agroforestry and Woodlot Extension Society (AWES) is a not-for-profit organization that aims to increase the awareness of the social, economic, and environmental values of woodlots in agricultural landscapes. Riparian habitat restoration is an important component of the work that AWES delivers, and in 2018, AWES initiated The Blindman River Restoration Project. The goal of this project is to initiate a change in management along the Blindman River that may involve re-establishing vegetative cover and modifying agricultural practices within riparian areas, with the objective of creating and enhancing wildlife habitat, while also mitigating drought, flooding, and water quality concerns in the watershed.

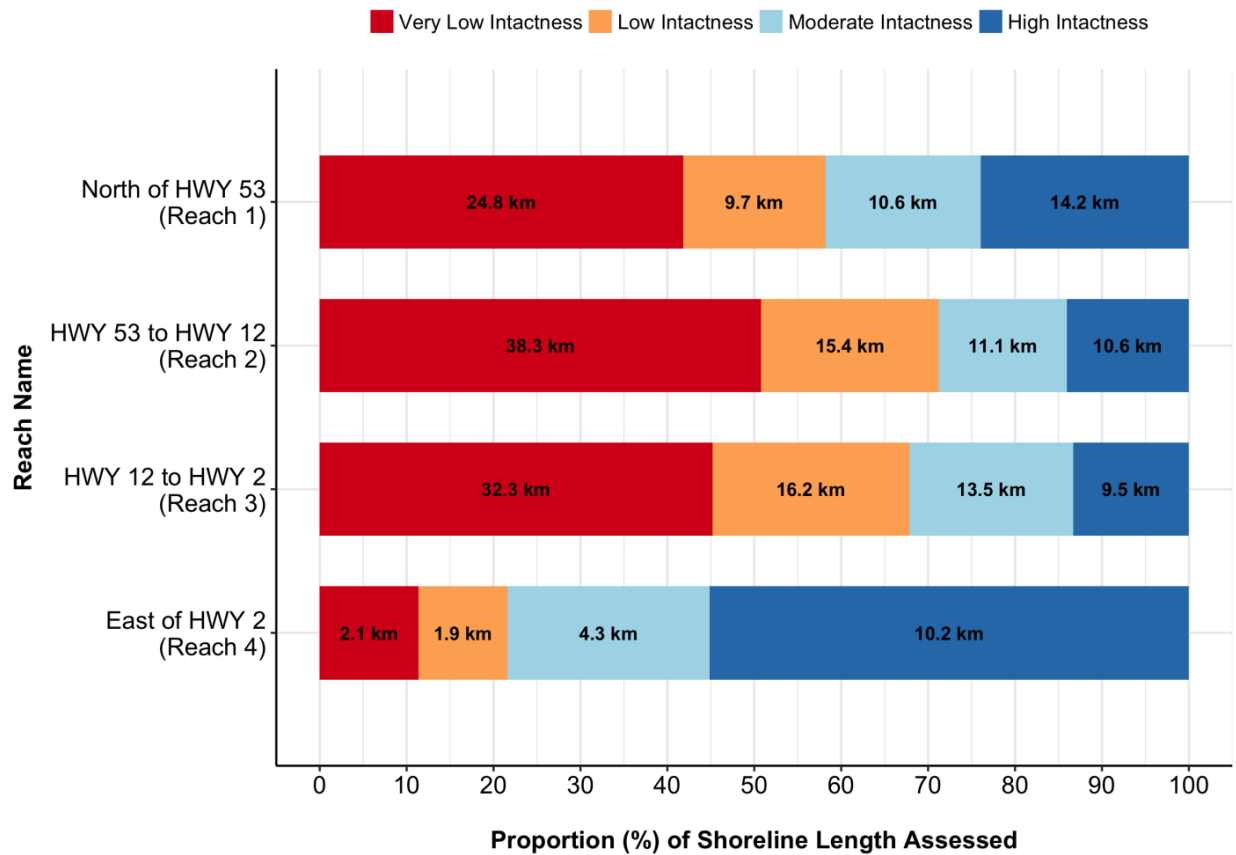
In order to efficiently target restoration efforts and resources, reliable information about the current condition of riparian habitats along the Blindman River is required. Although existing ground-based riparian assessment methods exist and are useful for gathering information about the general condition of riparian habitat at small spatial extents, information from these assessments cannot be scaled up to provide an overall picture of riparian condition along the entire length of the river. Consequently, the objective of this project was to conduct a riparian assessment of the Blindman River using a newly developed GIS-based assessment method. This method was developed using metrics comparable to existing ground-based and aerial videography methods, and uses automated and semi-automated GIS techniques to quantify the intactness of riparian management areas (RMAs) using land cover data derived from satellite imagery. For the purpose of this study, RMAs had a fixed width of 50 m and a variable length that was determined based upon major breaks in the percent cover of natural vegetation.

In total, ~225 km of shoreline along the Blindman River was included in this study. The shoreline area that was assessed included the portion of the river extending from the mouth of the Red Deer River upstream to the confluence with Anderson Creek, near the Hamlet of Bluffton. Overall, 62% of the shoreline (140.7 km) was classified as either Low (19%) or Very Low (43%) Intactness, with 20% of the shoreline assessed as High Intactness, and 18% classified as Moderate Intactness.

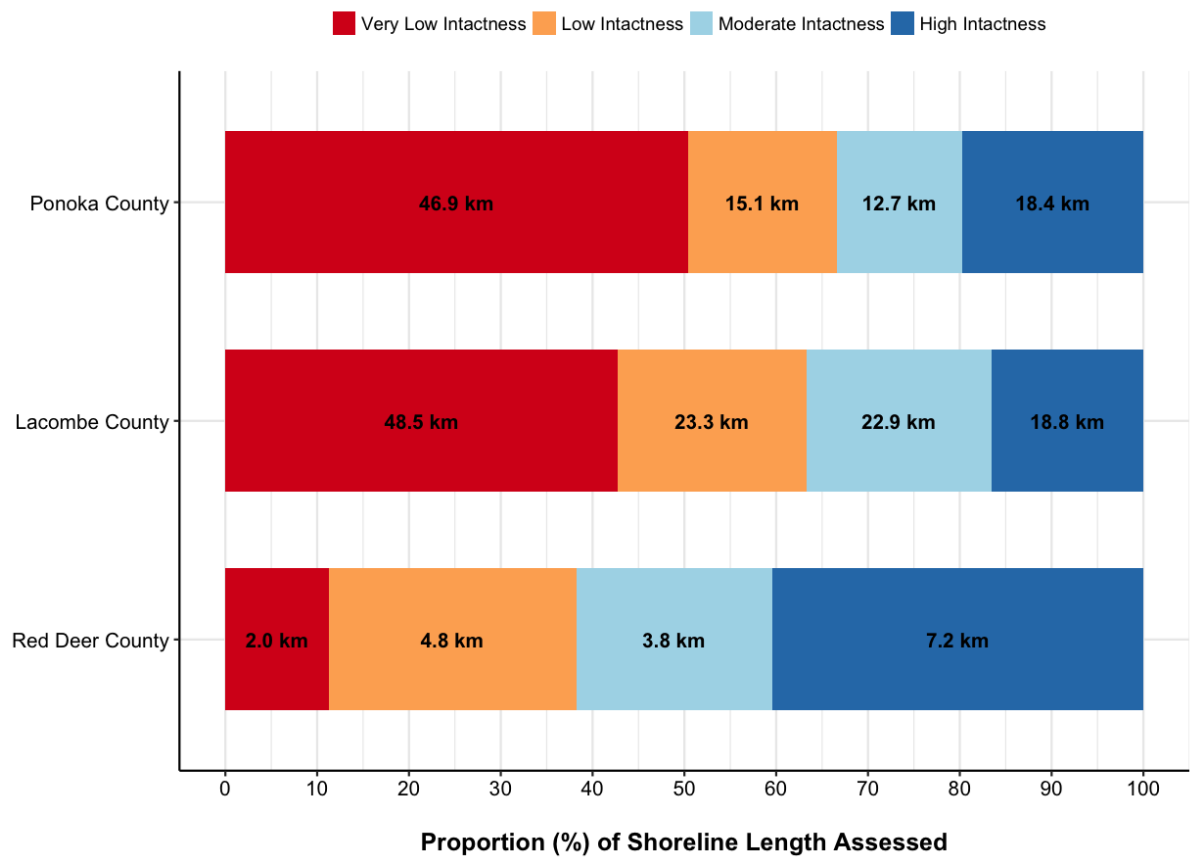


For the purpose of this study, the riparian assessment results were summarized geographically by river reach. Reach 1 was the northern-most reach and extended from the confluence with Anderson Creek to Highway 53; Reach 2 extended between Highway 53 and Highway 12; Reach 3 extended between Highway 12 and Highway 2; and Reach 4 extended from Highway 2 east to the mouth of the Red Deer River. Reach 2 had the greatest length of shoreline assessed (75.4 km), followed by Reach 3 (71.5 km), Reach 1 (59.3 km), and Reach 4 (18.5 km).

When riparian intactness is considered by the total length and proportion of shoreline assessed within each reach, the greatest amount of shoreline in Very Low condition was located in Reach 2 (38.3 km, 51%), followed by Reach 3 (32.3 km, 45%), and Reach 1 (24.8 km, 42%). Reach 4 had the smallest amount and proportion of shoreline assessed as Very Low (2.1 km, 11%) and Low (1.9 km, 10%) Intactness.



Results of this study were also summarized for the three rural municipalities that intersect the Blindman River watershed, including Ponoka County, Lacombe County, and Red Deer County. When riparian intactness is considered by the total length of shoreline assessed within each municipality, the greatest amount of shoreline in Very Low condition was located in Lacombe County (48.5 km), followed closely by Ponoka County (46.9 km), and Red Deer County (2.0 km). When riparian intactness is considered by the proportion of shoreline assessed within each municipality, the greatest proportion of shoreline classified as Very Low condition was located in Ponoka County (50%), as compared to Lacombe County (43%), and Red Deer County (11%).



The results of this work provide the Agroforestry and Woodlot Extension Society and their partners with an overview of the status of riparian areas along the Blindman River. This information can be used to spatially target areas along the river shoreline for restoration, and also provides data that can be used as a foundation for tracking change in riparian area intactness through time.



List of Terms

Abbreviations

AEP: Alberta Environment and Parks

ARHMS: Alberta Riparian Habitat Management Society

AWES: Agroforestry and Woodlot Extension Society

GIS: Geographic Information System

GOA: Government of Alberta

RMA: Riparian Management Area

Glossary

Aerial Videography: Video captured from a low flying aerial platform, such as helicopter or ultra light aircraft.

Indicator: A measurable or descriptive characteristic that can be used to observe, evaluate, or describe trends in ecological systems over time.

Intactness: In reference to the condition of natural habitat, intactness refers to the extent to which habitat has been altered or impaired by human activity, with areas where there is no human development being classified as high intactness.

Local Catchment Area: An area that, on the basis of topography, contributes water to a common outlet or drainage point that is directly associated with the shoreline of the Blindman River. Local catchment areas for this project were defined using Government of Alberta (GOA 2018) spatial data.

Metric: A qualitative or quantitative aspect of an *indicator*, a variable which can be measured (quantified) or described (qualitatively) and demonstrates either a trend in an indicator or whether or not a specific threshold was met.

Riparian Area, Riparian Habitat, Riparian Land, or Riparian Zone: Riparian lands are transitional areas between upland and aquatic ecosystems. They have variable width and extent both above and below ground. These lands are influenced by and/or exert an influence on associated water bodies, which includes alluvial aquifers and floodplains, when present. Riparian lands usually have soil, biological, and other physical characteristics that reflect the influence of water and/or hydrological processes (Clare and Sass 2012).

Riparian Management Area (RMA): An area along the shoreline that is of variable length and 50 m in width. For the purpose of this assessment, the 50 m RMA width was measured from the boundary of the open water within the Blindman River, which was delineated for the left and right bank using high resolution (2 m) satellite imagery.



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1.0 Introduction

1.1. Project Background & Context

Riparian areas perform a multitude of ecosystem functions, including water quality improvement, sediment removal, nutrient cycling, bank stabilization, and flood reduction. While these habitats provide a wide range of benefits to human communities, the loss and impairment of riparian lands in Alberta has been significant, and recent watershed management efforts throughout the province have been focused on identifying priority areas for riparian restoration and habitat management.

The Agroforestry and Woodlot Extension Society (AWES) is a not-for-profit organization focused on increasing the awareness of the social, economic, and environmental values of woodlots in agricultural landscapes. Riparian habitat restoration is an important component of the work that AWES delivers, and in 2018, AWES initiated The Blindman River Restoration Project. The objective of this project is to initiate a change in management along the Blindman River that may involve re-establishing vegetative cover and modifying agricultural practices within riparian areas, with the aim of creating and enhancing wildlife habitat, while also mitigating drought, flooding, and water quality concerns in the watershed.

In order to efficiently target restoration efforts and resources, reliable information about the current condition of riparian habitats along the Blindman River is required. Although existing ground-based riparian assessment methods exist and are useful for gathering information about the general condition of riparian habitat at small spatial extents, the site-specific approach used in these assessments cannot be scaled up to provide information about riparian condition along the entire length of the river. As a result, AWES approached Fiera Biological Consulting Ltd. (Fiera Biological) to conduct a riparian assessment of the Blindman River using a newly developed GIS-based method that has been applied in various watersheds across central Alberta (Fiera Biological 2018a -2018e). This method was developed using metrics comparable to existing aerial videography methods, and uses automated and semi-automated GIS techniques to quantify the intactness of riparian management areas using land cover data derived from satellite imagery.

The overall goal of this riparian assessment project was to quantify and document the condition of riparian habitat along both the left and right banks of the Blindman River to allow for the identification and prioritization of riparian areas for restoration. The results from this assessment also establish a baseline of riparian condition against which future monitoring and restoration efforts can be assessed.

1.2. Purpose & Intended Use of Report & Associated Data

Readers are asked to consider the following points regarding the scope of our assessments as they review the methods and interpret the results presented herein:

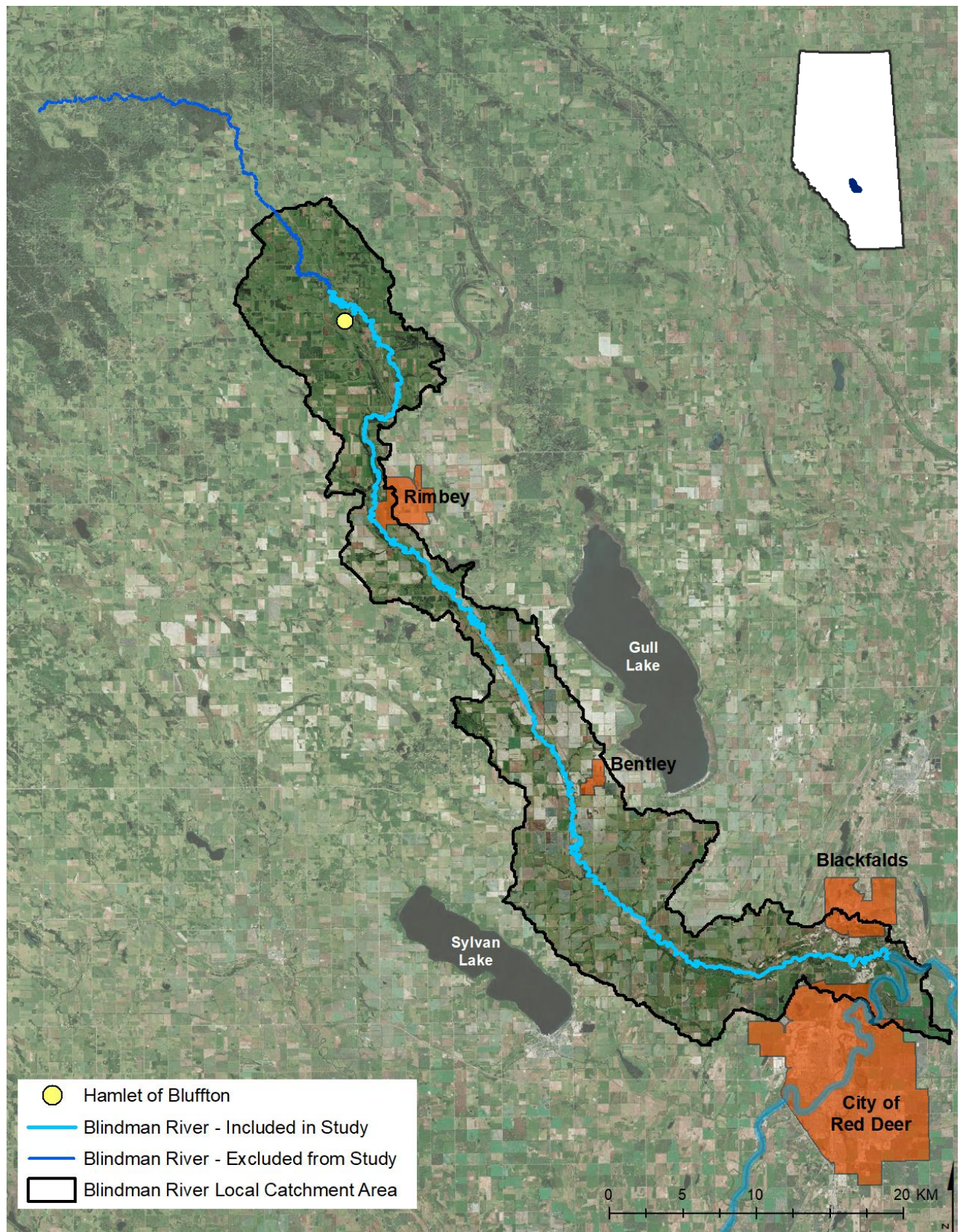
- This assessment characterizes the relative intactness of riparian areas using metrics that focus on natural attributes of a shoreline that are measurable in a GIS environment. No statement on the absolute condition of any riparian area is made and the results do not reflect the influence of factors that were not included in or considered for analysis.
- Intactness scores generated by this study are intended to support a screening-level assessment of management and/or protection priorities across broad geographic areas (e.g., subwatershed, municipality, stream reach). This GIS tool is not meant to replace more detailed, site-specific field assessments of riparian health or condition. Instead, the results from this assessment should be used to highlight smaller, more localized areas where field assessments and/or further validation may be required.



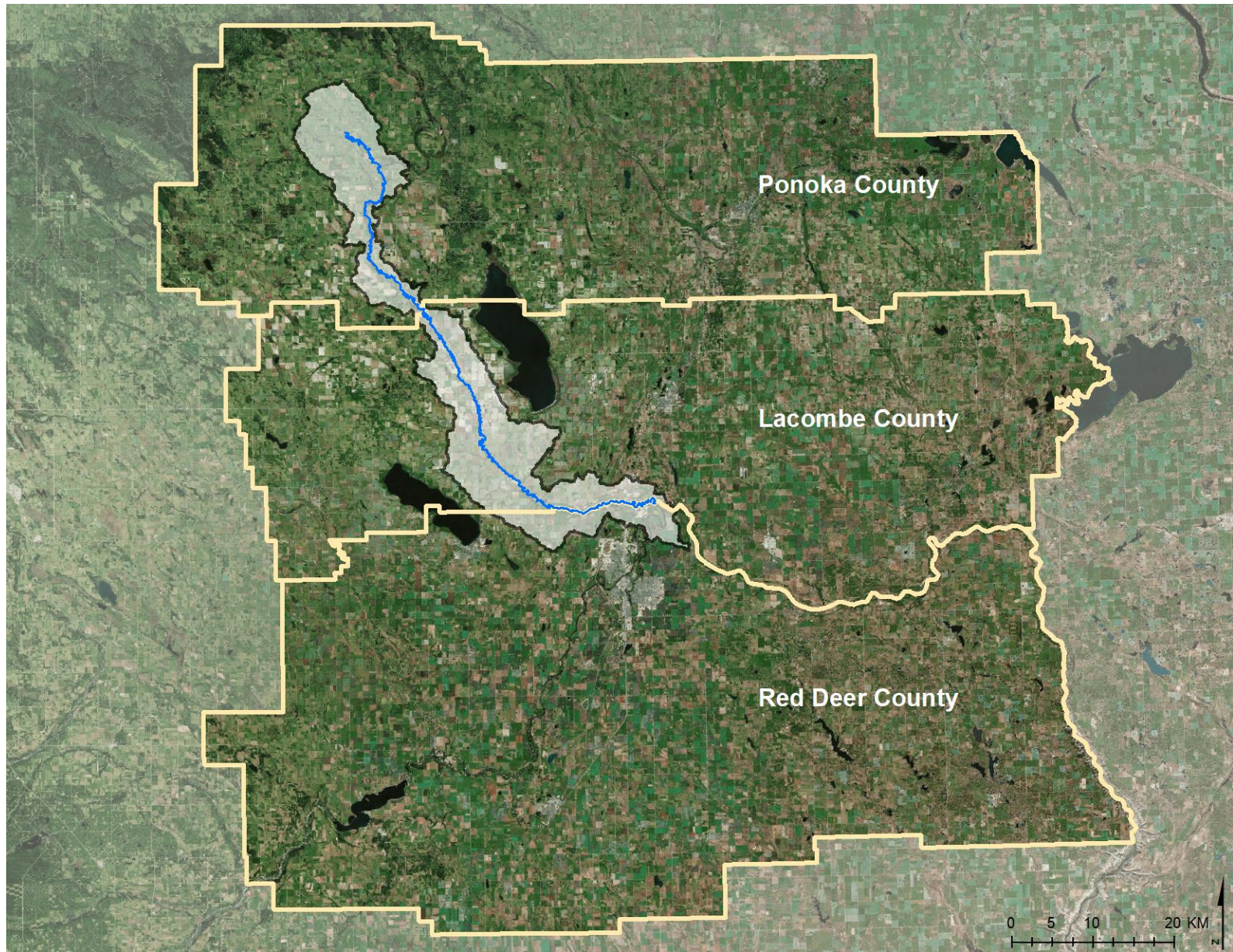
2.0 Study Area

The Blindman River is located in south-central Alberta and originates within Wetaskiwin County, near the Paul First Nation Buck Lake 133C reserve lands. From the headwaters, the river flows approximately 155 km downstream, where it discharges into the Red Deer River near the City of Red Deer and the Town of Blackfalds. Approximately 112 km of the Blindman River was included in this study. The shoreline area that was assessed included the portion of the river extending from the mouth of the Red Deer River upstream to the confluence with Anderson Creek, near the Hamlet of Bluffton (Map 1). Both the left and right banks of the river were assessed separately, for a total of ~225 km of shoreline that was assessed within three separate rural municipalities: Ponoka County, Lacombe County, and Red Deer County (Map 2).

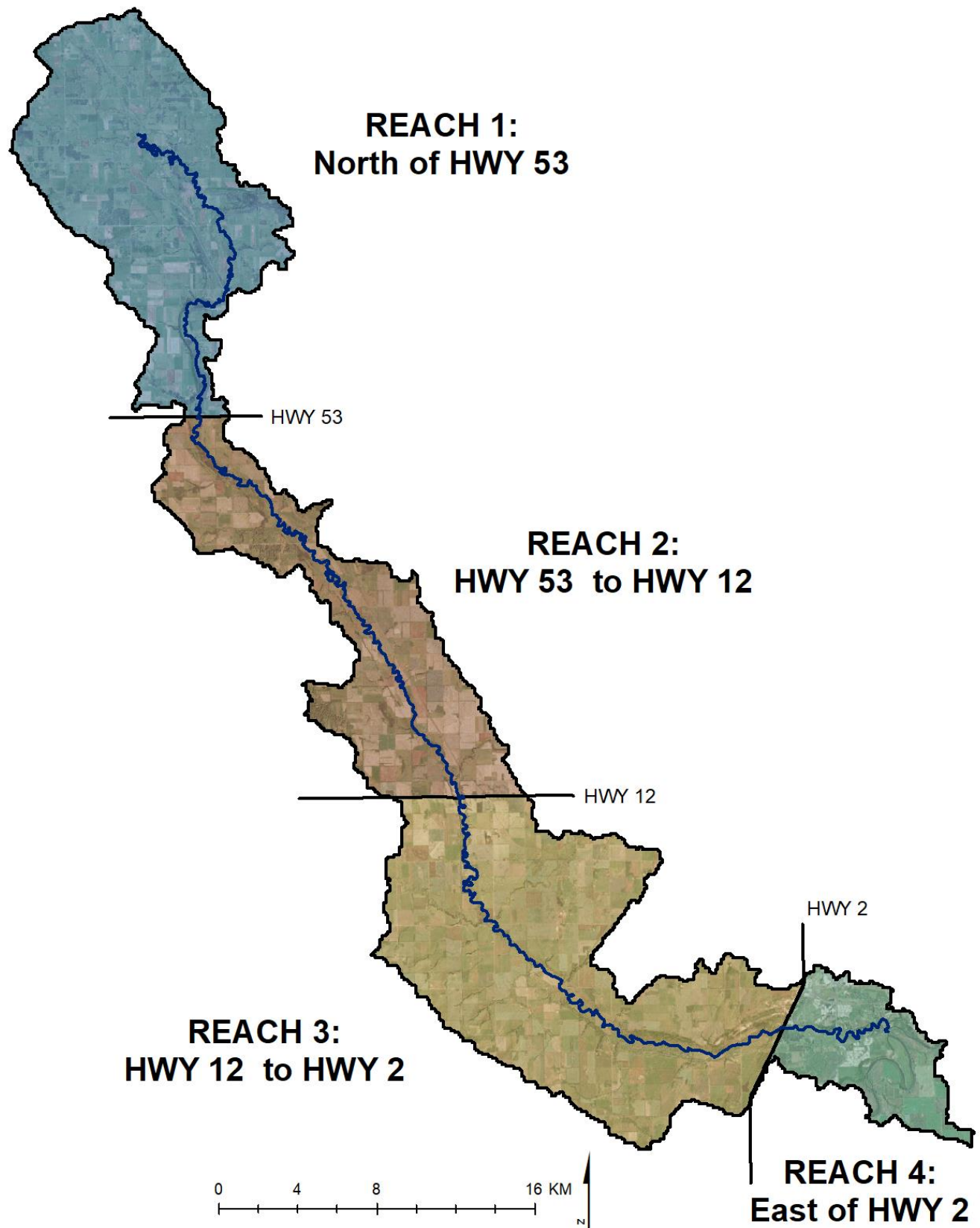
For the purpose of summarizing the riparian assessment results for this study, the Blindman River was divided into four separate reaches, which were defined by the intersection of major highways (Map 3). Reach 1 was the northern-most reach and extended from the confluence with Anderson Creek to Highway 53; Reach 2 extended between Highway 53 and Highway 12; Reach 3 extended between Highway 12 and Highway 2; and Reach 4 extended from Highway 2 east to the mouth of the Red Deer River.



Map 1. Location of the Blindman River in central Alberta. This study included the left and right banks of the portion of the river that extends from the mouth of the Red Deer River upstream to the Anderson Creek confluence, near the Hamlet of Bluffton.



Map 2. The portion of the Blindman River that was assessed as part of this study was located in three separate rural municipalities: Ponoka, Lacombe, and Red Deer.



Map 3. River reaches of the Blindman River, defined based upon the intersection of major highways.



3.0 Methods

3.1. Assessing Riparian Intactness

3.1.1. Indicator & Metric Selection

Within the last several years, considerable time and effort has been put into the development of a GIS method for assessing riparian areas, and this tool has been used to assess over 6,400 km of shoreline in central Alberta (Fiera Biological 2018a, b, c, and d). This riparian assessment work was completed using a GIS model that was developed to be comparable to existing videography methodologies (Fiera Biological 2018a), and includes the following three metrics that are quantified in a GIS environment using current land cover data:

- Metric 1: Proportional cover of vegetation and other natural land cover classes;
- Metric 2: Proportional cover of land cover classes containing woody vegetation;
- Metric 3: Proportional cover of land cover classes associated with human activity.

These methods have been validated against videography data collected in the Modeste watershed (Fiera Biological 2018a), as well as with field data collected at Pigeon, Gull, Sylvan, and Buffalo Lakes (Fiera Biological 2018e). Both the videography and the field validation studies have demonstrated that the GIS assessment provides a reliable estimate of riparian condition across a range of geographic areas and ecological conditions.

3.1.2. Acquisition and Derivation of Required Data

To quantify riparian intactness in a GIS environment using the metrics outlined above, a current land cover layer is required. While all previous GIS-based riparian assessments that we have conducted have utilized SPOT satellite imagery to create a 6 m resolution land cover, AWES was interested in creating a land cover layer with higher spatial resolution. As a result, we purchased a 2 m resolution multispectral (8-band) Worldview 2 satellite image to create a land cover layer for the 50 m RMAs on both the left and right banks. In addition, we created a 6 m resolution land cover layer for the local catchment areas intersecting the Blindman River using SPOT 6 satellite imagery, in order to characterize the dominant land cover within the study area.

Land Cover Layers

Worldview 2 Imagery covering approximately 172 km² of the study area along the shoreline of the Blindman River, and collected on June 20, 2016, was acquired from Harris Geospatial Solutions (Table 1). In addition, SPOT satellite imagery from 2016 was obtained from the Government of Alberta to cover the study area. Using these two imagery datasets, land cover classifications were created at two scales: the Worldview imagery was used to create a fine-scale high resolution 2 m classification of areas adjacent

to the Blindman River for the purposes of assessing intactness, and the SPOT imagery was used to create a coarser-scale 6 m classification for the local catchment areas to characterize land use and cover.

Both land cover classifications were developed using an object-based image analysis method. Using ENVI Feature Extraction (5.3.1.), each imagery dataset was segmented into imagery objects (i.e., a group of pixels) based on spectral and textural information to create segmented objects representing different land cover classes. Training sample datasets for each land cover class were manually selected using the imagery datasets and the classifications were run using a Random Forest classifier. The land cover layers created from each imagery dataset were then manually checked and edited to address misclassification errors, and additional classes were added, where required. For both classifications, the Alberta Base Features Road layer was used to improve the accuracy and the delineation of the Road classes. Given the different resolutions and intended use for each of the land cover classifications, the land cover class composition between the two classifications varied slightly. The high resolution Worldview 2 land cover for calculating intactness included 15 classes (Table 2), while the land cover derived from SPOT included 12 classes (Table 3).

Table 1. Description of the spatial data obtained or derived for use in developing classifications for the assessment of Riparian Management Area Intactness and for characterizing land use within the study area.

Data Layer	Date	Source	Usage
SPOT 6 Satellite Imagery	August 15, 2016	Government of Alberta	Derivation of course resolution (6 m) land cover classification
SPOT 7 Satellite Imagery	April 20, 2016	Government of Alberta	Derivation of course resolution (6 m) land cover classification
Worldview 2 Satellite Imagery	June 20, 2016	Harris Geospatial Solutions	Derivation of high resolution (2 m) land cover classification
Roads	2014	Alberta Base Features	Derivation of land cover classifications
High Resolution (2 m) Land Cover	2016	Fiera Biological. Layer was created using Worldview 2 imagery and derived layers	Derivation of RMAs and quantification of intactness metrics
Course Resolution (6 m) Land Cover	2016	Fiera Biological. Layer was created using SPOT imagery and derived layers	Characterization of study area and land cover summaries

Table 2. Land cover classes derived using the Worldview 2 imagery. The land cover layer derived from the Worldview imagery was used to quantify riparian management area intactness along the Blindman River.

Class Name	Description
Cultivated Crops	Agricultural land primarily used for cultivated crops
Pasture	Agricultural land primarily used as pasture; includes lands grazed at many different intensities and frequencies (e.g., rough pasture, tame pasture, range lands)
Human Bare Land	Bare ground that is human-caused or caused because of human-related activities (e.g., bare soil on river banks where livestock are highly active and have caused bare soil)
Gravel Road	Gravel roads and other gravel or bare ground surfaces
Paved Road	Paved roads and other paved surfaces
Disturbed Vegetation	Vegetation that has been disturbed by human activity. Primarily consists of vegetation next to roads, but may also include yards and other disturbed areas
Building	Buildings and other built features
Deciduous	Areas dominated by deciduous trees
Coniferous	Areas dominated by coniferous trees
Shrubby	Areas dominated by shrub cover. Includes both upland and wetland shrub-dominated areas
Wetland	Non-shrubby wetland areas (e.g., marsh, graminoid fen)
Natural Open Vegetation	Upland areas dominated by low (non-woody) vegetation, such as grasses and forbs
Bare Soil	Naturally occurring areas of bare soil (e.g., exposed banks, rock)
Open Water	Open water
Shallow Open Water	Shallow water areas that fluctuate in depth and area over time and may contain emergent vegetation at some times of the growing season

Table 3. Land cover classes derived using the SPOT imagery. The land cover derived from SPOT was used to generally characterize dominant cover in the study area.

Class Name	Description
Cultivated Crops	Agricultural land primarily used for cultivated crops
Pasture	Agricultural land primarily used as pasture; includes lands grazed at many different intensities and frequencies (e.g., rough pasture, tame pasture, range lands)
Human Bare Land	Bare ground that is human-caused or caused because of human-related activities (e.g., bare soil on river banks where livestock are highly active and have caused bare soil)
Road	Gravel and paved roads, and other paved and bare ground surfaces
Disturbed Vegetation	Vegetation that has been disturbed by human activity. Primarily consists of vegetation next to roads, but may also include yards and other disturbed areas
Building	Buildings and other built features
Forest	Areas dominated by deciduous or coniferous trees, or areas dominated by dense, tall shrubs
Wetland	Non-shrubby wetland areas (e.g., marsh, graminoid fen)
Natural Open Vegetation	Upland areas dominated by low (non-woody) vegetation, such as grasses and forbs
Bare Soil	Naturally occurring areas of bare soil (e.g., exposed banks, rock)
Open Water	Open water
Shallow Open Water	Shallow water areas that fluctuate in depth and area over time and may contain emergent vegetation at some times of the growing season

3.1.3. Refining the Blindman River Boundary

Previous intactness assessments using SPOT imagery have relied on a single polyline along the center of creeks and streams to generate the RMAs. A preliminary review of the provincial polyline layer for the Blindman River revealed that there was a discrepancy between the river polyline and the location of the banks in the Worldview 2 imagery. Because of the higher resolution of the Worldview 2 imagery and the width of the river in some areas, use of a single line to represent the center of the river would have resulted in an underestimation of the riparian area land use and cover within the RMA (i.e., up to 20% of the RMA would have been covered by the river). Therefore, a new polyline layer was created for each bank by hand digitizing the left and right bank so that it matched the Worldview 2 imagery within one pixel (i.e., within 2 m).

3.1.4. Delineating Riparian Management Area Width and Length

For the purpose of this assessment, riparian intactness is assessed within a “riparian management area” (RMA) that have two spatial components: width and length. Following the methods developed for the North Saskatchewan River basin (Fiera Biological 2018a), the upstream and downstream extent of each RMA defined for this study was delineated based upon major changes in the proportion of natural cover along the shoreline. To calculate the proportion of natural cover along the shorelines, all natural cover classes in the high resolution land cover layer were selected and exported as a single layer. The river layer was then divided into 10-meter segments on the left and right banks, and the proportion of natural cover within a 20 m moving window was calculated for each segment. All segments were then differentiated based upon the proportion of natural cover within the 20 m window, using 55% natural cover as the threshold to differentiate between the start and end of a new RMA segment. Previous assessments using a land cover derived from SPOT imagery applied a minimum RMA length of 20 m; because of the high resolution of the land cover derived from the Worldview 2 imagery and the ability to resolve smaller features with more detail and quantify cover classes more accurately, a minimum RMA length of 10 m was applied. The width of the RMAs was defined using a 50 m wide static buffer that was applied to both the left and right banks of the river.

3.1.5. Metric Quantification and Riparian Intactness Scoring

Once RMA segments were created, each of the three intactness metrics were quantified within each RMA. To quantify Metric 1, all natural cover classes were selected from the land cover layer and the proportion of the RMA covered by those cover classes was calculated. The natural classes used to quantify Metric 1 included: Deciduous, Coniferous, Shrubby, Wetland, Natural Open Vegetation, Bare Soil, and Shallow Open Water. To quantify Metric 2, the percent coverage of the all woody land cover classes (Deciduous, Coniferous, and Shrubby cover) was quantified for each RMA. For Metric 3, the percent cover of the following land cover classes were used to calculate human footprint within each RMA: Cultivated Crops, Pasture, Human Bare Land, Gravel Roads, Paved Roads, Disturbed Vegetation, and Building.

Once each metric was quantified, the values were weighted using the following values: Metric 1 = 0.15; Metric 2: 0.25; Metric 3: 0.60. Based on these weightings, intactness was calculated using the following formula:

$$Intactness = (0.15 \times Metric\ 1) + (0.25 \times Metric\ 2) + (0.60 \times Metric\ 3)$$

The summed weighted metric scores gave a final RMA intactness score that ranged between 0 and 100, and these scores were converted into intactness categories using the following percentile breaks:

- High Intactness (>75-100): Vegetation within the RMA is present with little or no human footprint.
- Moderate Intactness (>50-75): Vegetation within the RMA is present with some human footprint.
- Low Intactness (0-50): Vegetation cover within the RMA is limited and human footprint is prevalent.
- Very Low Intactness (0-25): Vegetation cover within the RMA is mostly cleared and human footprint is the most dominant land cover.



4.0 Riparian Assessment Results

4.1. Blindman River – Overall Results

When both the left and right banks of the Blindman River are considered together, a total of 224.6 km of shoreline was assessed in this study. Overall, 62% of the shoreline (140.7 km) was classified as either Low (19%) or Very Low (43%) Intactness, with 20% of the shoreline assessed as High Intactness, and 18% classified as Moderate Intactness (Figure 1).

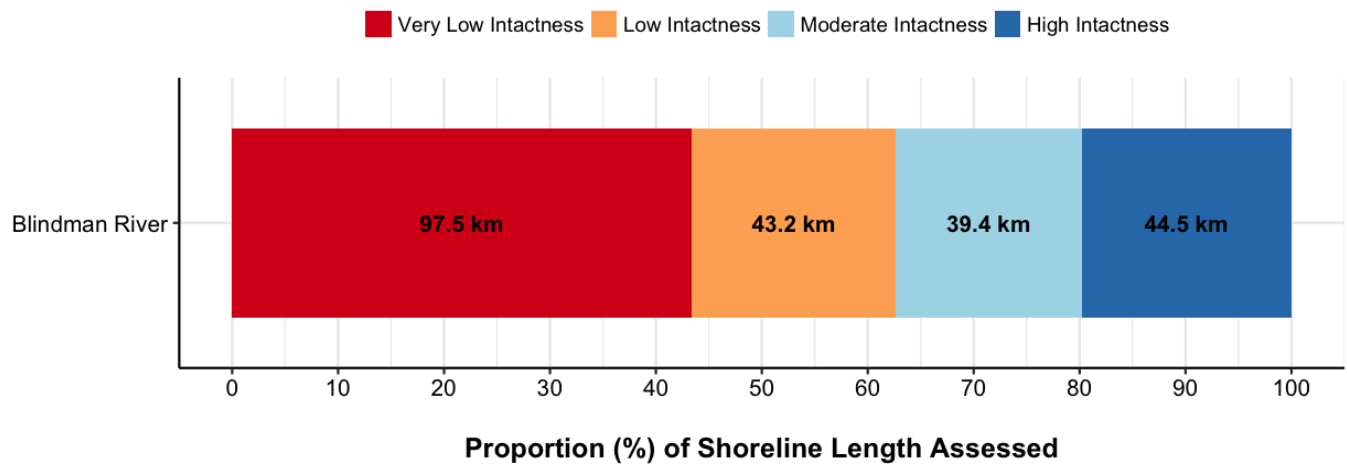


Figure 1. The proportion of shoreline along the Blindman River assigned to each riparian intactness category. Numbers within the bars indicate the total length of shoreline associated with each category.

4.2. River Reach Comparison

Riparian intactness was summarized by river reach, in order to better understand how condition varies spatially along the Blindman River. The river was divided into four reaches based upon the location of major highway intersection (Map 3), with Reach 2 having the greatest length of shoreline assessed (75.4 km), followed by Reach 3 (71.5 km), Reach 1 (59.3 km), and Reach 4 (18.5 km) (Figure 2).

When riparian intactness is considered by the total length (Figure 2) and proportion of shoreline (Figure 3) assessed within each reach, the greatest amount of shoreline in Very Low condition was located in Reach 2 (38.3 km, 51%), followed by Reach 3 (32.3 km, 45%), and Reach 1 (24.8 km, 42%). Reach 4 had the smallest amount and proportion of shoreline assessed as Very Low (2.1 km, 11%) and Low (1.9 km, 10%) Intactness (Figure 3).

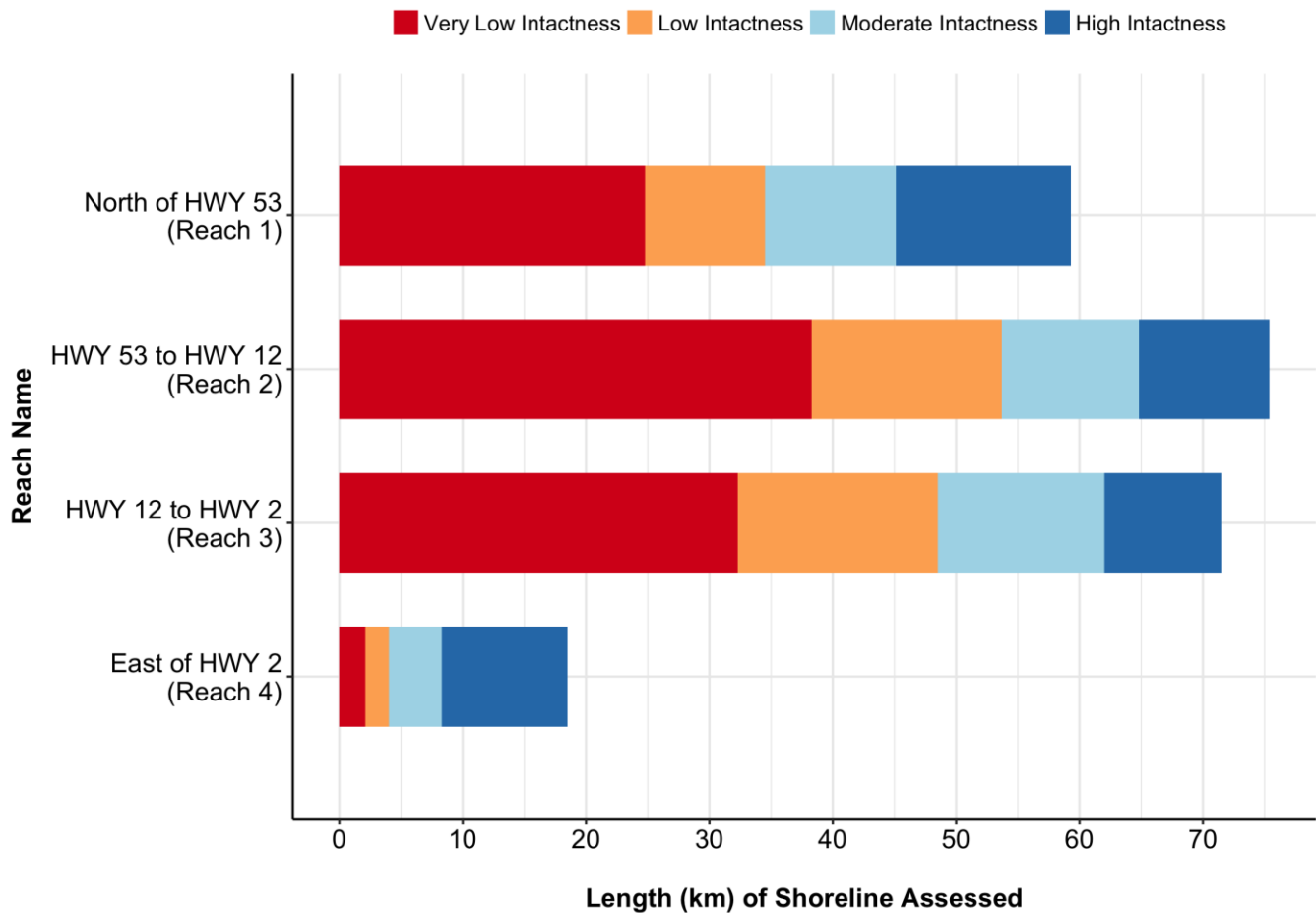


Figure 2. The length of shoreline assessed in each of the four river reaches, summarized by intactness category. The greatest length of shoreline assessed in the study was located within Reach 2 (75.4 km), while Reach 4 had the shortest length (18.5 km) of shoreline.

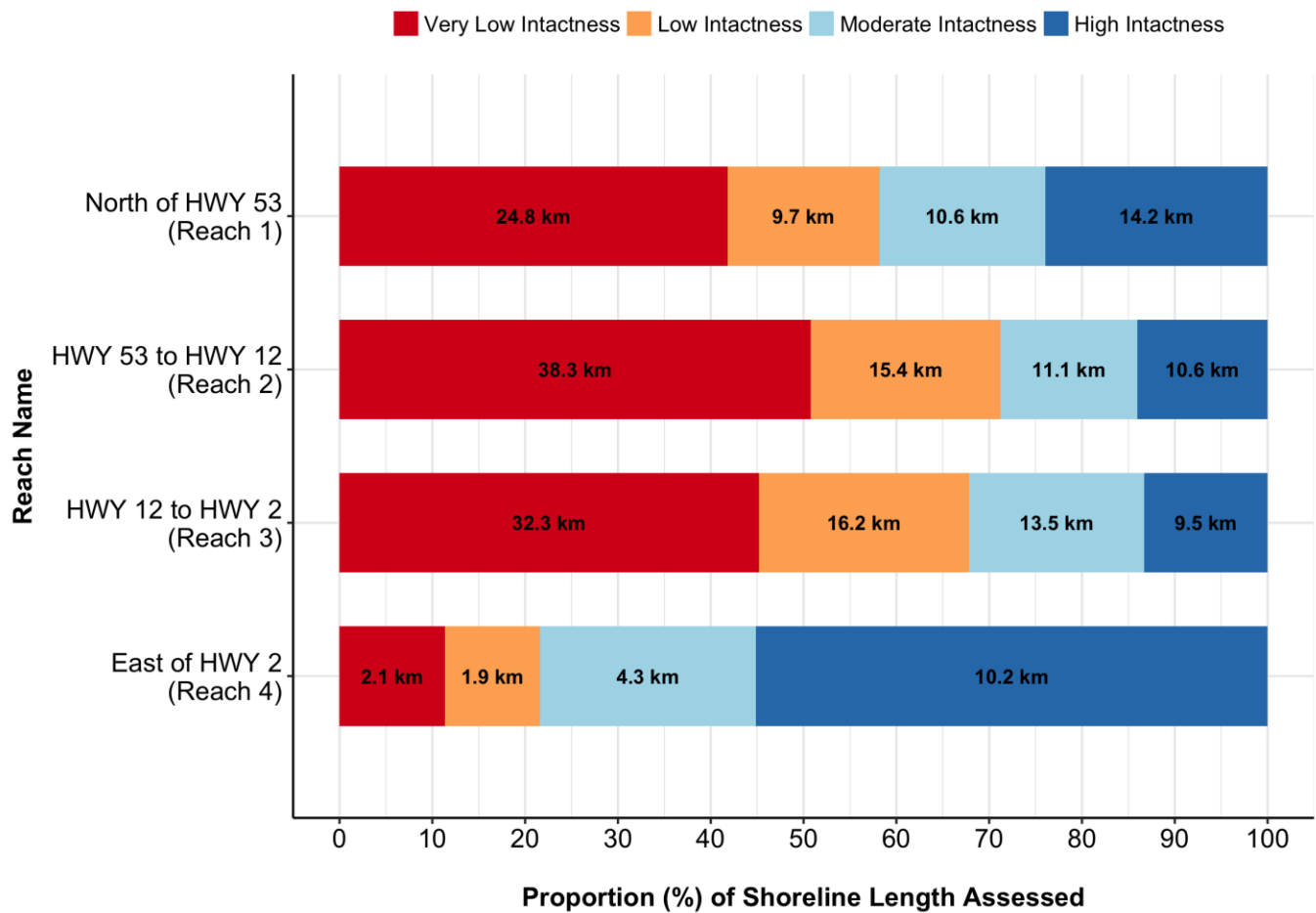


Figure 3. The proportion of shoreline assigned to each riparian intactness category, summarized for each of the four river reaches. Numbers within the bars indicate the total length of shoreline associated with each category.

4.2.1. River Reach 1 - North of HWY 53

A total of 59.3 km of river shoreline was assessed in Reach 1, which extends from Highway 53 to the confluence with Anderson Creek. Over 80% of the local catchment area in this Reach was classified as pasture land (44%), crop land (34%), or other human modified land cover types (3%) (Figure 4; Map 4).

More than half of the shoreline along the Blindman River within this reach was classified as either Very Low (42%, 24.8 km) or Low (16%, 9.7 km) Intactness (Figure 5). When intactness was assessed by bank, just over 40% of the left bank (Figure 6; Map 5) was classified as Very Low or Low Intactness, compared to 66% of the right bank (Figure 6; Map 6).

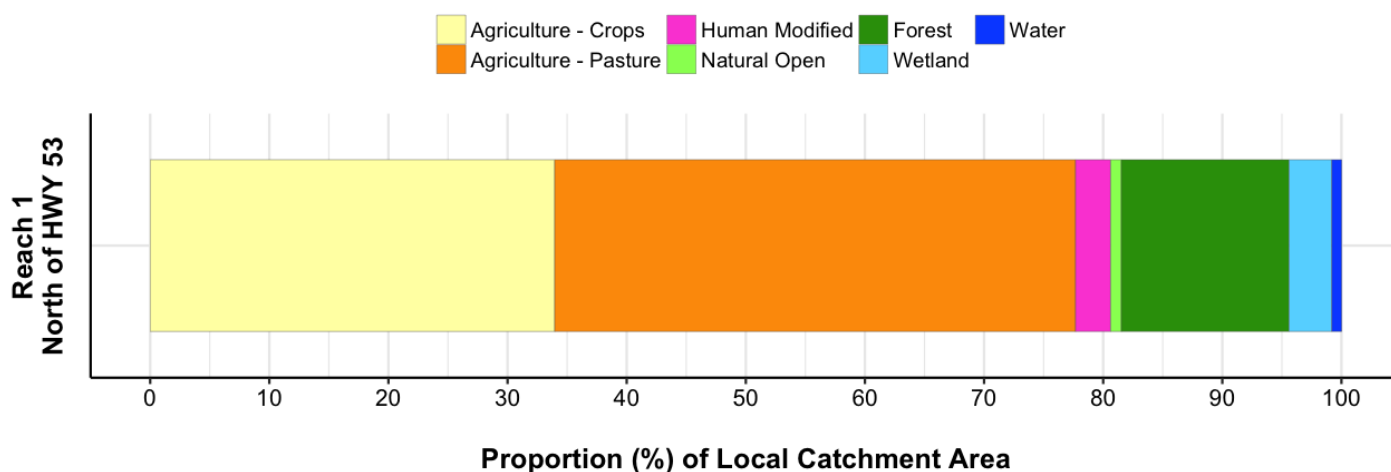


Figure 4. The proportion of lands within local catchment areas in Reach 1 classified by major land cover class.

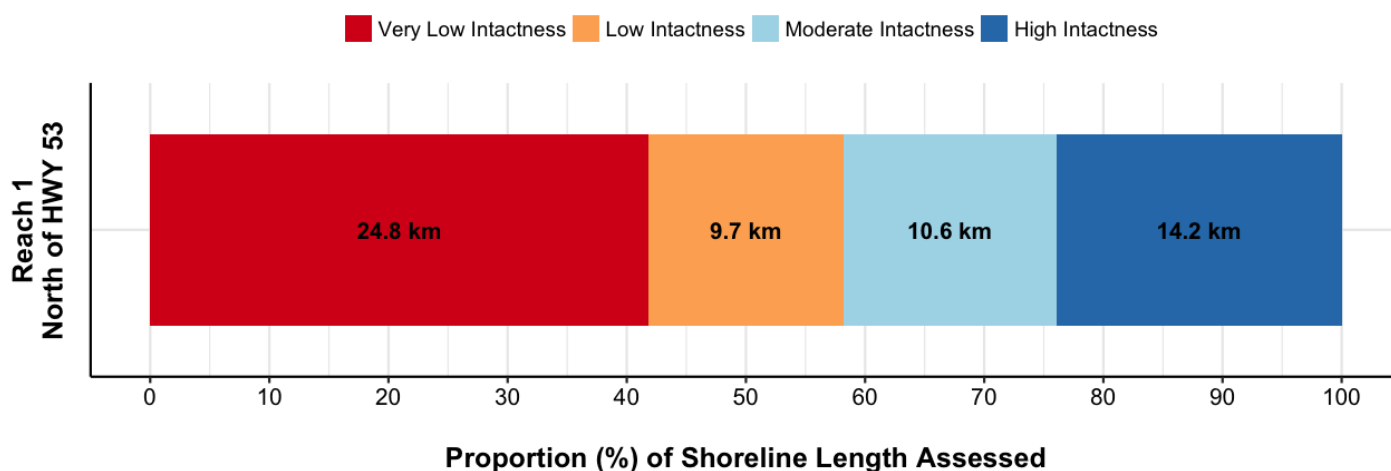


Figure 5. The proportion of shoreline within Reach 1 assigned to each riparian intactness category. Numbers within the bars indicate the total length of shoreline associated with each category.

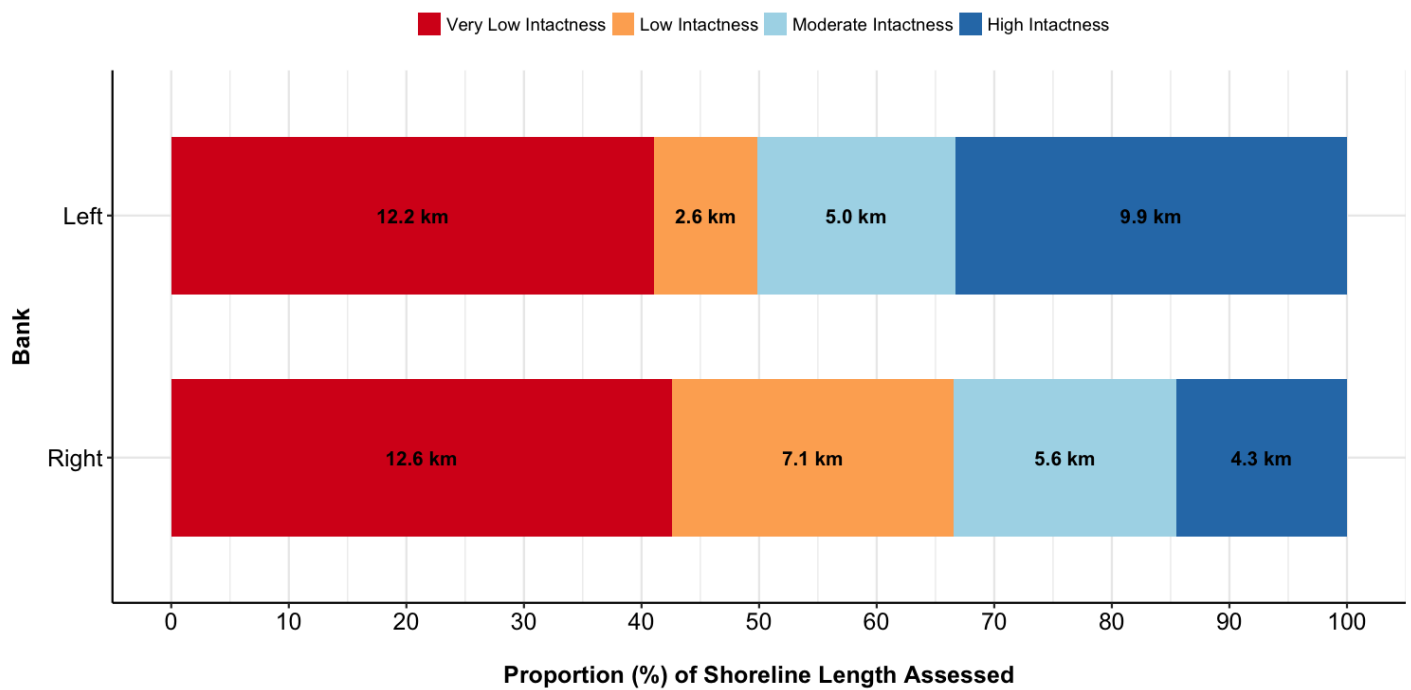
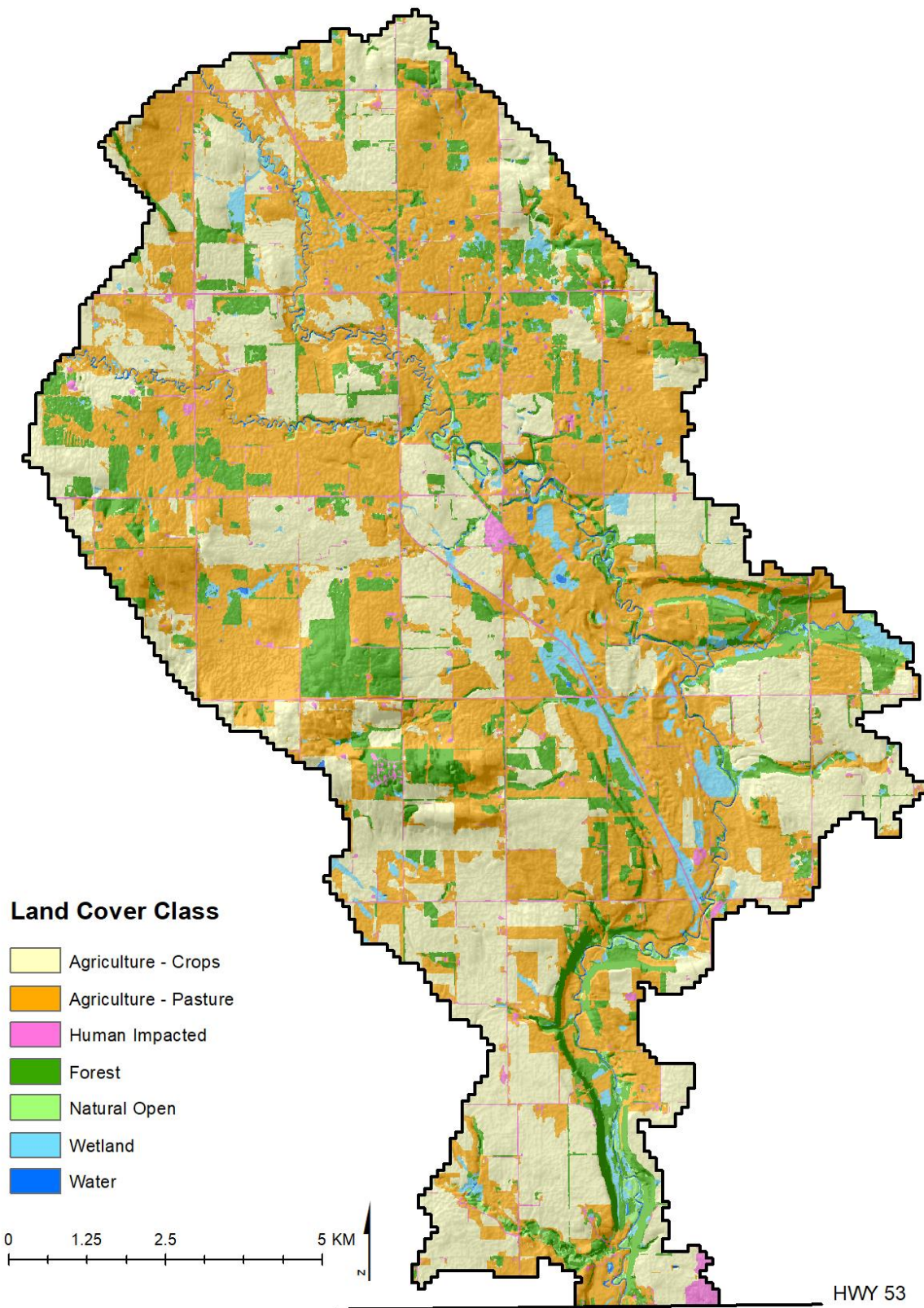
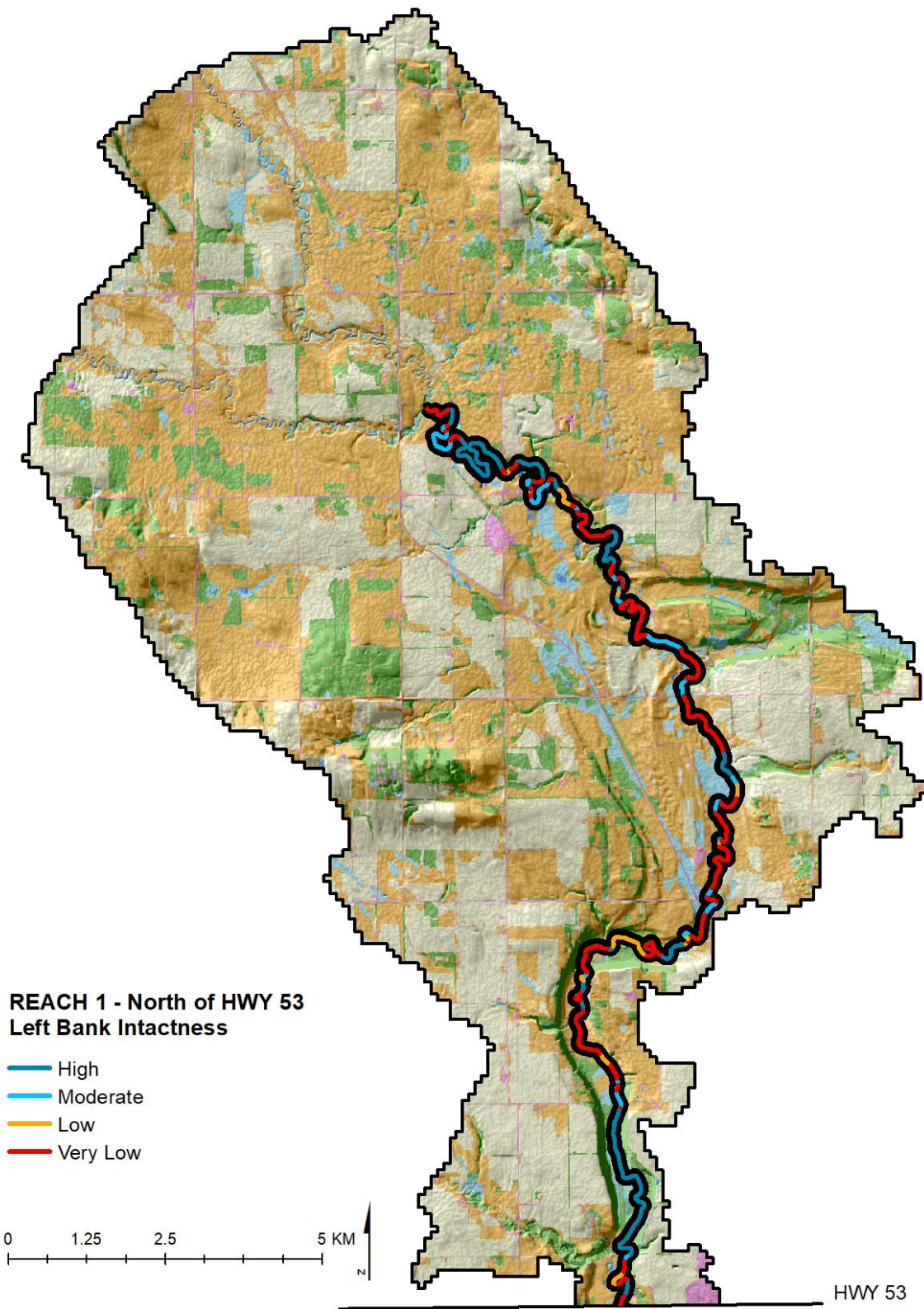


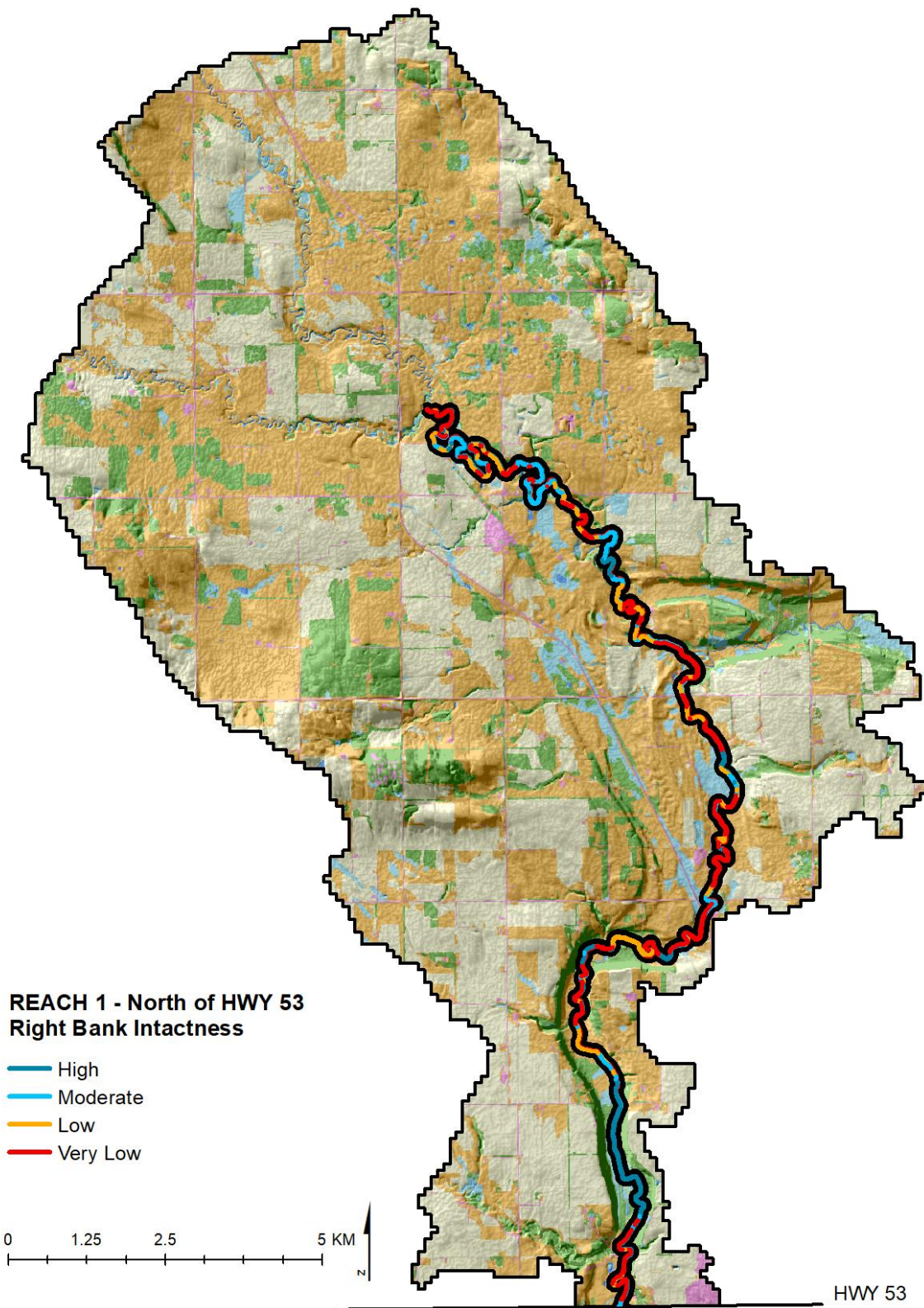
Figure 6. The proportion of the left and right bank within Reach 1 assigned to each riparian intactness category. Numbers within the bars indicate the total length of shoreline associated with each category.



Map 4. Land cover in Reach 1 – North of Highway 53.



Map 5. Intactness scores for the left bank (east shore) of the Blindman River in Reach 1.



Map 6. Intactness scores for the right bank (west shore) of the Blindman River in Reach 1.

4.2.2. River Reach 2 - HWY 53 to HWY 12

Reach 2 extends between Highway 53 and Highway 12, and includes a total of 75.4 km of river shoreline. Approximately 87% of the local catchment area in Reach 2 was classified as human footprint, with crop land making up the largest proportion (58%) of the land cover, followed by pasture land (25%; Figure 7; Map 7).

Approximately 71% of the shoreline along the Blindman River within this reach was classified as either Very Low (51%, 38.3 km) or Low (20%, 15.4 km) intactness (Figure 8). When intactness was assessed by bank, both the left and right bank had a similar proportion of shoreline assessed as either Very Low or Low Intactness. For the left bank, 56% of the shoreline was classified as Very Low and 15% was assessed as Low Intactness (Figure 9; Map 8) For the right bank, 45% of the shoreline was assessed as Very Low Intactness, with 26% assessed as Low Intactness (Figure 9; Map 9)

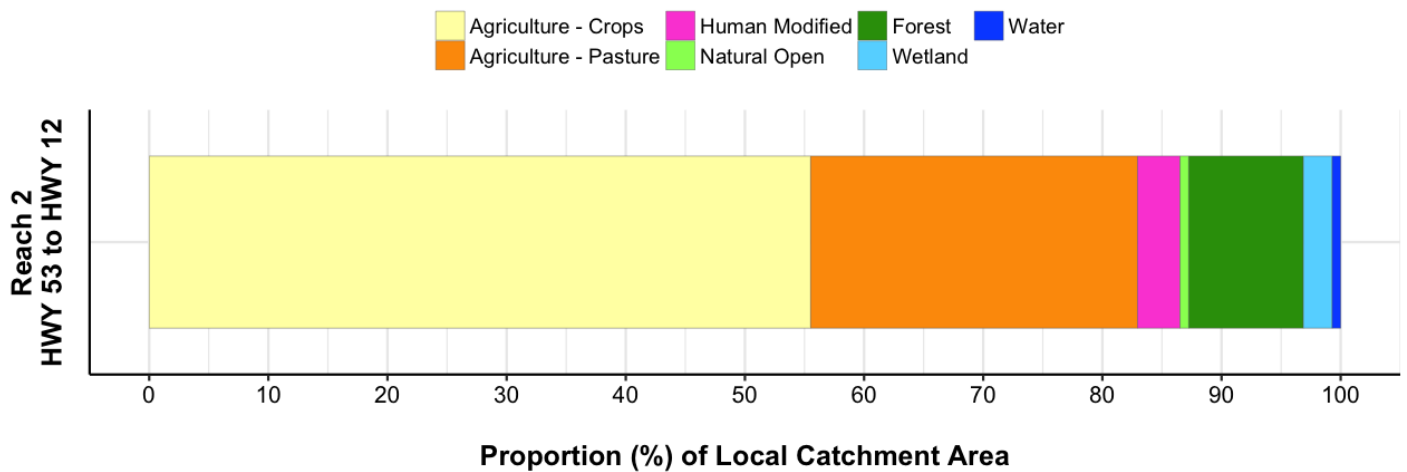


Figure 7. The proportion of lands within local catchment areas in Reach 2 classified by major land cover class.

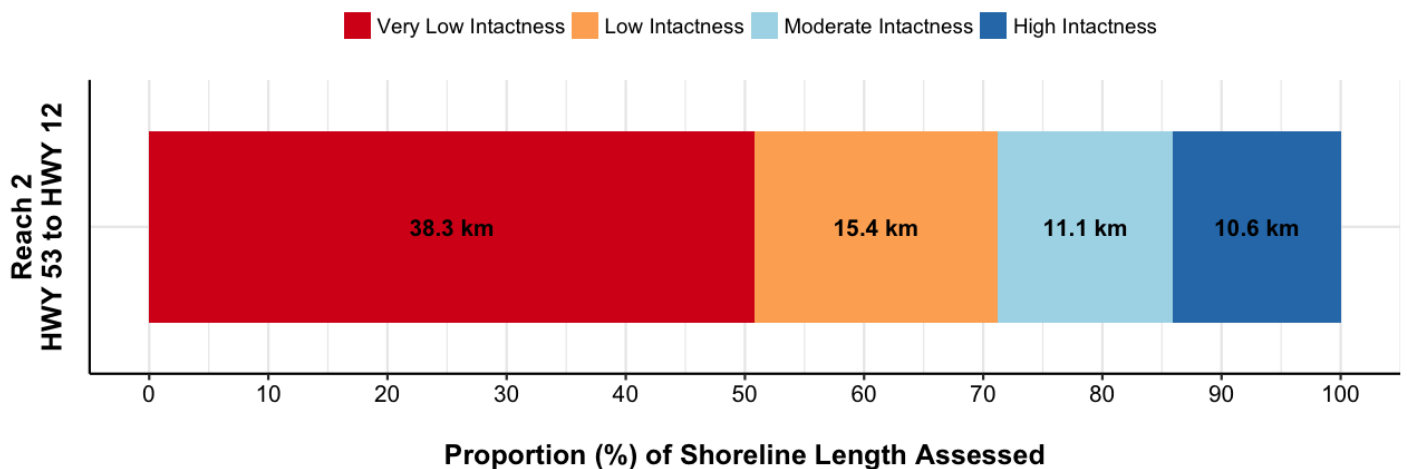


Figure 8. The proportion of shoreline within Reach 2 assigned to each riparian intactness category. Numbers within the bars indicate the total length (km) of shoreline associated with each category.

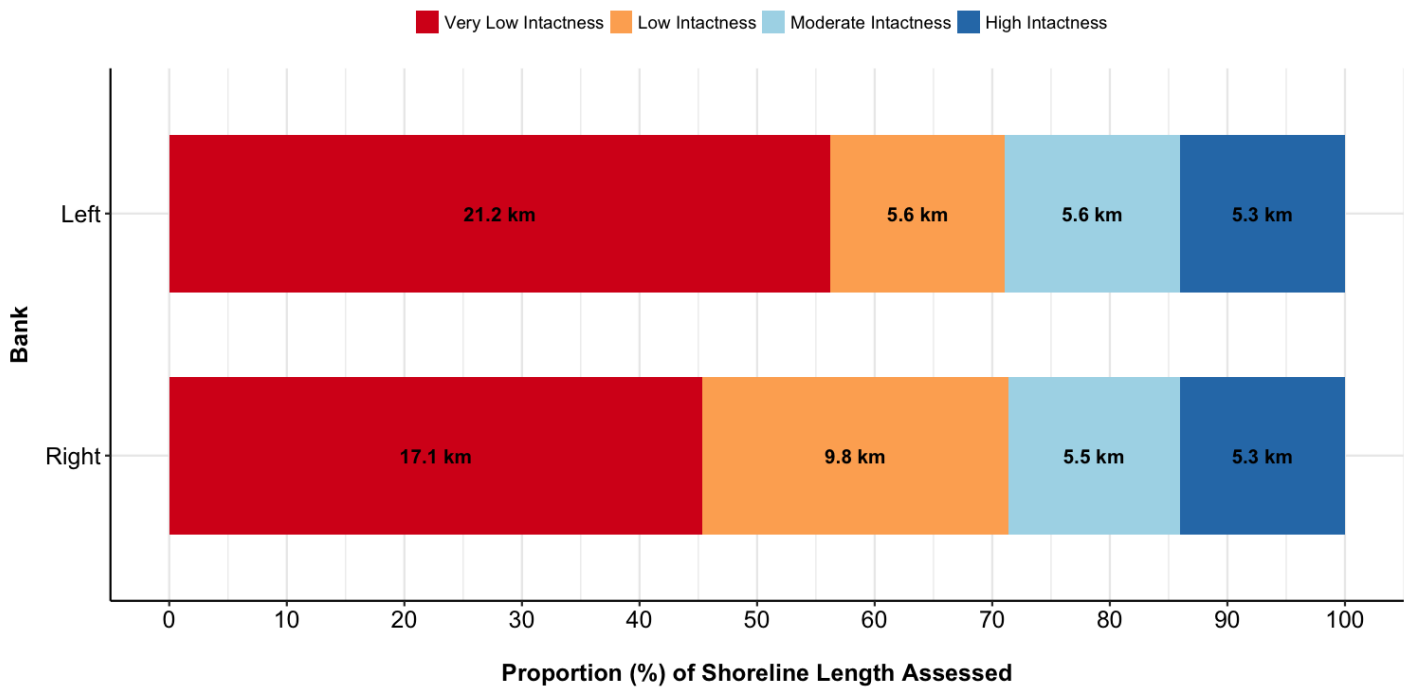
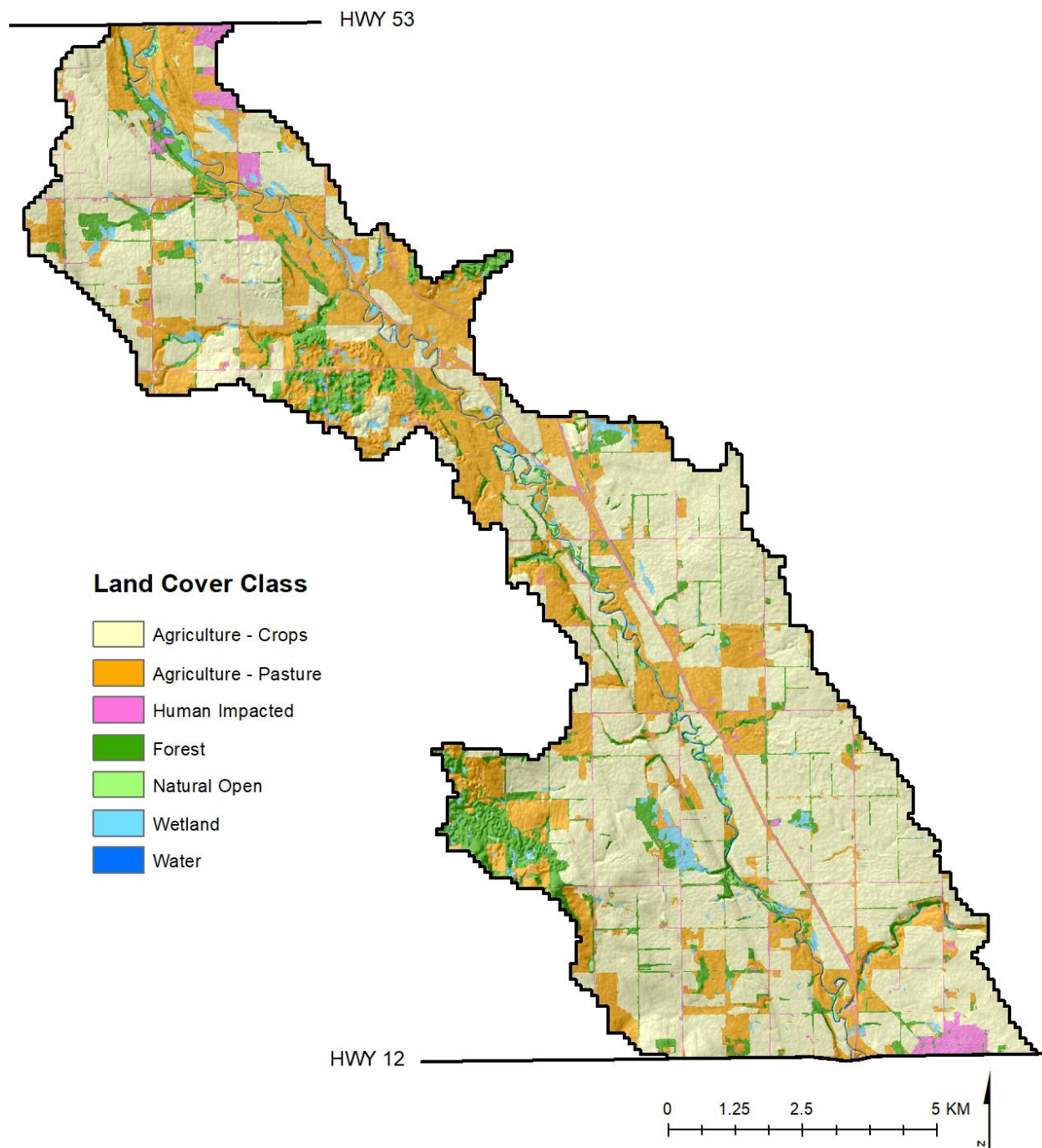
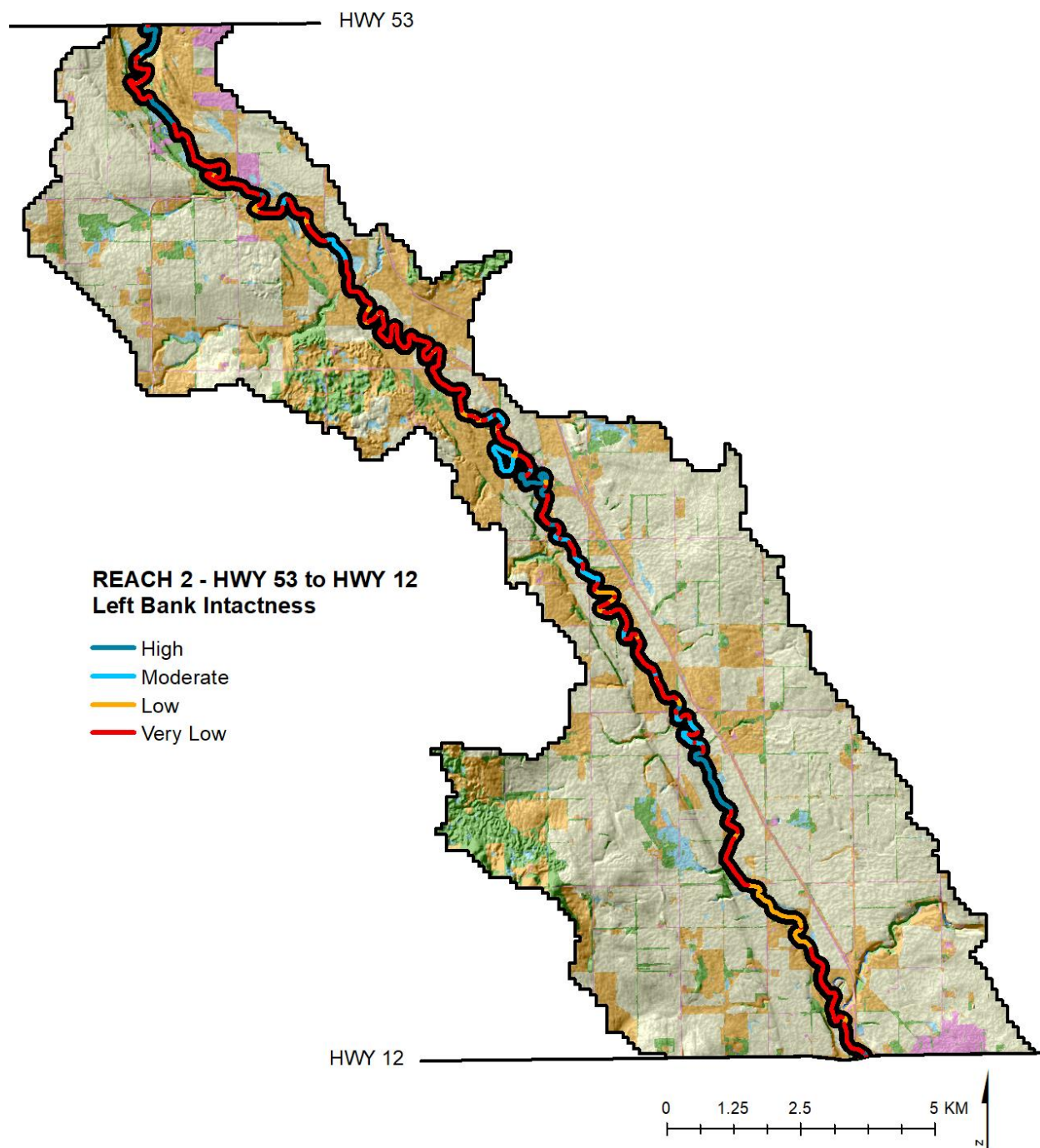


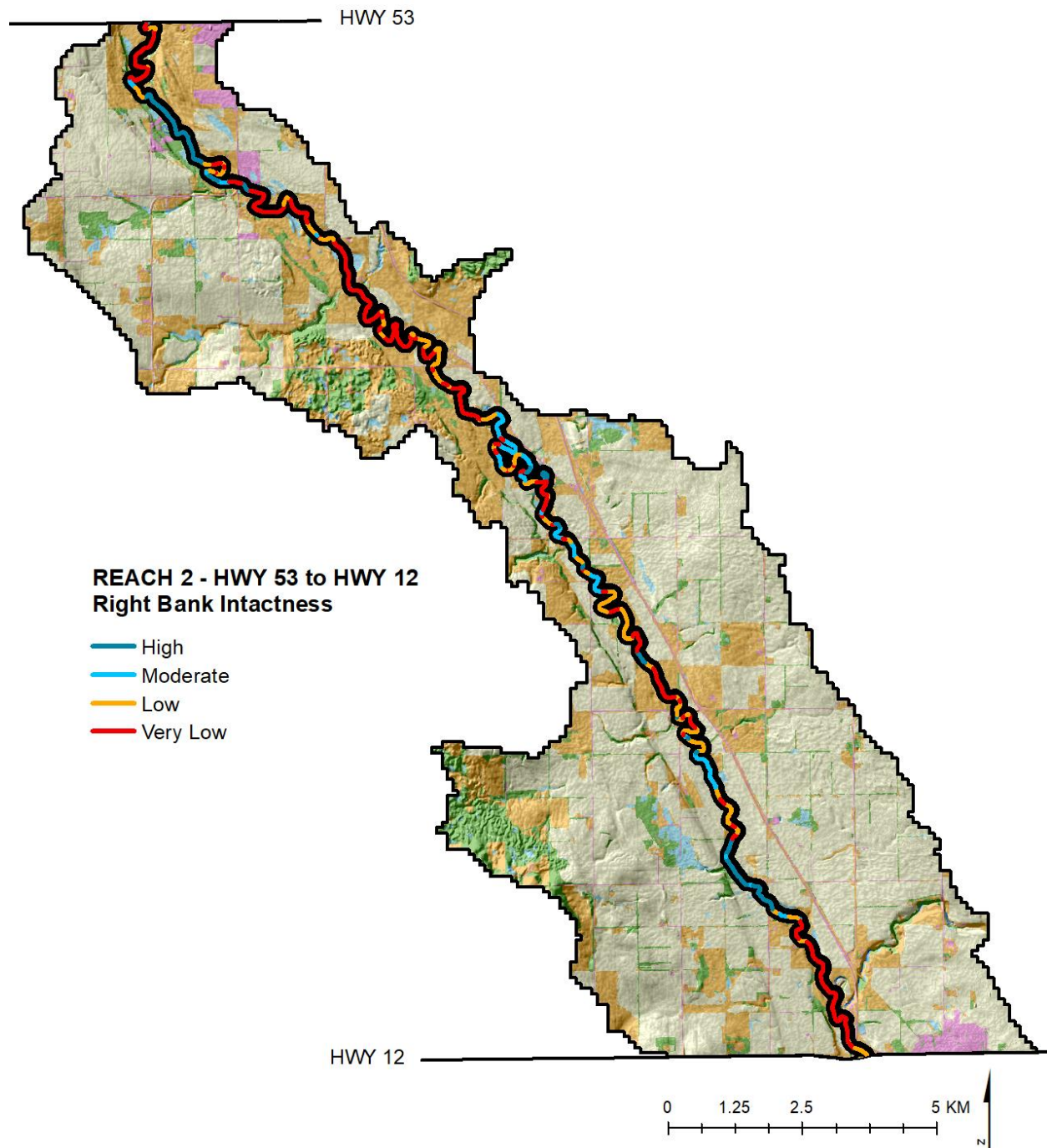
Figure 9. The proportion of the left and right bank within Reach 2 assigned to each riparian intactness category. Numbers within the bars indicate the total length (km) of shoreline associated with each category.



Map 7. Land cover within Reach 2 – Highway 53 to Highway 12.



Map 8. Intactness scores for the left (east) bank of the Blindman River in Reach 2.



Map 9. Intactness scores for the right (west) bank of the Blindman River in Reach 2.

4.2.3. River Reach 3 - HWY 12 to HWY 2

Reach 3 is the second longest reach, extending between Highway 12 and Highway 2, and includes 71.5 km of river shoreline. Nearly 87% of the local catchment area was classified as human footprint, with crop land making up the largest component of the human footprint (58%), followed by pasture land (25%), and other human modified land cover types (4%) (Figure 10; Map 10).

Approximately 68% of the river shoreline within this reach was classified as either Very Low (45%, 32.3 km) or Low (23%, 16.2 km) intactness (Figure 11). When intactness was assessed by bank, just over 75% of the left bank (Figure 12; Map 11) was classified as Very Low or Low Intactness, compared to 60% of the right bank (Figure 12; Map 12).

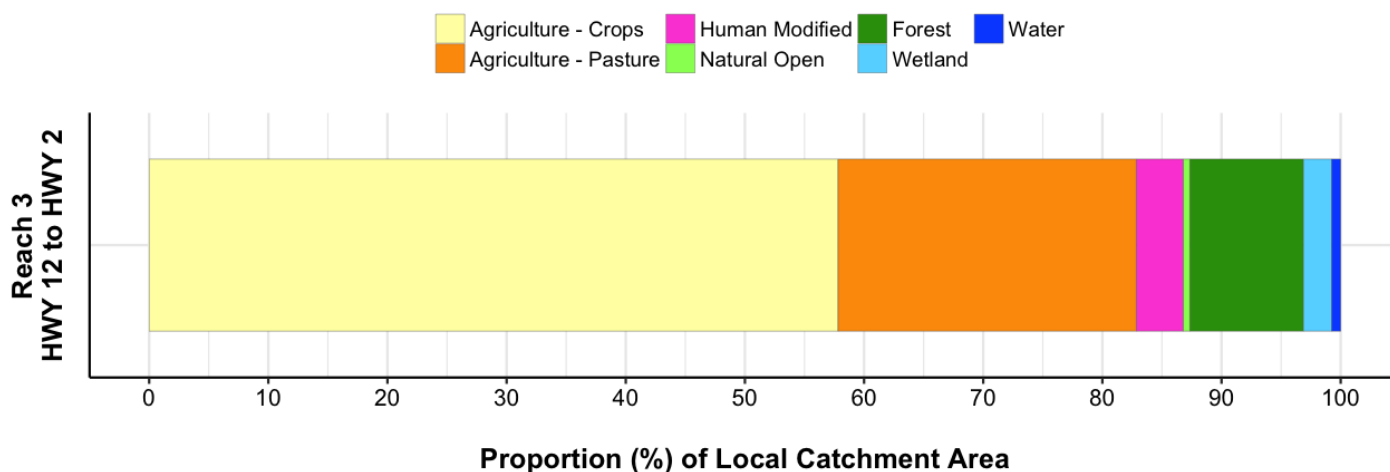


Figure 10. The proportion of lands within local catchment areas in Reach 3 classified by major land cover class.

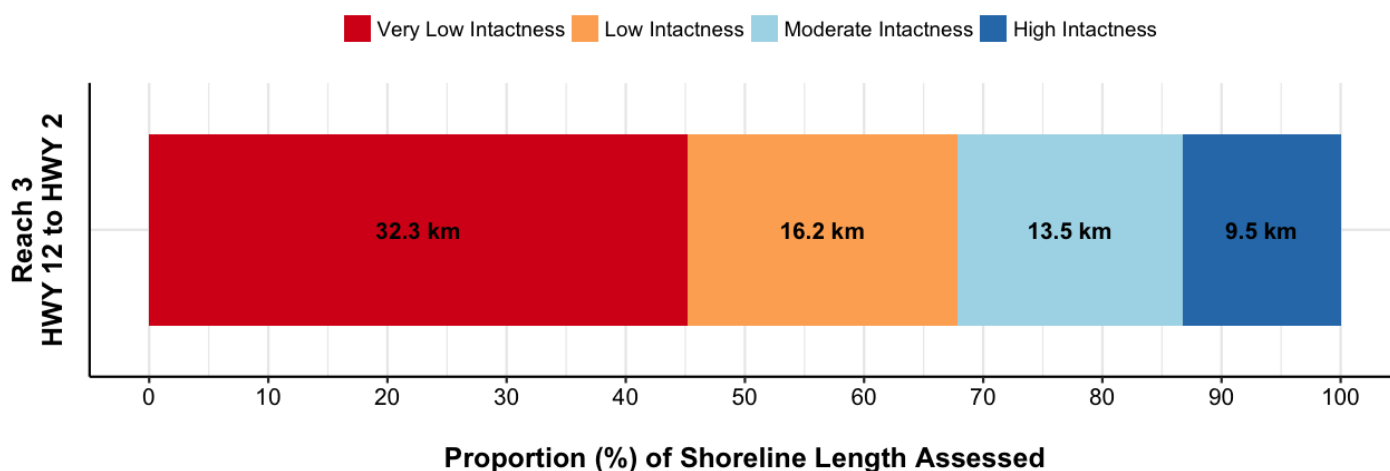


Figure 11. The proportion of shoreline within Reach 3 assigned to each riparian intactness category. Numbers within the bars indicate the total length of shoreline associated with each category.

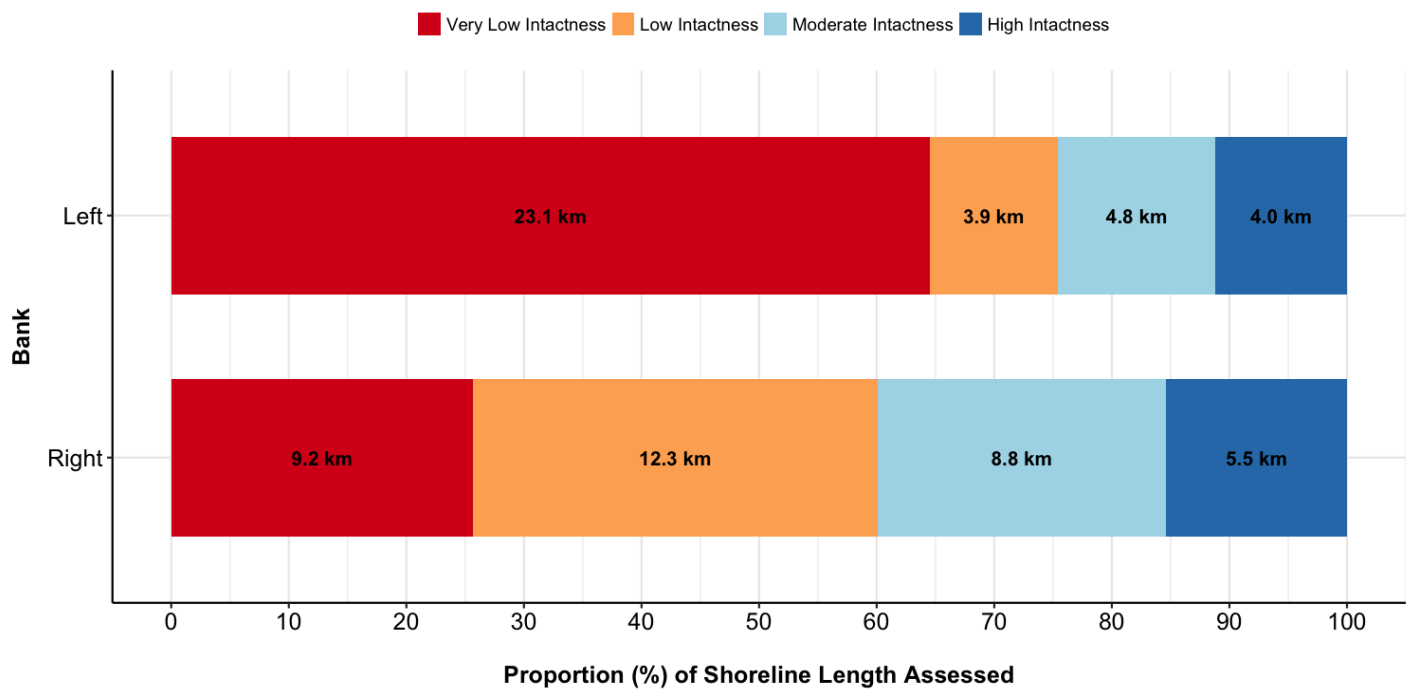
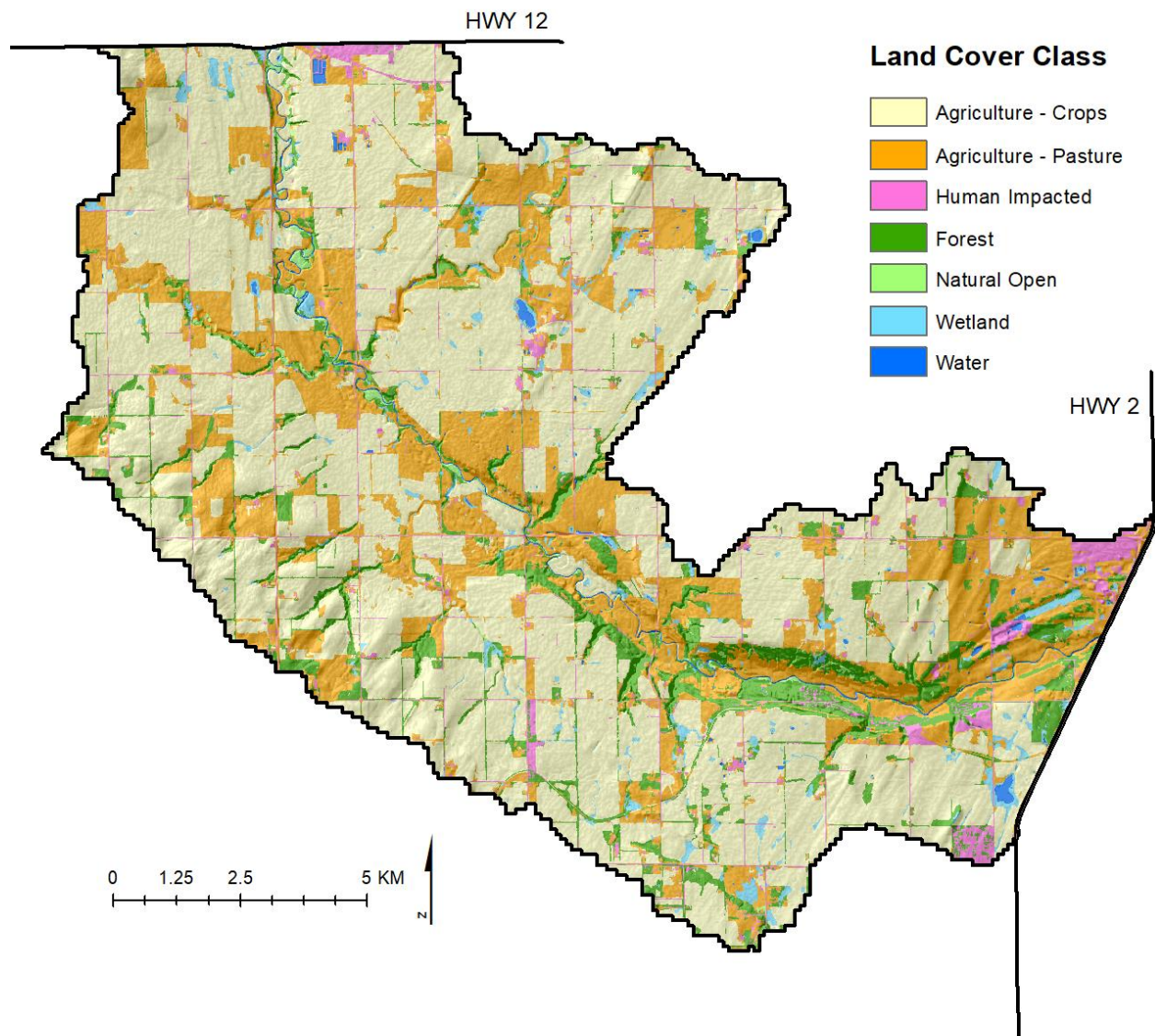
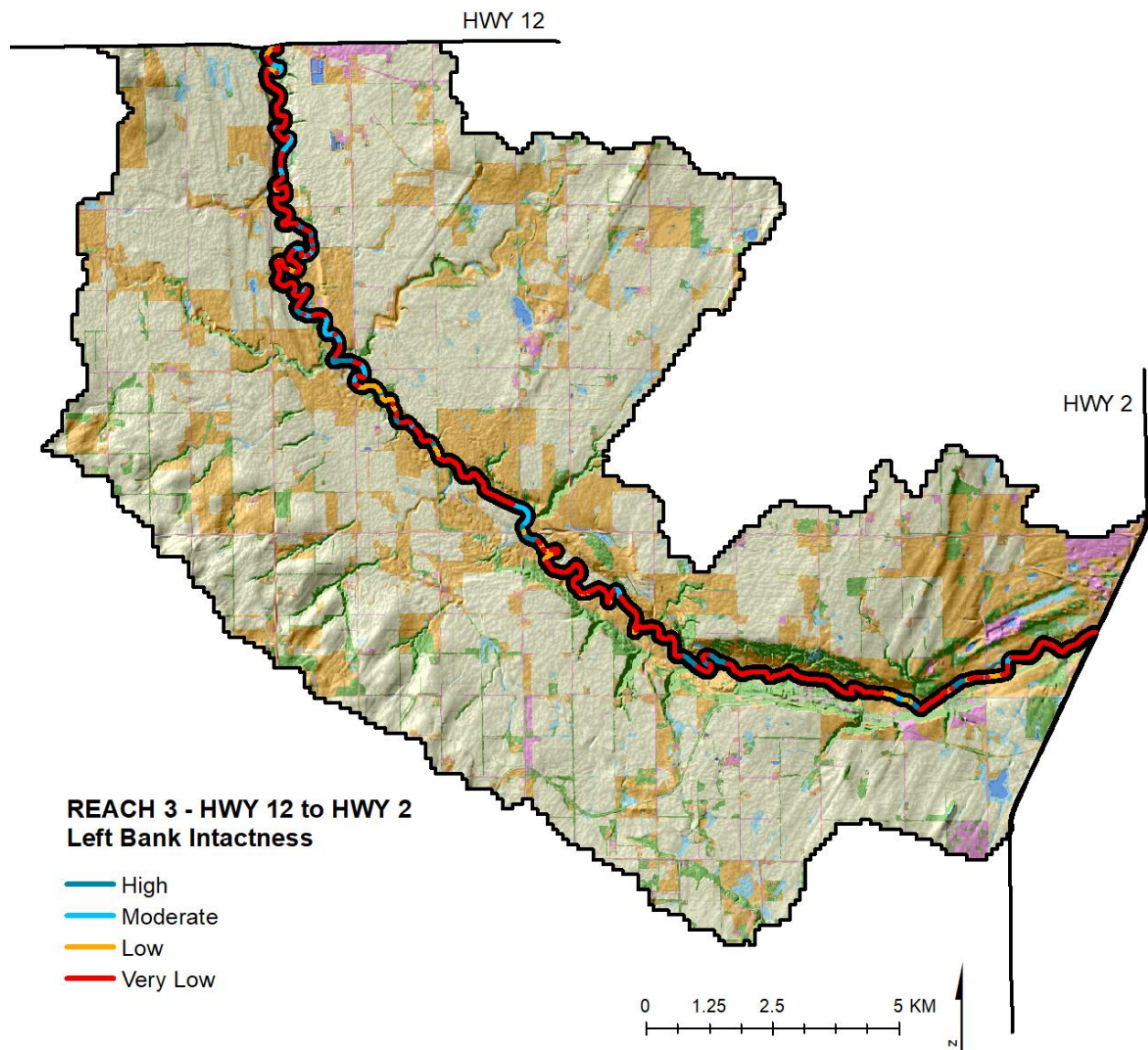


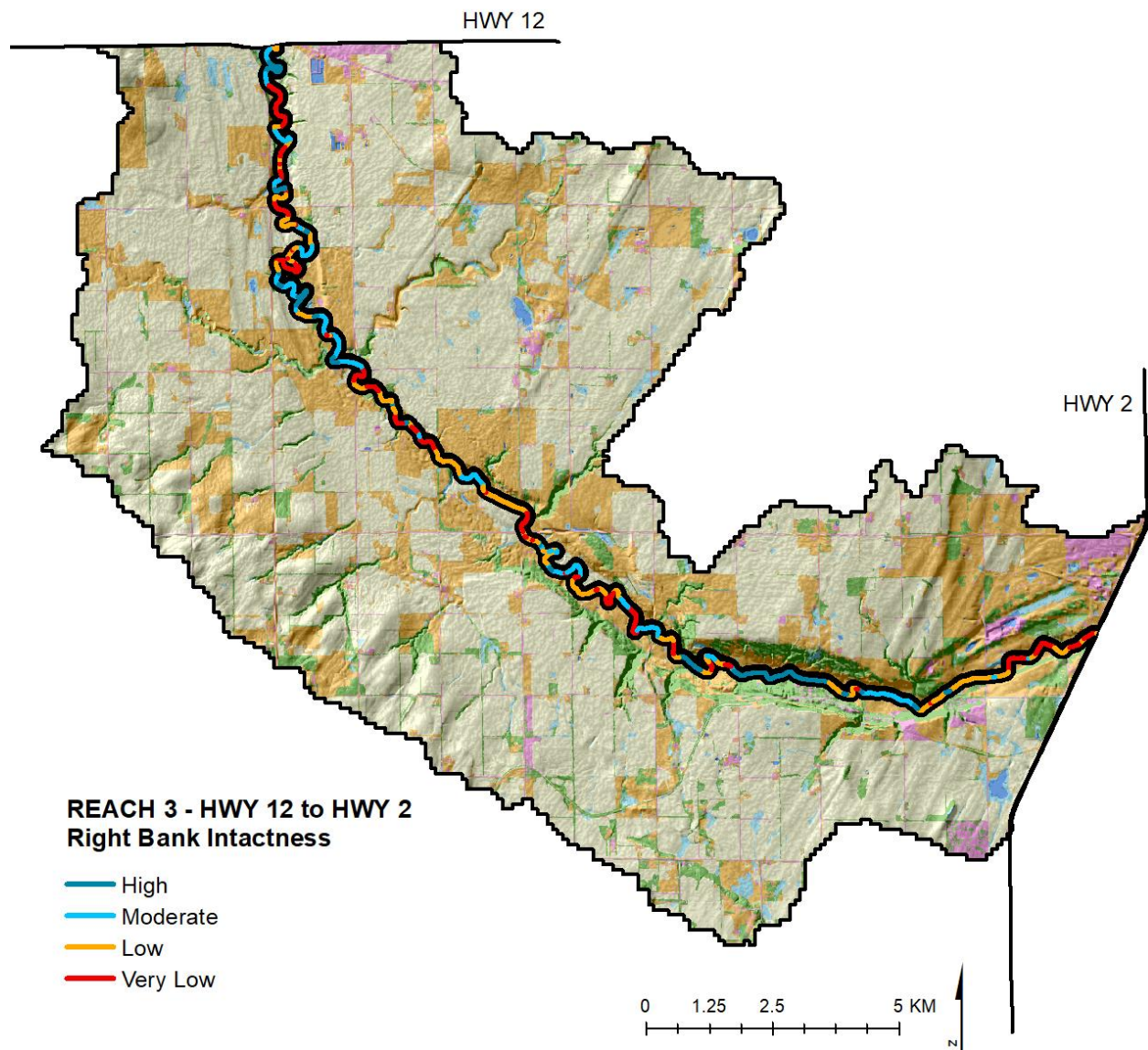
Figure 12. The proportion of the left and right bank within Reach 3 assigned to each riparian intactness category. Numbers within the bars indicate the total length of shoreline associated with each category.



Map 10. Land cover within Reach 3 – Highway 12 to Highway 2.



Map 11. Intactness scores for the left (east) bank of the Blindman River in Reach 3.



Map 12. Intactness scores for the right (west) bank of the Blindman River in Reach 3.

4.2.4. River Reach 4 – East of HWY 2

Reach 4, which extends east of Highway 2 and continues downstream to the confluence with the Red Deer River, had the shortest length of river shoreline assessed in this study (18.5 km). Approximately 76% of the land cover within the local catchment area was classified as human footprint, with crop land making up the largest component (35%), followed by human modified lands associated with the City of Red Deer and the Town of Blackfalds (20%), and pasture land (20%) (Figure 13; Map 13).

Compared to other reaches along the river, this reach had the smallest amount and proportion of shoreline assessed as Very Low (2.1 km, 11%) and Low (1.9 km, 10%) Intactness (Figure 14). When intactness was assessed by bank, the left bank had a larger proportion and length of shoreline classified as Very Low or Low (Figure 15; Map 14), as compared to the right bank (Figure 15; Map 15).

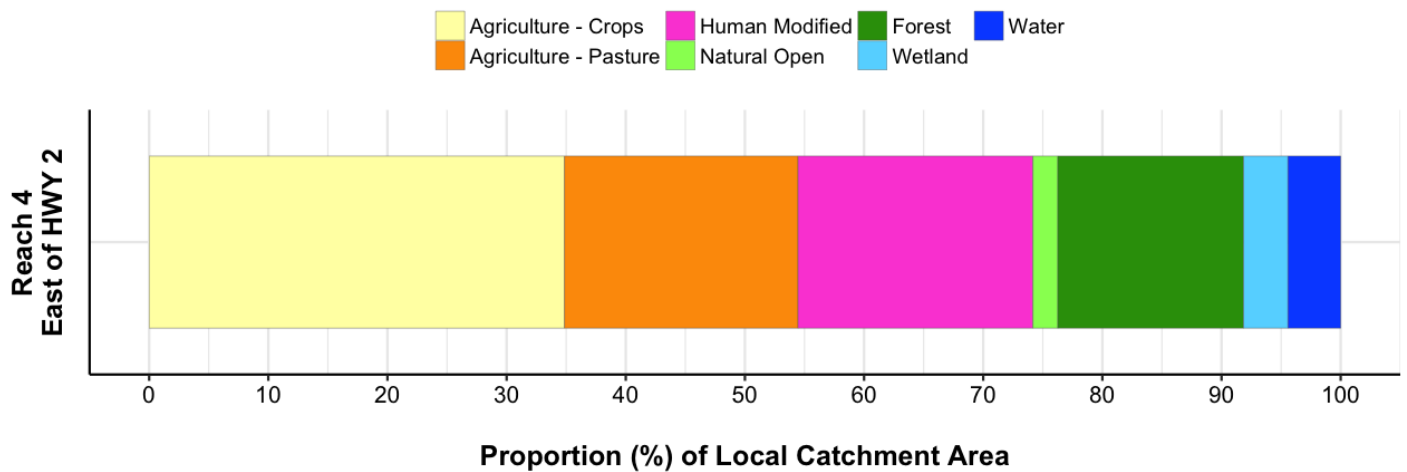


Figure 13. The proportion of lands within local catchment areas in Reach 4 classified by major land cover class.

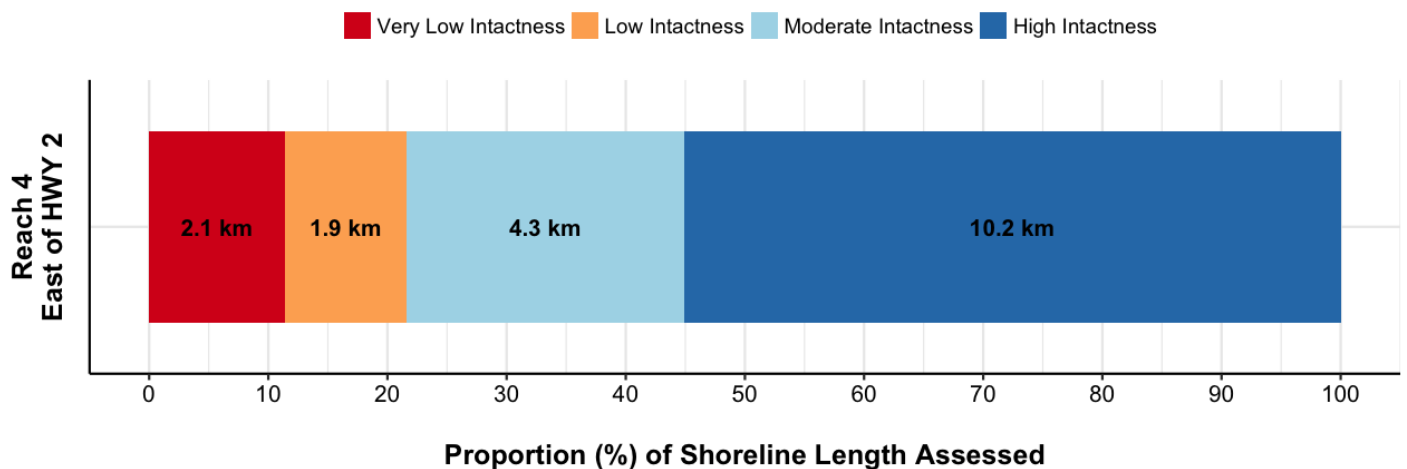


Figure 14. The proportion of shoreline within Reach 4 assigned to each riparian intactness category. Numbers within the bars indicate the total length (km) of shoreline associated with each category.

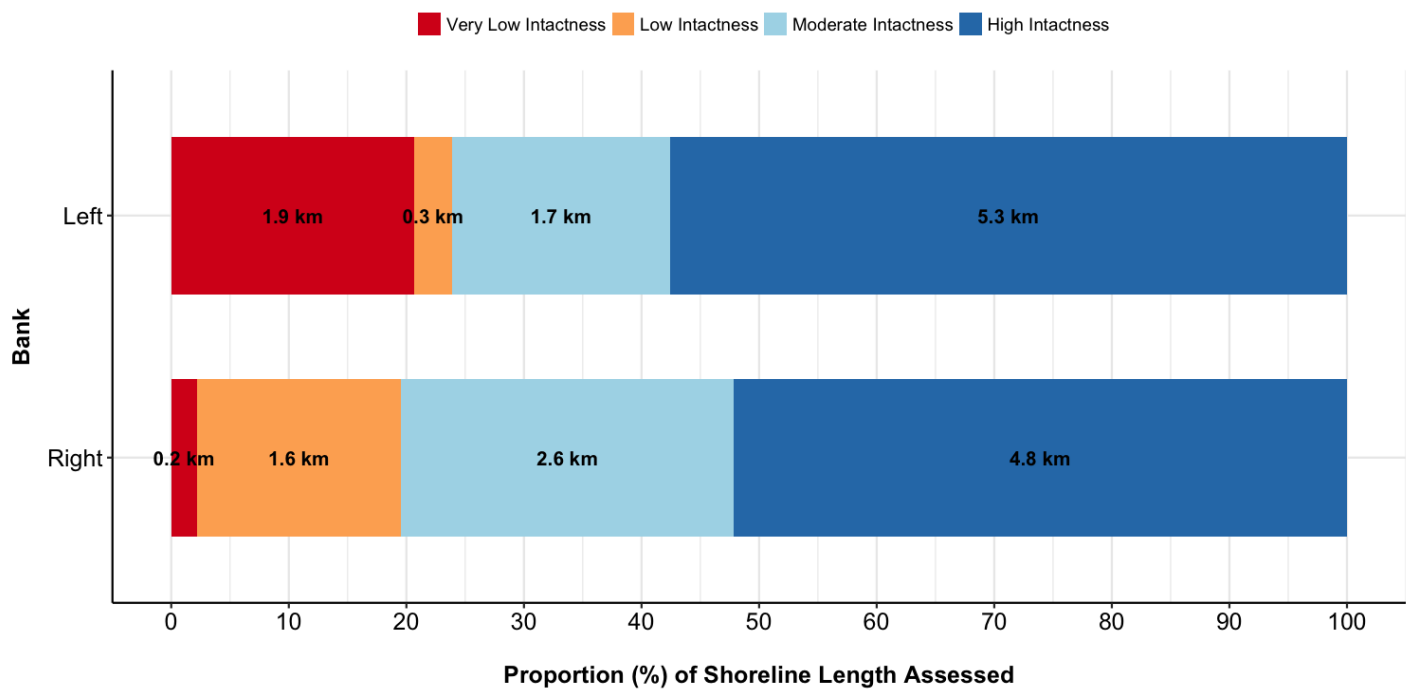
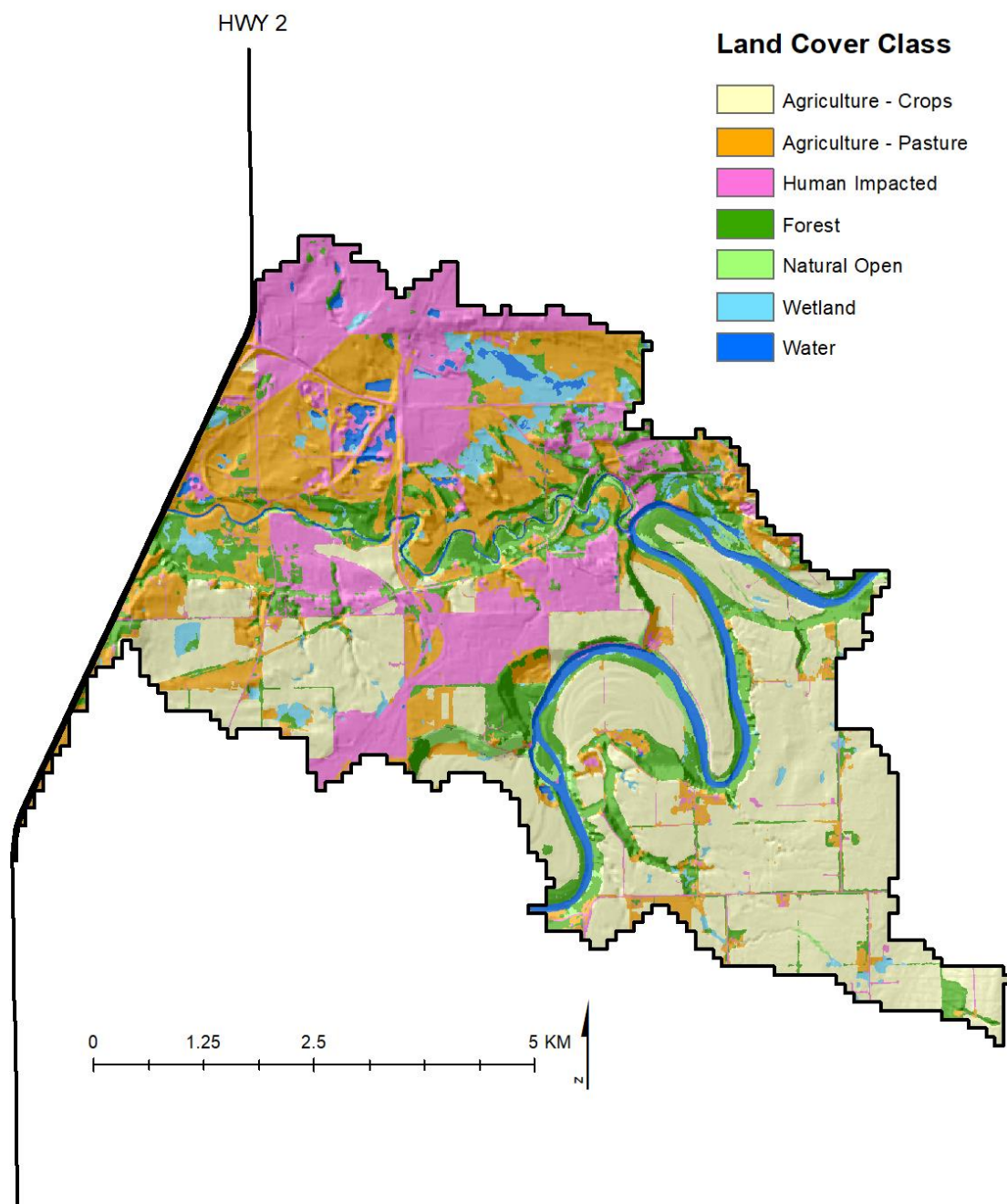
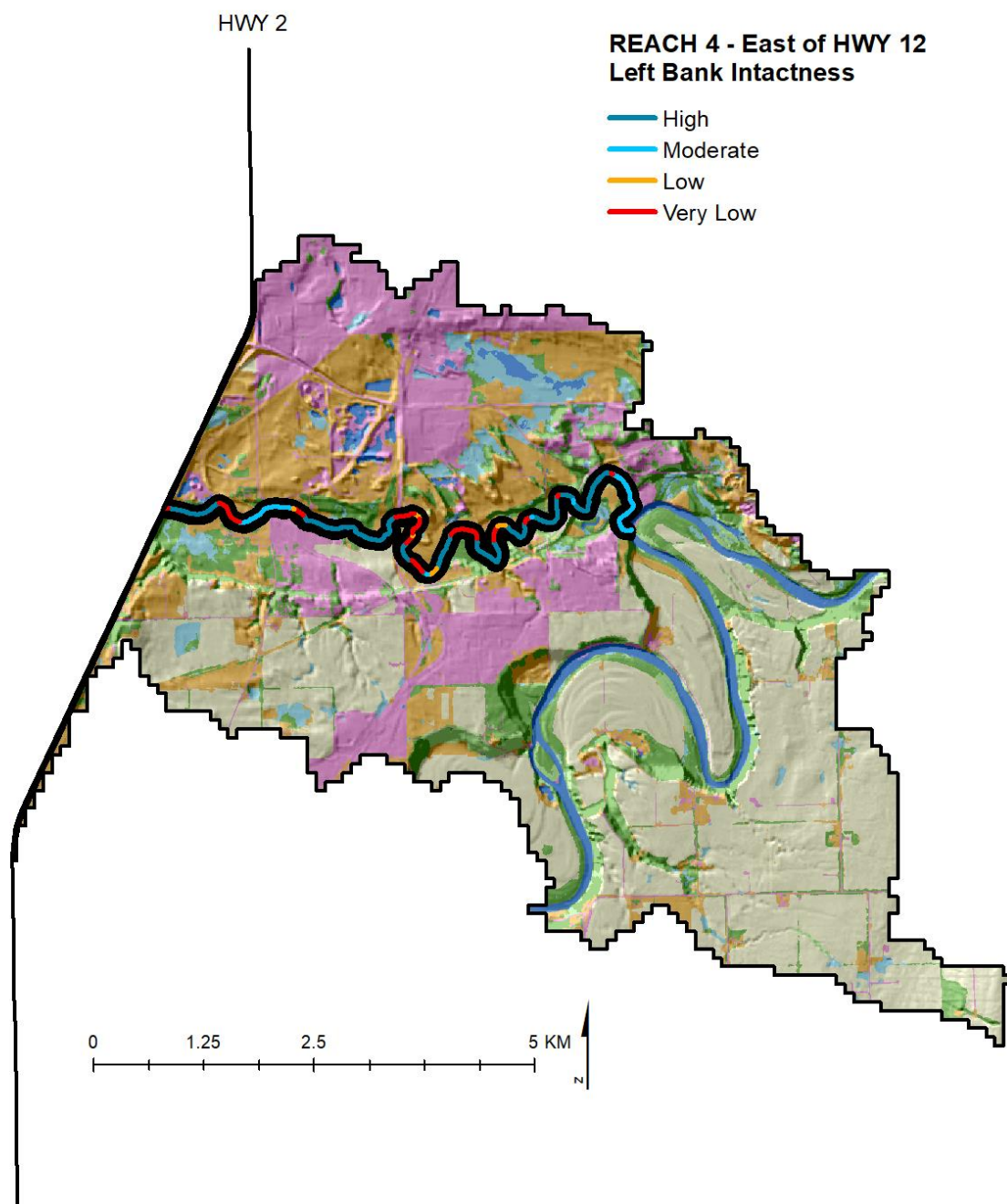


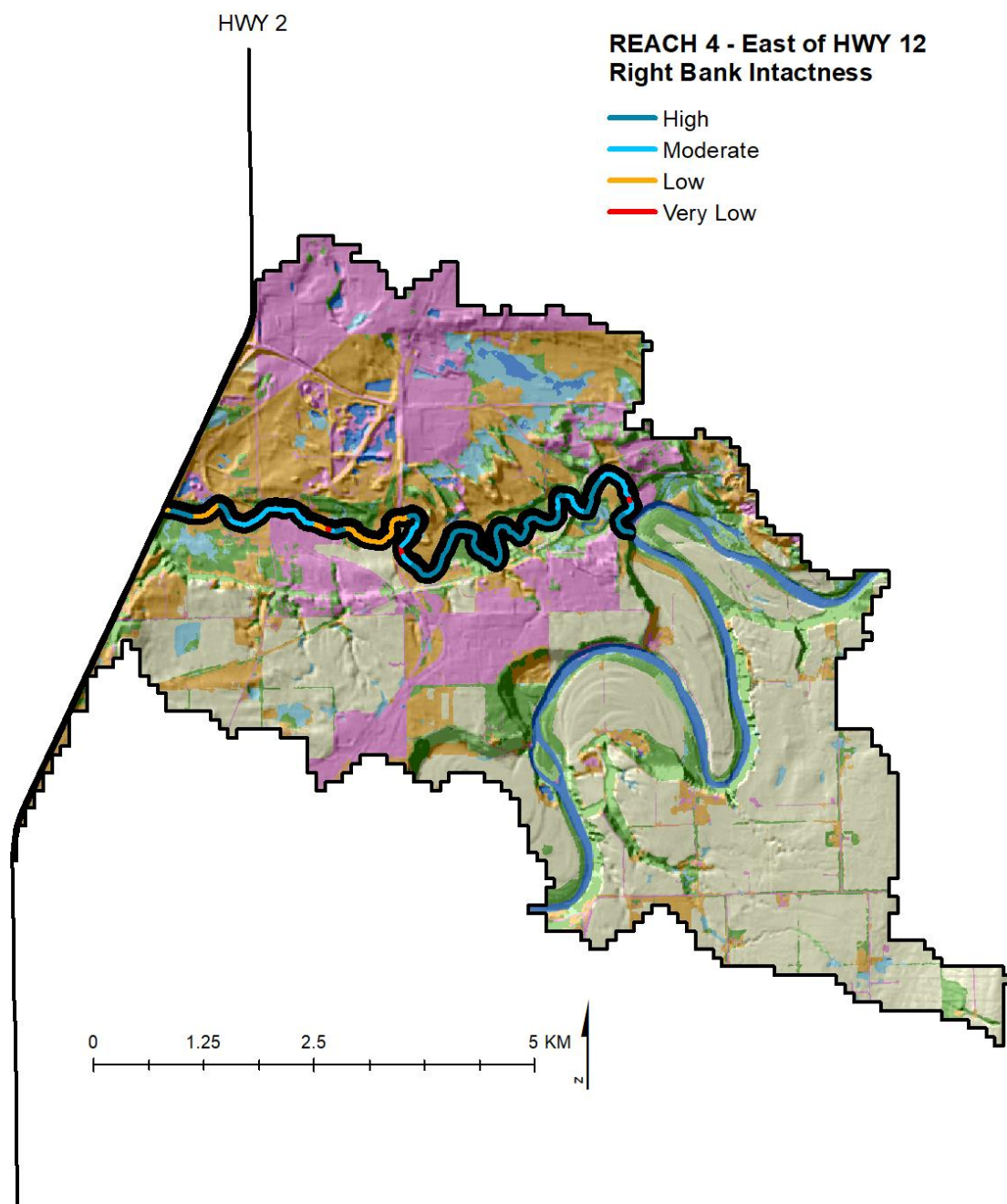
Figure 15. The proportion of the left and right bank within Reach 4 assigned to each riparian intactness category. Numbers within the bars indicate the total length of shoreline associated with each category.



Map 13. Land cover within Reach 4 – East of Highway 2.



Map 14. Intactness scores for the left (north) bank of the Blindman River in Reach 4.



Map 15. Intactness scores for the right (south) bank of the Blindman River in Reach 4.

4.3. Municipal Comparison

In order to provide riparian assessment information that is relevant from a municipal planning and policy perspective, this section summarizes riparian intactness results by municipality. Specifically, the results of this study were summarized for the three rural municipalities that intersect the Blindman River watershed, including Ponoka County, Lacombe County, and Red Deer County (Map 2). Lacombe County contained the greatest length (113.5 km) of river shoreline that was assessed in this study, followed by Ponoka County (93.1 km), and Red Deer County (17.8 km) (Figure 16).

When riparian intactness is considered by the total length of shoreline assessed within each municipality, the greatest amount of shoreline in Very Low condition was located in Lacombe County (48.5 km), followed closely by Ponoka County (46.9 km), and lastly, Red Deer County (2.0 km) (Figure 16). However, when riparian intactness is considered by the proportion of shoreline assessed within each municipality, the greatest proportion of shoreline classified as Very Low condition was located in Ponoka County (50%), as compared to Lacombe County (43%), and Red Deer County (11%) (Figure 17).

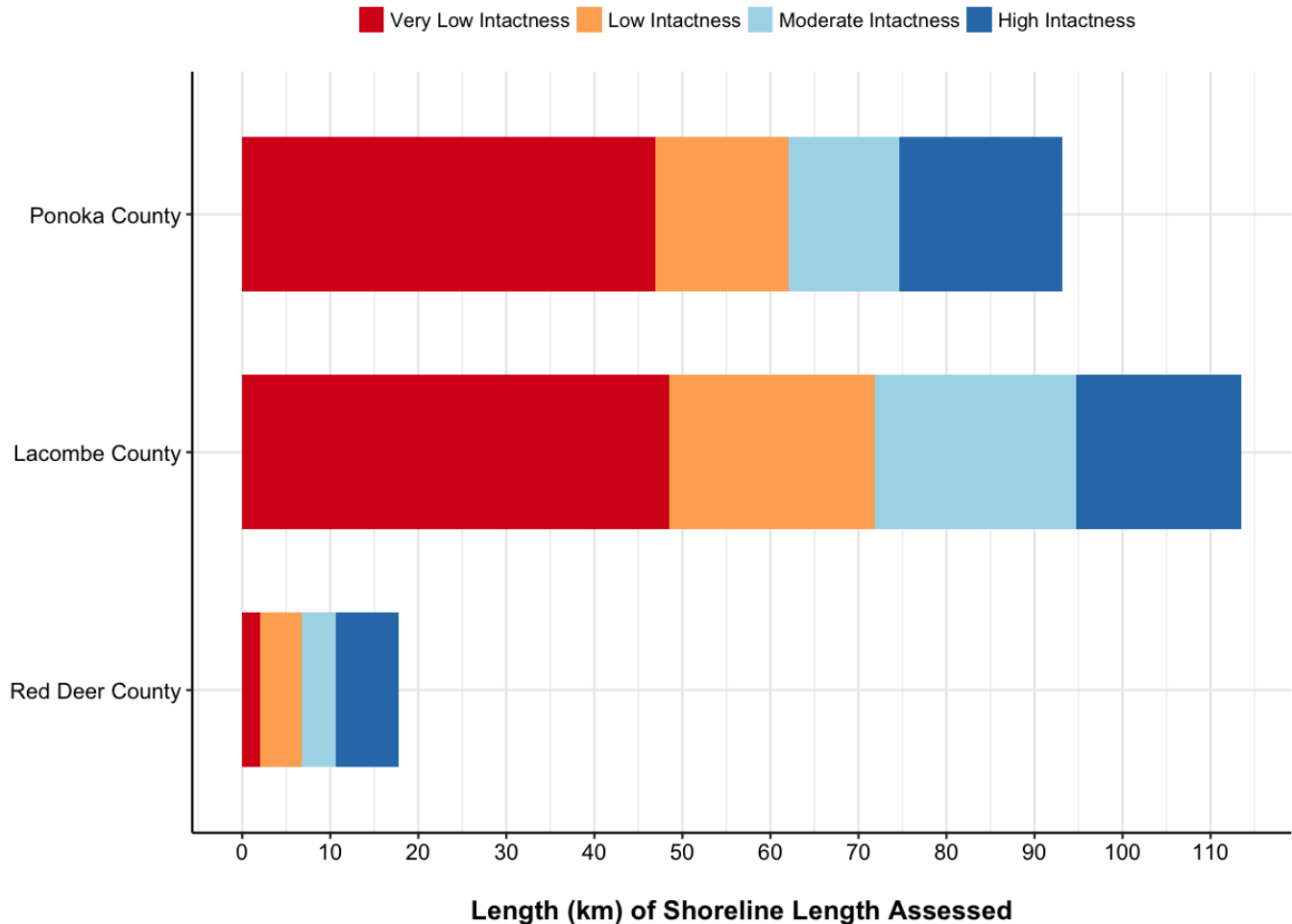


Figure 16. The length of shoreline assessed in each of the four river reaches, summarized by intactness category. The greatest length of shoreline assessed in the study was located within Lacombe County (113.5 km), while Red Deer County had the shortest length (17.8 km) of shoreline assessed.

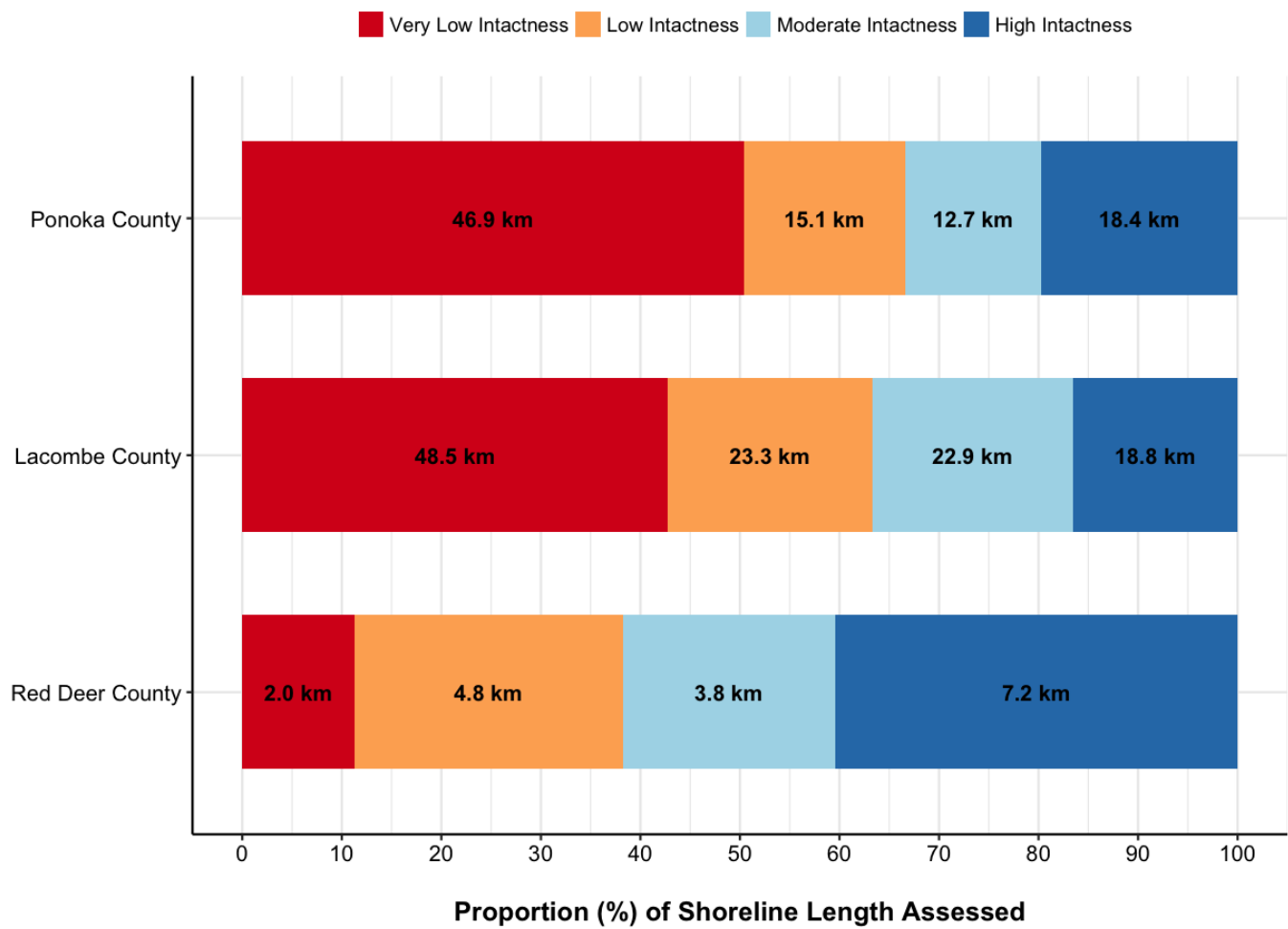


Figure 17. The proportion of shoreline assigned to each riparian intactness category, summarized for each municipality. Numbers within the bars indicate the total length of shoreline associated with each category.



5.0 Conclusion

The overall goal of this project was to quantify and characterize the intactness of riparian management areas along the shoreline of the Blindman River using a GIS-based assessment method. In total, 224.6 km of river shoreline was assessed within four distinct river reaches. Overall, 62% of the shoreline, totalling 140.7 km, was classified as either Low (19%, 43.2 km) or Very Low (43%, 97.5 km) Intactness, with only 20% (44.5 km) of the shoreline being classified as High Intactness, and 18% (39.4 km) classified as Moderate Intactness. When intactness was summarized by river reach, Reach 2 (Highway 53 to Highway 12) had the largest proportion (51%) and greatest length (38.3 km) of shoreline classified as Very Low condition.

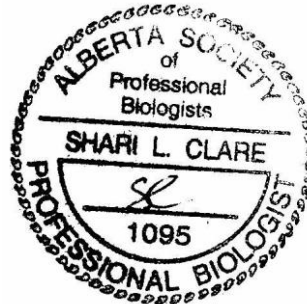
The results of this work provide the Agroforestry and Woodlot Extension Society and their partners with an overview of the status of riparian areas along the Blindman River. This information can be used to spatially target areas along the river shoreline for restoration, and also provides data that can be used as a foundation for tracking change in riparian area intactness through time.

5.1. Closure

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