

Riparian Health Inventory Report Seven Persons Creek Project Area

Interim Report: Year One



January, 2003

Prepared for:
Cypress County Watershed Group

Project Area:
Seven Persons Creek
Murray Lake downstream to the City of Medicine Hat boundary including
Nine Mile Coulee and 'Knodel' Reservoir

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BACKGROUND

- Any release of the information contained in this report, in whole or in part, to parties other than the members of the Cypress County Watershed Group will not be the responsibility of Cows and Fish. Liabilities with the release of this report or use of the information beyond the original intent of the work will be the responsibility of the Cypress County Watershed Group.
- This report includes information from Seven Persons Creek, Murray Lake, Nine Mile Coulee and a small reservoir (Knodel Reservoir). All systems are part of the Seven Persons Creek drainage, so for the purposes of clarity, all information in this report is collectively referred to as the Seven Persons Creek project area.
- This report outlines the findings from Year One of the Cypress County Watershed Group's riparian inventory initiative. Additional riparian inventories and/or assessments are required in subsequent year(s) to fairly represent the overall snapshot of riparian health within the Seven Persons Creek project area.
- All information in this report is a summary and does not share any specific information on individual landholdings assessed, based on Cows and Fish's commitment of confidentiality with the landowners who participated. Only general findings, reflecting the overall state of riparian health of the Seven Persons Creek project area are presented in this report.
- This report is a summary of riparian health inventories completed within the Seven Persons Creek project area by Cows and Fish field crews during July of 2002. A riparian health inventory differs from the 'shorter' riparian health assessment (survey) because it is a detailed inventory that thoroughly examines the vegetative, soil and hydrological parameters of the project area. The riparian health score is calculated based on the details of the inventory and is used to discuss the overall riparian health of Seven Persons Creek. Riparian health inventories provide comprehensive information about the diversity, structure and health of plant communities within the project area. The collection of this baseline information is an important first step for riparian resource management professionals to make riparian management recommendations and monitor change in riparian health over time.
- The inventory and assessment of the functioning condition (health) of riparian habitat does *not* address any in-stream, hydrological (i.e. issues associated with water flow regimes, water diversions, extractions, dam impacts) or water quality parameters associated with the the Seven Persons Creek project area.

Before you get started, here are some important terms used throughout this report that you should know...

Canopy cover – the ground area covered by vegetative growth. Different plant species can provide varying degrees of cover depending on their overall size and abundance.

Disturbance-caused undesirable herbaceous species – native or introduced non-woody plant species that are well adapted to disturbance or an environment of continual stress. This term *does not* include invasive plant species.

Floodplain – the land base alongside a stream that has the potential to be flooded during high water events.

Hoof shear – pieces of bank broken off as a result of hooved animals walking along the stream edge.

Human-caused bare ground – areas devoid of vegetation as a result of human activity. This can include vehicle roads, recreational trails and livestock trampling.

Invasive plant species – these are typically weed species classified as *noxious* or *restricted* by your municipal district or county and have the potential to infest riparian areas.

Lotic – this term means *flowing water* (i.e. streams and rivers).

Lentic – this term means *standing or still water* (i.e. lakes, ponds and sloughs).

Pointbar – areas along the stream edge where sediment has been naturally deposited by moving water. These typically occur on the inside portion of a channel bend. Also known as a *sandbar*.

Polygon – term used to describe a riparian inventory site.

Pugging and hummocking – the depressions (pugging) and raised mounds of soil (hummocking) resulting from large animals walking through soft or moist soil.

Reach – section of a stream, lake or wetland with similar physical and vegetative features and similar management influences.

Stream channel incisement – the degree of downward erosion within the channel bed.

Structural alteration – physical changes to the shape or contour of the streambank or shoreline caused by human influences. Some examples are livestock crossings, culverts and ‘riprap’.

Tree and shrub regeneration – the presence of seedlings and saplings, or the ‘new growth’.

Woody plant species – simply refers to trees and shrubs. These plants serve different riparian functions than grasses and broad-leaf plants.

PROJECT AREA

The project area is defined as a selection of riparian areas involving a number of landowners along Seven Persons Creek from the Murray Lake downstream to the Cypress County/City of Medicine Hat boundary. Two of the 11 polygons assessed were located on lentic systems (one on Murray Lake and one on Knodel Reservoir) within the Seven Persons Creek project area (refer to project area map – Figure 1). Funding and support for this project was provided by the Community Riparian Program (CRP), individual landowners involved with the Cypress County Watershed Group and the Cows and Fish partners.

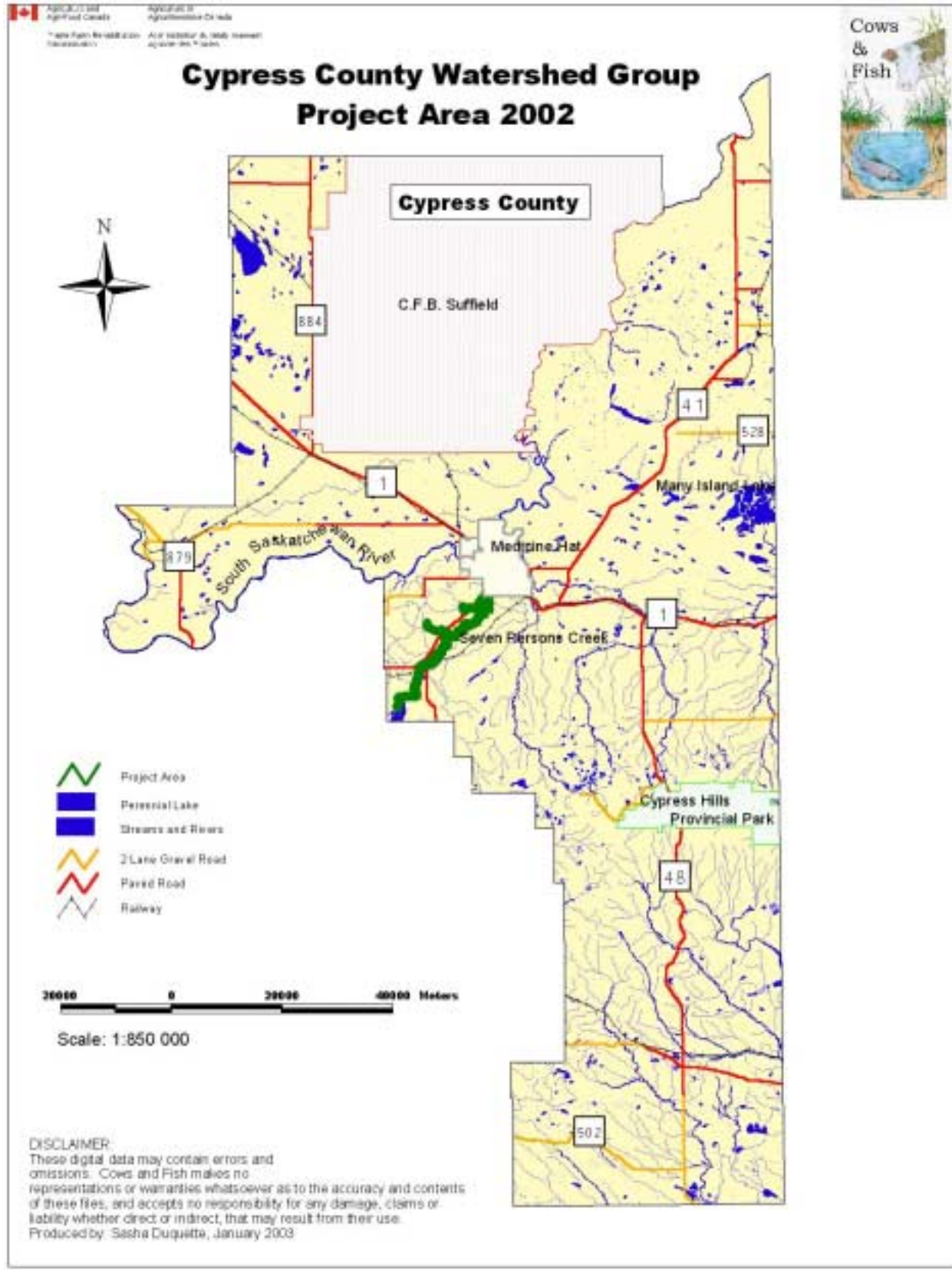
Year	Stream/Water body	# Landowners Contacted	# Landowners Participated	# Polygons Assessed	Stream/Shore Distance Assessed (km)
2002	Seven Persons Creek	4	4	6	3.9
2002	Nine Mile Creek	1	1	3	0.9
2002	Murray Lake	1	1	1	1.1
2002	Knodel Reservoir	1	1	1	0.4

Polygon Selection

Based on the objectives and resources of the community group, it was not possible for every kilometre of stream /shore to be assessed. For this particular project area, only landholdings belonging to people who requested an inventory of their riparian were assessed. Riparian inventory sites, or polygons, were then identified within those landholdings after one-on-one discussion with the landowners, who described the different management practices used in the pastures along the stream or shore.

Due to the limited number of landholdings involved with the first year of riparian evaluation, it is emphasised that this summary is **not a fair representation** of the health of the Seven Persons Creek project area. This report was produced as an **interim report only** with the final overall watershed report to be drafted after the completion of riparian evaluation within the project area.

Figure 1. Seven Persons Creek Project Area (2001)



WHY ASSESS RIPARIAN HEALTH?

Riparian areas are simply the portions of the landscape strongly influenced by water and are recognised by water-loving vegetation along rivers, streams, lakes, springs, ponds and seeps. When in a properly functioning condition or *healthy* state, these *green zones* are one of the most ecologically diverse ecosystems in the world. Healthy riparian areas sustain fish and wildlife populations, provide good water quality and supply, provide forage for livestock, and support people on the landscape.

Today, riparian areas are seen to be among the most valuable, productive, and vulnerable areas of the agricultural sector. In Alberta, growing public concern over water quality and land use issues is foreshadowing the U.S. experience where concern over these issues has led to legislated solutions. **This report is a first-step approach** by you and your community to find non-legislated solutions to help face current and future riparian land use issues.

The intent of riparian health inventories is to provide a *state of the environment report* to the local community. Hopefully, this report will provide better information on riparian health or function to assist your community in making the best decisions on how to manage riparian range resources most effectively.

Combining this information with existing practical knowledge of rangeland resources will provide the best alternatives for the sustainability of healthy riparian areas within the Seven Persons Creek watershed. In general, this information assists producers and local communities to identify and effectively develop non-legislated or voluntary action plans to address specific riparian land use issues within local watersheds.

Assessing riparian health allows communities, landowners and professionals to:

- **Create awareness** amongst local producers and their communities and build common understanding on riparian management issues in their watersheds.
- **Take voluntary action** by assisting local decision-makers develop strategies to find local solutions to address riparian land use issues.
- **Demonstrate the agricultural sector is willing to face the issues** by first acknowledging the need to take stock or determine the *state of the environment* of their watersheds and operations.
- **Identify the “good news” stories** of producers already managing healthy riparian areas.
- **Temper the need for legislation and regulation** as proactive efforts by producers and their communities values cooperation over conflict, demonstrating their willingness to face the issues.
- **Monitor progress** in improving, maintaining and protecting riparian health for their operation or watershed.
- **Identify environmental risk** and integrate into farm and ranch planning

Working together on riparian management issues, including riparian health inventories, displays a proactive message to the public that your community, and the agricultural sector in general, are taking steps to ensure the health of our landscapes and water supplies are being protected, maintained and improved.

WHY ARE HEALTHY RIPARIAN AREAS IMPORTANT?

Riparian areas can be viewed like a jigsaw puzzle, as they can be broken into pieces that are important to the whole image or function. How these individual *pieces* or components (e.g. vegetation, especially deep-rooted plant species) function together affect the health of the riparian ecosystem including the stream, its watershed, and overall landscape health and productivity.

To be healthy, riparian areas need to perform certain functions including trapping sediment to maintain and build streambanks, recharging groundwater supplies, providing stable flows, flood protection, habitat for fish and wildlife, as well as, shelter and forage for livestock. Even though riparian areas comprise a small percentage of the total land area within the Seven Persons Creek watershed, they are critical to the long-term sustainability of a healthy landscape.

The *Pieces* Of Riparian Health

To effectively understand the current status of riparian function we ask a number of questions regarding the functioning condition of the riparian area (Is it *healthy*?). Healthy riparian areas have the following *pieces* intact and functioning properly:

- successful reproduction and establishment of seedling, sapling and mature trees and shrubs (if site has potential to grow them),
- lightly browsed trees and shrubs (by livestock or wildlife),
- floodplains and banks with abundant plant growth,
- banks with deep-rooted plant species (trees and shrubs),
- very few, if any, invasive weeds (e.g. Canada thistle),
- not many disturbance-caused plant species (e.g. Kentucky bluegrass, dandelion),
- very little bare ground or altered banks, and
- ability to frequently (i.e. every few years) access a floodplain at least double the channel width.

The riparian health inventory addresses a number of questions or *parameters* that help determine how the pieces of a riparian area are functioning. The inventory arrives at an overall health category for the riparian area, identified by a health score. Riparian health ratings are broken down into three categories and score ranges:

<i>Health Category</i>	<i>Score Ranges</i>	<i>Description</i>
Healthy	80-100%	little to no impairment to any riparian functions
Healthy but with problems	60-79%	some impairment to riparian functions due to management or natural causes
Unhealthy	<60%	severe impairment to riparian functions due to management or natural causes

WHAT DID WE FIND?

- **A lot of helpful and keen landowners.** The level of interest and co-operation demonstrated by landowners in the Seven Persons Creek project area was exceptional. Thanks to everyone who allowed access to their land and supported this riparian inventory initiative. In all, 11 polygons were assessed on 7 landholdings within the project area in 2002.
- **Some concerns with riparian health.** The majority of the 11 polygons assessed within the Seven Persons Creek project area rated *healthy but with problems* in relation to the proper functioning condition guidelines within the inventory protocol. The overall assessment of riparian health for the Seven Persons Creek project area is as follows (Figure 2);

- Of the 11 polygons assessed:
 - 0% (0/11) are *healthy*,
 - 73% (8/11) are *healthy but with problems*,
 - 27% (3/11) are *unhealthy*.
- Please note: due to the small number of polygons assessed these health ratings do not represent the health of the entire Seven Persons Creek watershed.

Remember: All information is confidential and is in the process of being provided to each landowner through individual landowner reports. **This is not a finger pointing exercise; it's an awareness process.**

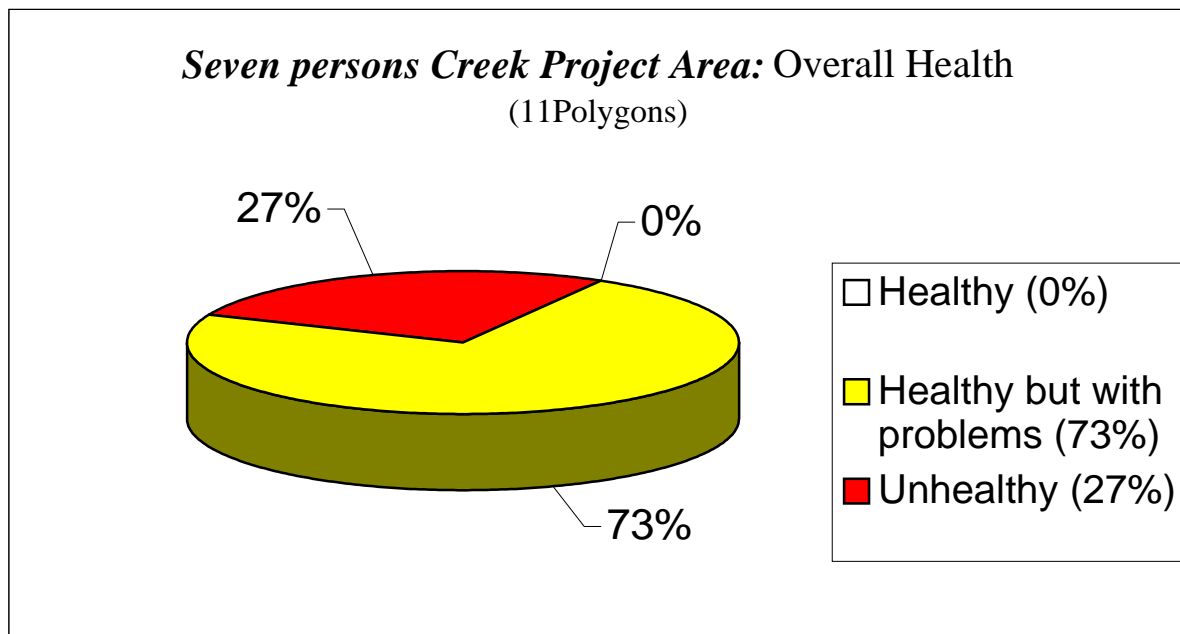


Figure 2. Breakdown of riparian health results for 11 polygons within the Seven Persons Creek project area.

Figures 3 to 6 show photographs from each of the four systems assessed within the Seven Persons Creek project area.



Good tree and shrub establishment

Disturbance grasses

Grazing resistant shrubs

Figure 3. Typical riparian area of Seven Persons Creek.
Photo Credit: Michael Uchikura



Healthy sedges

Good sandbar willow regeneration

Figure 4.; Typical riparian area of Knodel Reservoir
Photo Credit: Michael Gerrand



Figure 5. Typical riparian area of Nine Mile Creek.

Photo Credit: Michael Gerrard

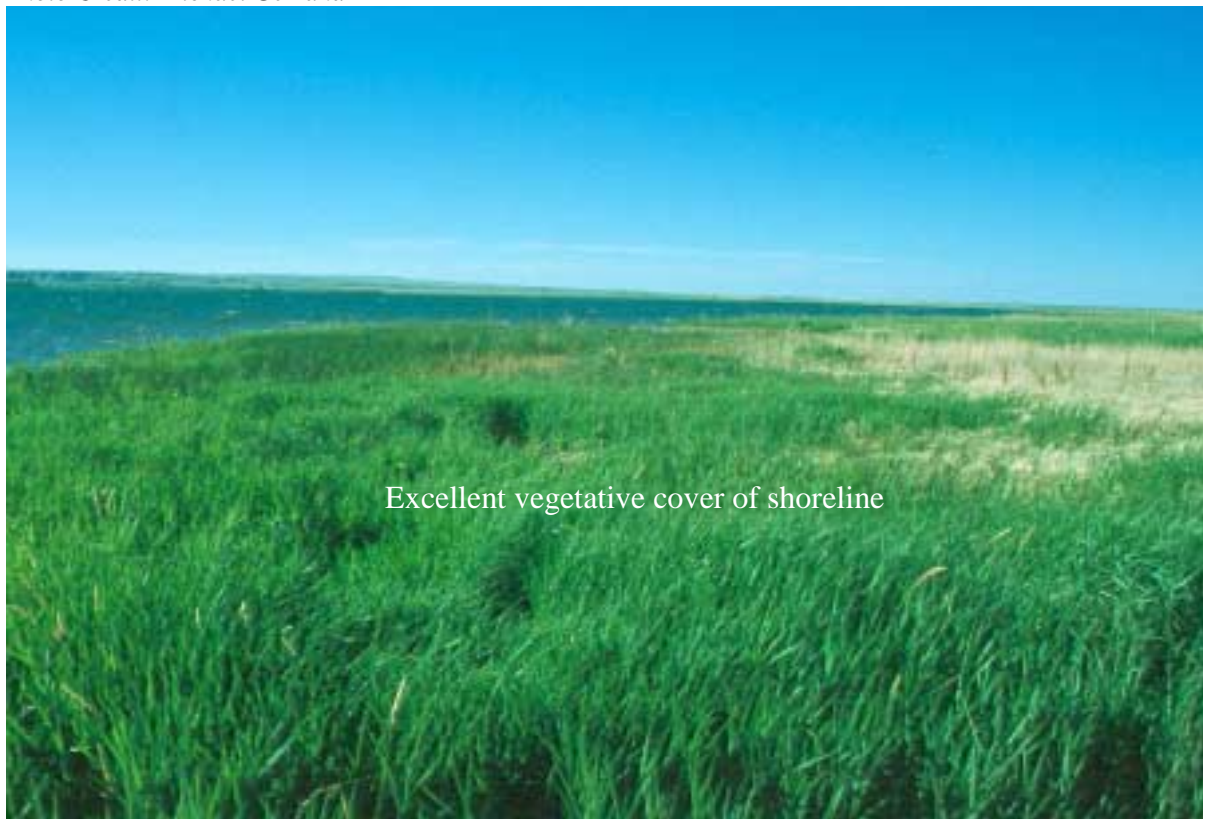


Figure 6. Typical riparian area of Murray Lake

PhotoCredit: Michael Uchikura

RIPARIAN HEALTH DISCUSSION

A Closer Look At The *Pieces*

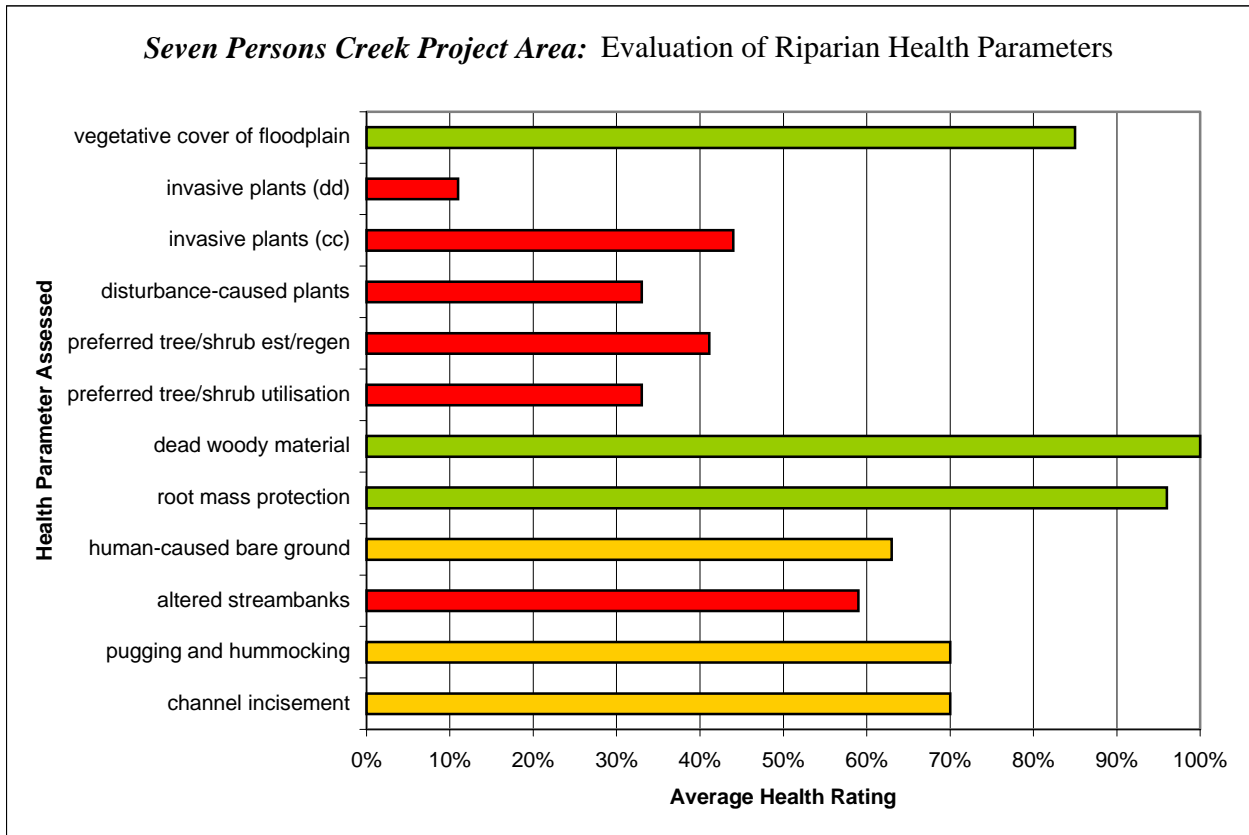
Riparian areas are complex, dynamic systems that have a variety of attributes or health parameters that perform certain functions. These health parameters are like *pieces of a puzzle*. If all the *pieces* are intact, a riparian area functions properly or is healthy and, for example, provides shelter and forage for livestock and wildlife. When riparian health degrades, one or more of the *pieces* are impacted by natural or human-caused disturbances such as grazing, flooding or fire. Riparian areas are *healthy but with problems* when a few health parameters experience light to moderate impacts. As the rate and intensity of disturbance increases, the severity of health degradation can reach a point when the riparian area fails to perform its functions properly and becomes *unhealthy*. Generally, it is often difficult to see specific parameters decline in health, especially if the degradation occurs gradually over a long period of time. This health inventory establishes an important baseline to compare to in the future, to keep track of whether riparian health is being maintained, improved or is declining.

During our assessment of riparian health we looked closely at 11 health parameters and assessed their functioning condition (Figure 6). Six of the parameters relate to vegetation and five relate to soil and hydrology. The score sheet for the Seven Persons Creek project area is in Appendix A. A glossary detailing how each of these parameters is scored is in Appendix B. By objectively examining each of these health parameters we can determine which *pieces* are adequately performing the necessary functions of a healthy riparian area, and which are not. This examination provides us with a better understanding of where to concentrate efforts if improvements in riparian management are required, and what land use practices are currently maintaining riparian health.

Riparian Areas: A User's Guide to Health is a new Cows and Fish publication (included with this report) that visually describes the concepts of riparian health and explains how the tools for riparian health evaluation can be applied on the landscape; and can be used as part of a larger package of awareness about riparian areas.

Please Keep in Mind

The objective of completing these riparian health inventories is to provide a *coarse filter* review of the status of riparian health or function within the project area. The riparian health scores provide a general status of riparian health, not an absolute one. Riparian areas are dynamic and are constantly changing. Because of this natural variability, the range of possible scores in each category is broad and one assessment is only an approximation of health. Inventories over a period of years at the same locations will provide a better picture of whether current management is maintaining, improving or negatively impacting riparian health.



Unhealthy (<60%) Impairment to riparian health parameter due to human or natural causes.

Healthy but with problems (60-79%) Some impairment to riparian health parameter due to human or natural causes.

Healthy (80-100%) Little or no impairment to riparian health parameter.

Figure 7. Breakdown of riparian health results for 11 parameters assessed for the Seven Persons Creek project area

The most important aspect of the following discussion involves integrating riparian management objectives with riparian management principles. An overview of riparian management principles can be found in Cows and Fish Caring for the Green Zone(included with this report).

The following discussion provides some insights regarding the current status of the health of riparian areas within the project area.

Historic and Present Influences on Riparian Health

- **Grazing animals (including livestock and wildlife)** have primarily dominated land use in Alberta’s riparian zones for hundreds of years. Prior to the introduction of cattle, bison provided the greatest seasonal grazing pressures on riparian areas within the project area. Currently, livestock grazing continues to be the dominant land use influencing riparian

health along Seven Persons Creek and adjacent lands¹.

- **Cropland cultivation** and tame pasture ‘improvements’ for grazing and hay, including some localised, prolonged continuous season-long grazing by livestock, have contributed to an increased presence of disturbance-caused undesirable plants within the riparian zones. Opinions vary on how these plant species, in particular Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*) should be viewed in terms of contributing to riparian health, but generally are thought to reduce long-term productivity of riparian systems.
- **Agricultural, residential and industrial activity** including farming (irrigation and inputs), country residential wastewater discharge, oil and gas exploration / development, roads and pipeline crossings has influenced stream dynamics and riparian health over time. Incremental effects of this activity have coincided with cattle grazing for the past century, influencing current riparian health and water quality within the Seven Persons Creek watershed. The most recent water quality information collected indicates that there are a few concerns, mostly relating to bacteria (Seven Persons Creek Water Quality Report, Madawaska Consulting, 2001). Declines in riparian area health may be linked to water quality issues as healthy riparian areas are a critical element in maintaining water quality (tapping sediment, reducing erosion, storing nutrients and contaminants etc²).

Riparian Plant Communities

- A well-known stockman, A.E. Cross, once stated, “Look after the grass, and the grass will look after you.” If there is one thing a land manager, landowner or community can do to improve riparian health, it is to keep riparian plant communities healthy by using proper grazing management strategies and land use practices.

Classification of Riparian Plant Communities

Understanding the type of riparian plant communities a stream system has the potential to grow is important for a number of reasons:

- Allows producers and land managers to know if the desired plant communities are growing there already and if not, why not? For example, will Seven Persons Creek grow cottonwoods or willows? How extensive should the plant communities be?
- Provides insight into the feasibility of improving existing site conditions and recovering desired and healthier plant communities, if the desired plant community does not exist or is limited.
- Knowing how far existing plant communities are from the potential natural community (PNC) of the riparian area allows us to:
 - set realistic goals to either improve or maintain existing riparian health,
 - understand how long recovery may take if improvement is needed, and
 - obtain insight into what management strategies need to be implemented for improvement to occur or to maintain existing riparian health.

Within the Seven Persons Creek project area:

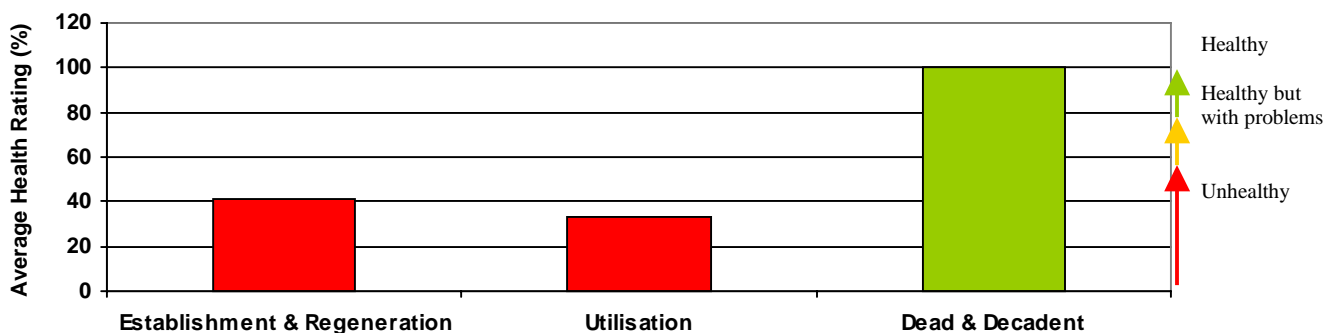
¹ Based on aerial photo interpretation and observations from Cows and Fish field crews.

² Cows and Fish Fact Sheet: Water Quality and Riparian Areas

- Certain reaches of the Seven Persons Creek project area have the potential to grow willow communities, however, our investigations still do not confirm how extensive these communities can be due to various limitations (e.g. water availability, cattle grazing, and possibly localised salinity). The full potential for willow communities will be determined by management practices allowing for maximum rest from disturbance.
- 18 different plant communities were identified.
- The Manitoba maple/chokecherry plant community was identified on 4 of the 11 polygons occupying 6% of the project area.
- Shrub communities occupy about one quarter (27%) of the project area.
- However, one half (53%) of the shrubs is comprised of the grazing resistant shrub communities common wild rose (*Rosa woodsii*) and to a lesser extent snowberry/buckbrush (*Symphoricarpos occidentalis*).
- The other half (47%) of the shrub communities is comprised of preferred³ shrub communities (including two willow communities).
- Ten different graminoid communities were identified within the project area.
- For prairie stream systems, managing for the maximum amount of sedge communities, and shrubs where feasible, is a good long-term goal.

Disturbance-caused grass species like smooth brome, foxtail barley (*Hordeum jubatum*) and Kentucky blue grass occupy 30% of the project area. These grass species do not have deep, binding root masses, and are not contributing to the streambank stability within the Seven Persons Creek project area.

Woody Plants - Trees and Shrubs: Presence, Reproduction and Health



Presence

- Three native tree species and 15 native shrub species were recorded within the Seven Persons Creek project area.
- Russian olive (*Elaeagnus angustifolia*) was observed in one polygon.
- Total area covered by all trees and shrubs combined is 24%.
- The presence of trees is negligible and the dominant shrubs are common wild rose, thorny

³ native, palatable shrubs (willows, red-osier dogwood etc.) that contribute to riparian function or health

buffalo berry (*Sheperdia argenta*) and snowberry/buckbrush. Silver sagebrush (*Artemisia cana*) is another shrub with a significant presence.

- A list of all plant species found in the project area is available in Appendix C.
- The presence of many different tree and shrub species is often a good indicator of structure and diversity. A diversity of plants provides “habitat layers” – low, medium, and high, benefiting wildlife and livestock.

Reproduction

- It has been determined that Nine Mile Creek probably does not have the potential to grow trees and so this system was not included in the overall assessment.
- Currently there are a few concerns with the reproduction of *preferred* trees and shrubs along Seven Persons Creek.
- Preferred tree and shrub reproduction is occurring in only about a quarter of the polygons.
- Only in these few polygons, at least 10% of the total canopy cover of trees and shrubs is represented by seedlings and saplings.
- Successful reproduction and establishment of the present trees and shrubs will maintain these stands and promote riparian health.

Health

- Existing tree and shrub communities show normal amounts of dead and decadent branches in the upper canopy. This indicates there is sufficient moisture within the system, and that disease is not a problem in maintaining these communities.
- There are concerns with the overall health of shrubs.
- About half of the shrub canopy cover is comprised of only two grazing-resistant, disturbance-increaser shrubs (snowberry/buckbrush and common wild rose).
- In almost all polygons, preferred trees and shrubs species are receiving moderate to heavy browse pressure from livestock (to a lesser degree wildlife). In many locations this browse pressure is removing new growth and preventing seedlings and saplings from reaching a mature age class.
- The indicators of heavy browse pressure are *umbrella-shaped* mature shrubs and *flat-topped* or *hedged* seedling and saplings.

How the Health of Shrubs Could Be Improved

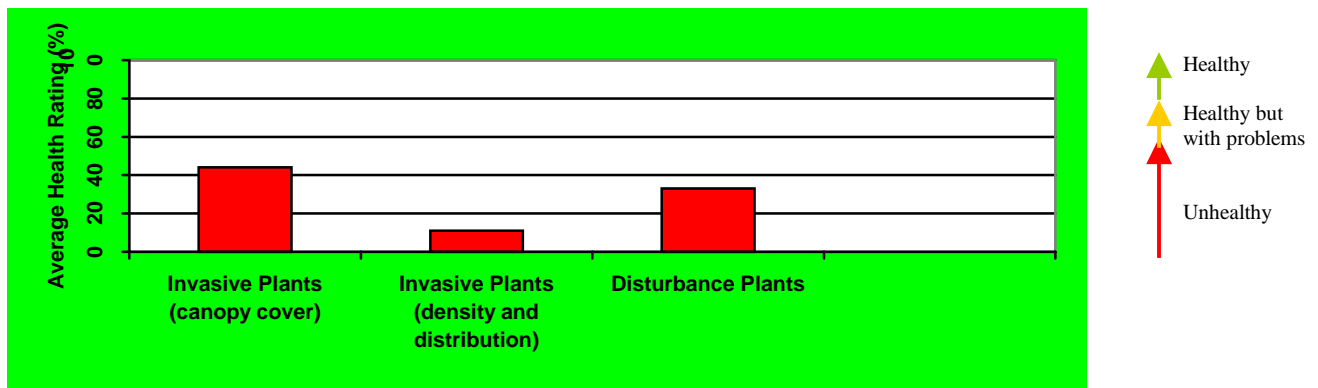
- ***Reduce browse pressure on shrubs.*** Currently, the level of browse utilisation of trees and shrubs is fairly high. At the current rate of utilisation there could be problems with the reproduction of preferred trees and shrubs in the near future, jeopardising their long-term presence within the riparian zones of the project area.

- **Increase the presence of preferred shrubs.** The presence of preferred shrubs on all polygons indicates they are able to grow within the Seven Persons Creek project area however, there are places where the presence of grazing resistant, disturbance-increaser shrubs are out-competing preferred shrubs. It is important to ensure existing shrub communities of snowberry/buckbrush and rose do not increase. All woody species provide some riparian function but some do it better than others; snowberry/buckbrush and rose are rated as having only moderate to low streambank protection potential as compared to willows, for example.

Where Efforts Could Be Focussed

- **Increase rest period from grazing during the growing season.** Rest from continuous browse pressure is one step towards maintaining regeneration of existing preferred trees and shrub communities and improving future reproduction and establishment. Attention to livestock management options such as distribution, timing, rotation, and stocking rate should enable preferred trees and shrubs to be maintained and increased. By not addressing browse pressure, existing tree and shrub communities could decline and lesser palatable species could increase (e.g. snowberry/buckbrush and rose).

Non-Woody Riparian Plants: Diversity and Health



Diversity

- 37 species of grasses and grass-like plants (graminoids) and 65 species of broad leafed plants (forbs) were recorded within the Seven Persons Creek project area.
- 66% (67 species) of the non-woody riparian plants recorded are native plants. Native plants provide riparian functions including deep, binding root masses and summer and winter forage production for livestock and wildlife.
- 4 poisonous plant species: showy milkweed (*Asclepias speciosa*), water hemlock (*Cicuta maculata*), common horsetail (*Equisetum arvense*) and Indian hemp (*Apocynum cannabinum*) were recorded within the project area but they were not present in high amounts to cause concern. If poisonous plants were found on any landowner's property, they are identified in the plant list within their individual report.

Health

- Almost all polygons have adequate amounts of plant cover (85-95%).
- About 36% of the project area is occupied by disturbance-caused plants (grasses and forbs). Of the 19 disturbance-caused plants present, the most prevalent are foxtail barley (*Hordeum jubatum*), crested wheatgrass (*Agropyron pectiniforme*), smooth brome and Kentucky bluegrass⁴.
- All polygons except one have greater than 25% of the riparian area covered in disturbance-caused undesirable herbaceous species. Disturbance-caused plants typically do not have a deep, binding root mass and therefore do not provide streambank protection as well as non-disturbance native species.
- Despite the abundance of disturbance-caused plants, native grasses and forbs continue to be maintained within the project area.
- **The prevalence of invasive plants (e.g. noxious weeds) is a concern.** All polygons have sporadically occurring invasive plants from one end of the polygon to the other with large patches in between. Canada thistle (*Cirsium arvense*) and perennial sow thistle (*Sonchus arvense*) are the two most prevalent invasive weeds.

How the Health of Non-Woody Riparian Plants Could Be Improved

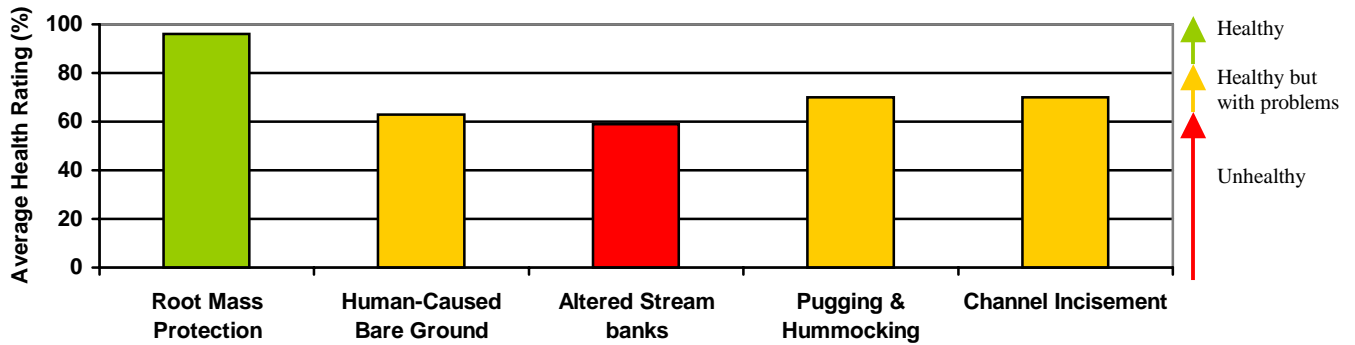
- ***Reduce the presence of disturbance-caused plants.*** Complete elimination of disturbance-caused plants is not realistic, however, with sound grazing strategies the prevalence of disturbance-caused plants could be reduced. From a grazing perspective, disturbance-caused plants do provide some forage for livestock at specific times of the year but require specific management, as they “green up” and mature earlier than most native grasses. Providing maximum rest during the growing season, skim grazing and time-controlled grazing management practices can be applied, to reduce the potential for an increase in these species while maintaining an abundance of native species.
- ***Reduce the presence of invasive plants.*** The abundance of noxious weeds can fluctuate greatly from year to year and should therefore be monitored closely. The first step is to reduce the amount of exposed soil where invasive plants become established. Each landowner has been notified of these plants along with contact information for the municipal agricultural fieldman or local weed representative. (Doug Henderson, 403-526-2888, doug@cypress.ab.ca)

Where Efforts Could Be Focussed

- Achieving the above goals requires ensuring plant communities have enough rest from grazing during the growing season to reduce the amount of bare ground and to allow native plants to out-compete disturbance-caused and invasive plants for nutrients and water. A combination of weed control measures and grazing strategies that consider distribution, timing and stocking rates will be required.

⁴ Kentucky bluegrass, smooth brome are tame or introduced species that have invaded many rangelands over the past decades. Opinions vary on how these grasses should be viewed in terms of contributing to riparian or pasture health but generally are thought to reduce long-term productivity. For the purpose of this assessment, points were subtracted for the presence of these non-native species.

Streambanks and Floodplain: Alterations and Stability



Alterations

- Overall, the streambanks of Seven Persons Creek project area are in fair condition with 14% of the streambanks within the project area having structural alterations by human activities. There are a few hotspots within Seven Persons Creek project area as four of the nine lotic polygons have greater than 15% of the streambanks structurally altered by human activities.
- The majority of alterations that exist have been caused by livestock activity (hoof shear, trailing). Road construction and stream crossings are contributing to a lesser extent.
- Exposed soil surface or bare ground was not a problem in the majority of polygons. Of the bare ground overall, about one quarter is naturally occurring (depositional material from recent flood events) and three quarters is human-caused. The minimal bare ground that is present is mostly from livestock hoof action. As mentioned above, noxious weeds can quickly become established in areas of bare ground.

Stability

- All lotic polygons within the project area are covered with adequate amounts of deep, binding root mass. Less than one percent of the streambanks are displaying active lateral cutting of the project area, where stream channel incisement is more significant.
- Adequate amounts of shrubs and sedges with deep, binding root masses are preventing extensive lateral cutting and instability.
- Seven Persons Creek appears to have experienced down-cutting (vertical instability) in the past. Currently, the channel appears to be stable, but due to the present flow regime, there is limited floodplain development.
- High water events periodically access the highest terraces of the floodplain. Flooding is an important factor in dispersing moisture throughout the riparian area and in the formation of point bars (necessary for riparian vegetation establishment).

How Health of Stream banks and Floodplains Be Improved

- **Reduce livestock access to streambanks and active floodplain** to allow structurally altered and damaged areas time to heal. There is excellent potential for the recovery of the few areas of altered streambanks.

- Limiting livestock access will increase deep-rooted woody plants, which will help trap sediment to rebuild stream banks, and protect against lateral cutting and erosion. Once again, rest is needed during the sensitive portions of the growing season such as early spring to promote recovery.

THE NEXT STEPS

Community and Individual Action

- ***Take stock of current and past conditions.*** The first step in addressing riparian management issues has been initiated. This report represents the beginning of the collection of baseline information on riparian health. Additional riparian inventories and/or health assessments need to be done to fairly represent the overall snapshot of riparian health within the Seven Persons Creek project area. Future riparian assessment in conjunction with a review of historical land use practices will help the Cypress County Watershed Group answer the question “***Where are we now?***”
- ***Highlight and profile what’s working on the landscape right now.*** Once the riparian inventory work is complete, the next step is to use this knowledge, along with the application of sound range and riparian management techniques, towards the restoration of riparian health. By working with landowners wanting to improve riparian health, practical examples of proper riparian management can be demonstrated to other landowners and communities. Landowners already managing healthy riparian areas in the area can be profiled, meaning their “good news” stories can be shared with others to speed up our knowledge of what works. As these sites yield results, the landowners of the Cypress County Watershed Group will be closer to answering the question “***Where do we want to go?***”
- ***Take control of the reins.*** Every participating landowner has received a report on the riparian health for their landholding indicating what *pieces* of riparian health are there and what might be missing. Within these landowner reports are some basic range management principles specific to their riparian pastures, providing insight into the question “***How do we get there?***”
- ***Continue riparian inventory work over the long-term.*** Monitor progress of community and individual effort to address riparian land use issues. With the application of sound range management principles on an individual and watershed basis, it is inevitable that the trend in riparian health will be positive over time.
 - A single evaluation cannot define the absolute status of site health. To measure trend (improving, declining or staying the same) monitoring should be pursued in subsequent years. This can be achieved by establishing demonstration and profile sites, or another overall riparian inventory – every 3 to 5 years.
 - Management objectives should include maintaining the existing sedge and willow communities.

- Restoration of healthy shrub communities will be slow. However, some improvement should be recognised within a few years, depending on the commitment of the individual, riparian site potential and the riparian management strategy implemented.

Long-term riparian monitoring and refinement in management will answer the question “*Did we make it?*”.

Please Note:

The field workbook Riparian Health Assessment for Streams & Small Rivers is available from Cows and Fish. This workbook explains how to conduct a riparian health assessment, or *rapid survey*, to quickly check the health status of your riparian area. This tool will allow landowners and managers to monitor and track their own progress regarding riparian health.

The Alberta Lentic Wetland Health Assessment (Survey) is available from Cows and Fish. It explains how to conduct a riparian health assessment, or *rapid survey*, to quickly check the health status of your riparian area. This tool will allow landowners and managers to monitor and track their own progress regarding riparian health.

To inquire about additional references for range or pasture management and plant identification and for further information on any aspect of this report, please contact:

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APPENDIX A

Riparian Health Score Sheet

Riparian Health Score Sheet –Seven Persons Creek Project Area

<i>Based on the average health scores for each parameter from 13 polygons</i>		Average		
Question	Actual Score	Possible Score	%	
Vegetation				
1. Vegetative Cover of Floodplain and Streambanks	5.1	6		
2a. Invasive Plant Species (Canopy Cover)	1.3	3		
2b. Invasive Plant Species (Density/Distribution)	0.3	3		
3. Disturbance-Caused Undesireable Herbaceous Species	1.0	3		
4. Preferred Tree and Shrub Establishment and Regeneration	2.4	6		
5. Utilisation of Preferred Trees and Shrubs	1.0	3		
6. Decadent and Dead Woody Material	3.0	3		
Vegetation Subtotal:	13.9	27	51%	
Soil/Hydrology				
7. Streambank Root Mass Protection	5.8	6		
8. Human-Caused Bare Ground	3.8	6		
9. Structurally Altered Banks	3.6	6		
10. Pugging and/or Hummocking	2.1	3		
11. Channel Incisement	6.3	9		
Soil/Hydrology Subtotal:	21.6	30	72%	
Project Area Total:				
	35.4	57	63.2%	

APPENDIX B

Description of Riparian Health Parameters

The riparian health score is based on 11 basic parameters that pertain to riparian health. This appendix addresses the guidelines and stipulations followed when each parameter was answered during the assessment. Keep in mind that these parameters are meant to encompass the broad range of ecological diversity that stream, river, lake, and wetland systems have the potential to express. The interpretations are not completely specific to any one type of stream system, yet still capture the essential factors of riparian health and function.

Many different factors must be considered when answering any one of these parameters. It is quite possible that every scenario that could be encountered when conducting assessments is not covered here. Personal judgment based on sound riparian knowledge and good visual estimations are critical tools necessary for answering these questions consistently.

This description of riparian health parameters is based on the Alberta Lotic Wetland Health Assessment for Streams and Small Rivers (Survey) User Manual as created by Bitterroot Restoration, Inc. (2002).

RIPARIAN HEALTH PARAMETERS

Some factors on the evaluation will not apply on all sites. Sites without potential for woody species are not rated on factors concerning trees and shrubs. Vegetative site potential can be determined by using a key to site type (e.g., Hansen and others 1995, Kovalchik 1987, or another appropriate publication). On severely disturbed sites, vegetation potential can be difficult to determine. On such sites, clues to potential may be sought on nearby sites with similar landscape position.

Most of the factors rated in this evaluation are based on ocular estimations. Such estimation may be difficult on large, brushy sites where visibility is limited, but extreme precision is not necessary. While the rating categories are broad, evaluators do need to calibrate their eye with practice. It is important to remember that a health rating is not an absolute value. The factor breakout groupings and point weighting in the evaluation are somewhat subjective and are not grounded in quantitative science so much as in the collective experience of an array of riparian scientists, range professionals, and land managers.

Each factor below will be rated according to conditions observed on the site. The evaluator will estimate the scoring category and enter that value on the score sheet.

1. Vegetative Cover of Floodplain and Streambanks. Vegetation cover helps to stabilize banks, control nutrient cycling, reduce water velocity, provide fish cover and food, trap sediments, reduce erosion, and reduce the rate of evaporation (Platts and others 1987). Vegetation cover is ocularly estimated using the canopy cover method (Daubenmire 1959).

Stream channels that go dry during the growing season can create problems for polygon delineation. Some stream channels remain unvegetated after the water is gone. If the total vegetative cover of the channel is no more than 15%, it is considered a non-vegetated stream channel and is *excluded* from the polygon. Exceptions to this minimum of 15% canopy cover include channels with the vegetation removed by human-causes (such as grazing, logging, and construction). These are considered exposed soil surface (bare ground). Those channels that do contain more than 15% vegetative cover are included as part of the riparian vegetation.

Scoring:

6 = More than 95% of the polygon area is covered by plant growth.

4 = 85% to 95% of the polygon area is covered by plant growth.

2 = 75% to 85% of the polygon area is covered by plant growth.

0 = Less than 75% of the polygon area is covered by plant growth.

2. Invasive Plant Species (weeds).

Invasive plants are alien species whose introduction does or is likely to cause economic or environmental harm. Whether the disturbance that allowed their establishment is natural or human-caused, weed presence indicates a degrading ecosystem. While some of these species may contribute to some riparian functions, their negative impacts reduce overall site health. This item assesses the degree and extent to which the site is infested by invasive plants. The severity of the problem is a function of the density/distribution (pattern of occurrence), as well as canopy cover (abundance) of the weeds. In determining the health score, all invasive species are considered collectively, not individually. A weed list should be used that is standard for the locality and that indicates which species are being considered (i.e., *Invasive Weed and Disturbance-caused Undesirable Plant List* [Cows and Fish 2002]). Some common invasive species are listed on the form, and space is allowed for recording others. **Leave no listed species field blank, however;** enter "0" to indicate absence of a value.

2a. Total Canopy Cover of Invasive Plant Species. The observer must evaluate the total percentage of the polygon area that is covered by the combined canopy of all plants of all species of invasive plants. Determine which rating applies in the scoring scale below.

Scoring:

- 3 = No invasive plant species (weeds) on the site.
- 2 = Invasive plants present with total canopy cover less than 1 percent of the polygon area.
- 1 = Invasive plants present with total canopy cover between 1 and 15 percent of the polygon area.
- 0 = Invasive plants present with total canopy cover more than 15 percent of the polygon area.

2b. Density/Distribution of Invasive Plant Species. The observer must pick a category of pattern and extent of invasive plant distribution from the chart below that best fits what is observed on the polygon, while realizing that the real situation may be only roughly approximated at best by any of these diagrams. Choose the category that most closely matches what you see.

Scoring:

- 3 = No invasive plant species (weeds) on the site.
- 2 = Invasive plants present with density/distribution in categories 1, 2, or 3.
- 1 = Invasive plants present with density/distribution in categories 4, 5, 6, or 7.
- 0 = Invasive plants present with density/distribution in categories 8, or higher.

CLASS	DESCRIPTION OF ABUNDANCE	DISTRIBUTION PATTERN
0	No invasive plants on the polygon	
1	Rare occurrence	•
2	A few sporadically occurring individual plants	• • •
3	A single patch	•••
4	A single patch plus a few sporadically occurring plants	••• • •
5	Several sporadically occurring plants	• • • •
6	A single patch plus several sporadically occurring plants	••• • • •
7	A few patches	••• ••• •••
8	A few patches plus several sporadically occurring plants	••• ••• ••• • •
9	Several well spaced patches	••• ••• ••• •••
10	Continuous uniform occurrence of well spaced plants	••••••••••••••••••••
11	Continuous occurrence of plants with a few gaps in the distribution	••••••••••••••••••••
12	Continuous dense occurrence of plants	••••••••••••••••••••
13	Continuous occurrence of plants associated with a wetter or drier zone within the polygon.	••••••••••••••••••••

Figure 1. Density and distribution of invasive plants.

NOTE: Prior to the 2001 season, the health score for weed infestation was assessed from a single numerical value that does not represent weed canopy cover, but instead represents the fraction of the polygon area on which weeds had a well established population of individuals (i.e., the area infested).

3. Disturbance-increaser Undesirable Herbaceous Species. A large cover of disturbance-increaser undesirable herbaceous species, native or exotic, indicates displacement from the potential natural community (PNC) and a reduction in riparian health. These species generally are less productive, have shallow roots, and poorly perform most riparian functions. They usually result from some disturbance which removes more desirable species. Invasive species considered in the previous item are not reconsidered here. As in the previous item, the evaluator should state the list of species considered. A partial list of undesirable herbaceous species appropriate for use in Alberta follows. The evaluator should list additional species included.

<i>Antennaria</i> spp. (pussy-toes)	<i>Hordeum jubatum</i> (foxtail barley)	<i>Potentilla anserina</i> (silverweed)
<i>Brassicaceae</i> (mustards)	<i>Plantago</i> spp. (plantains)	<i>Taraxacum</i> spp. (dandelion)
<i>Bromus inermis</i> (smooth brome)	<i>Poa pratensis</i> (Kentucky bluegrass)	<i>Trifolium</i> spp. (clovers)
<i>Fragaria</i> spp. (strawberries)	_____	_____
_____	_____	_____

Scoring:

- 3** = Less than 5% of the site covered by disturbance-caused undesirable herbaceous species.
- 2** = 5% to 25% of the site covered by disturbance-caused undesirable herbaceous species.
- 1** = 25% to 45% of the site covered by disturbance-caused undesirable herbaceous species.
- 0** = More than 45% of the site covered by disturbance-caused undesirable herbaceous species.

4. Preferred Tree and Shrub Establishment and Regeneration. (Skip this item if the site lacks potential for trees or shrubs; for example, the site is a herbaceous wet meadow or cattail marsh.) Not all riparian areas can support trees and/or shrubs. However, on those sites where such species do belong, they play important roles. The root systems of woody species are excellent bank stabilizers, while their spreading canopies provide protection to soil, water, wildlife, and livestock. Young age classes of woody species are important indicators of the continued presence of woody communities not only at a given point in time but into the future. Woody species potential can be determined by using a key to site type (Hansen and others 1995, Kovalchik 1987, Padgett and others 1987). On severely disturbed sites, the evaluator should seek clues to potential by observing nearby sites with similar landscape position. (*Note:* Vegetation potential is commonly underestimated on sites with a long history of disturbance.)

One tree species (*Elaeagnus angustifolia* [Russian olive]) and four shrub genera (*Symphoricarpos* spp. [snowberry], *Rosa* spp. [rose], *Crataegus* spp. [hawthorn], and *Tamarix* spp. [salt cedar]) are excluded from the evaluation of establishment and regeneration. These are species that may reflect long-term disturbance on a site, that are generally less palatable to browsers, and that tend to increase under long-term moderate-to-heavy grazing pressure; **AND** for which there is rarely any problem in maintaining presence on site. *Elaeagnus angustifolia* (Russian olive) and *Tamarix* spp. [salt cedar] are considered especially aggressive, undesirable exotic plants.

The main reason for excluding these plants is they are far more abundant on many sites than are species of greater concern (i.e., *Salix* spp. [willows], *Cornus stolonifera* [red-osier dogwood], *Amelanchier alnifolia* [serviceberry], and many other taller native riparian species), and they may mask the ecological significance of a small amount of a species of greater concern. **FOR EXAMPLE:** A polygon may have *Symphoricarpos occidentalis* (common snowberry) with 30% canopy cover showing young plants for replacement of older ones, while also having a trace of *Salix exigua* (sandbar willow) present, but represented only by older mature individuals.

We feel that the failure of the willow to regenerate (even though there is only a small amount) is very important in the health evaluation, but by including the snowberry and willow together on this polygon, the condition of the willow would be hidden (overwhelmed by the larger amount of snowberry).

For shrubs in general, seedlings and saplings can be distinguished from mature plants as follows. For those species having a mature height generally over 6.0 ft (1.8 m), seedlings and saplings are those individuals less than 6.0 ft (1.8 m) tall. For species normally not exceeding 6.0 ft (1.8 m), seedlings and saplings are those individuals less than 1.5 ft (0.45 m) tall or which lack reproductive structures and the relative stature to suggest maturity. (**Note:** Observers should take care not to confuse short stature resulting from heavy browsing with that due to youth.)

Scoring: (If the site has no potential for trees or shrubs [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA.)

6 = More than 15% of the total canopy cover of preferred trees/shrubs is seedlings and saplings.

4 = 5% to 15% of the total canopy cover of preferred trees/shrubs is seedlings and saplings.

2 = Less than 5% of the total canopy cover of preferred tree/shrubs is seedlings and saplings.

0 = Preferred tree/shrub seedlings or saplings absent.

5. Utilization of Preferred Trees and Shrubs. (Skip this item if the site lacks trees or shrubs; for example, the site is a herbaceous wet meadow or cattail marsh.) Many riparian woody species are browsed by livestock and/or wildlife. Heavy browsing can prevent establishment or regeneration of these important species. Excessive browsing can eliminate them from the community and result in their replacement by undesirable invaders.

One tree species (*Elaeagnus angustifolia* [Russian olive]) and four shrub genera (*Symphoricarpos* spp. [snowberry], *Rosa* spp. [rose], *Crataegus* spp. [hawthorn], and *Tamarix* spp. [salt cedar]) are excluded from the evaluation of utilization of woody species. These are plants that may reflect long-term disturbance on a site, that are generally less palatable to browsers, and that tend to increase under long-term moderate-to-heavy grazing pressure; **AND** for which there is rarely any problem in maintaining presence on site. *Elaeagnus angustifolia* (Russian olive) and *Tamarix* spp. [salt cedar] are considered especially aggressive, undesirable exotic plants.

The main reason for excluding these plants is they are far more abundant on many sites than are species of greater concern (i.e., *Salix* spp. [willows], *Cornus stolonifera* [red-osier dogwood], *Amelanchier alnifolia* [serviceberry], and many other taller native riparian species), and they may mask the ecological significance of a small amount of a heavily utilized species of greater concern. **FOR EXAMPLE:** A polygon may have *Symphoricarpos occidentalis* (common snowberry) with 30% canopy cover showing only light utilization, while also having a trace of *Salix exigua* (sandbar willow) present showing heavy utilization. We feel that, although there is only a small amount of willow present, the fact that it is being heavily utilized is very important to the health evaluation. By including the snowberry and willow together on this polygon, the condition of the willow would be hidden (overwhelmed by the larger amount of snowberry).

When estimating degree of utilization, count browsed second year and older leaders on representative plants of woody species normally browsed by ungulates. Do not count current year's use since this may not accurately reflect actual use because significant browsing can occur late in the season. Determine percentage by comparing the number of leaders browsed with the total number of leaders available (those within animal reach) on a representative sample (at least three plants) of each tree and shrub species present. Do not include use of dead plants unless it is clear this condition was the result of over-grazing.

Scoring: (If the site has no potential for trees or shrubs [except for the species listed above to be excluded], replace both Actual Score and Possible Score with NA.)

3 = None (0% to 5% of available second year and older leaders of preferred species are browsed).

2 = Light (5% to 25% of available second year and older leaders of preferred species are browsed).

1 = Moderate (25% to 50% of available second year and older leaders of preferred species are browsed).

0 = Heavy (More than 50% of available second year and older leaders of preferred species are browsed).

6. Standing Decadent and Dead Woody Material. (Skip this item if the site lacks trees or shrubs; for example, the site is a herbaceous wet meadow or cattail marsh.) The amount of decadent and dead woody material on a site can be an indicator of the overall health of a riparian area. Large amounts of decadent and dead woody material may indicate a reduced flow of water through the stream (dewatering) due to either human or natural causes. Dewatering of a site, if severe enough, may change the site vegetation potential from riparian species to upland species. In addition, decadent and dead woody material may indicate severe stress from over browsing. Finally, large amounts of decadent and dead woody material may indicate climatic impacts, disease and insect damage. For instance, severe winters may cause extreme die back of trees and shrubs, and cyclic insect infestations may kill individuals in a stand. In all these cases, a high percentage of dead and decadent woody material reflects degraded vegetative health, which can lead to reduced streambank integrity, channel incisement, and excessive lateral cutting, besides reducing production and other wildlife values.

The most common usage of the term *decadent* may be for over mature trees past their prime and which may be dying, but we use the term in a broader sense. We count decadent plants, both trees and shrubs, as those with 30% or more dead wood in the upper canopy. In this item, scores are based on the percentage of total woody canopy cover which is decadent or dead, not on how much of the total polygon canopy cover consists of dead and decadent woody material. Only decadent and dead standing material is included, not that which is lying on the ground.

Scoring: (If site lacks potential for woody species, replace both Actual and Potential Scores with NA.)

3 = Less than 5% of the total canopy cover of woody species is decadent or dead.

2 = 5% to 25% of the total canopy cover of woody species is decadent or dead.

1 = 25% to 45% of the total canopy cover of woody species is decadent or dead.

0 = More than 45% of the total canopy cover of woody species is decadent or dead.

7. Streambank Root Mass Protection. Streamside vegetation stabilizes the soil to the extent that it provides deep, binding roots. All tree and shrub species provide such roots. Herbaceous annuals lack this quality. Perennial herbs provide it in varying degree. Some rhizomatous species, such as sedges (*Carex* spp.), are excellent streambank stabilizers. Other rhizomatous species, such as Kentucky bluegrass (*Poa pratensis*), have shallow roots and are poor streambank stabilizers. The evaluator should seek to determine if the types of root systems present in the polygon are in fact contributing to the stability of the streambanks. For this item consider the streambank to extend from the toe of the bank to approximately 18 inches beyond the top of the bank. The bank top is that point where the upper bank levels off to the relatively flat surface of a floodplain or terrace. Remember to include both banks (e.g., both sides of the stream).

Scoring:

6 = More than 85% of the streambank has a deep, binding root mass.

4 = 65% to 85% of the streambank has a deep, binding root mass.

2 = 35% to 65% of the streambank has a deep, binding root mass.

0 = Less than 35% of the streambank has a deep, binding root mass.

8. Human-Caused Bare Ground. Bare ground is soil not covered by plants, litter or duff, downed wood, or rocks larger than 2.5 inches (6 cm). Bare ground caused by human activity indicates a deterioration of riparian health. Sediment deposits and other natural bare ground are excluded as normal or probably beyond immediate management control.

Human land uses causing bare ground include livestock grazing, recreation, roads, and industrial activities. The evaluator should consider the causes of all bare ground observed and estimate the fraction that is human-caused.

Stream channels that go dry during the growing season can create problems for polygon delineation. Some stream channels remain unvegetated after the water is gone. If the total vegetative cover of the

channel is no more than 15%, it is considered a non-vegetated stream channel and is *excluded* from the polygon. Exceptions to this minimum of 15% canopy cover include channels with the vegetation removed by human-causes (such as grazing, logging, and construction). These are considered exposed soil surface (bare ground). Those channels that do contain more than 15% vegetative cover are included as part of the riparian vegetation.

Scoring:

- 6** = Less than 1% of the site is human-caused bare ground.
- 4** = 1% to 5% of the site is human-caused bare ground.
- 2** = 5% to 15% of the site is human-caused bare ground.
- 0** = More than 15% of the site is human-caused bare ground.

9. Streambank Structurally Altered by Human Activity. Streambank structural integrity is vital to good channel configuration and bank shape. Impaired structure can mobilize channel and bank materials, cause loss of fishery and wildlife habitat, lower the water table, etc. Bank alteration can result from such causes as livestock hoof shear, recreation, and resource extraction. Do not include pugging and hummocking as they are taken care of later. In rating this item, consider the bank area from the water's edge up to 18 inches (45 cm) beyond the top of the bank. The bank top is that point where the upper bank levels off to the relatively flat surface of a floodplain or terrace. Remember to include both banks (e.g., both sides of the stream).

Scoring:

- 6** = Less than 5% of the bank is structurally altered by human activity.
- 4** = 5% to 15% of the bank is structurally altered by human activity.
- 2** = 15% to 35% of the bank is structurally altered by human activity.
- 0** = More than 35% of the bank is structurally altered by human activity.

10. Pugging and/or Hummocking. *Pugging* is typically considered the tracks of large animals left in fine textured soil. It is usually caused by hooved animals, livestock or wildlife, but on some sites the tracks of humans and/or their machines are left in fine textured soils. Clayey or silt mud is commonly of a consistency to hold tracks. Upon drying, pugged areas will have a hard, irregular surface, difficult to walk across. Bare soil may or may not be present. *Hummocking* is a micro-topographic relief characterized by raised pedicels of vegetated soil as much as 2 ft higher than the surrounding ground which results from long term large animal trampling and tracking in soft soil. Vegetation on the pedicels usually differs from that on the surrounding lower area due to moisture difference between the two levels.

Scoring:

- 3** = Less than 5% of the polygon is affected by pugging and/or hummocking.
- 2** = 5% to 15% of the polygon is affected by pugging and/or hummocking.
- 1** = 15% to 25% of the polygon is affected by pugging and/or hummocking.
- 0** = More than 25% of the polygon is affected by pugging and/or hummocking.

11. Stream Channel Incisement (vertical stability). Incisement can lower the water table enough to change current vegetation and site potential. It can also increase stream energy, reduce water retention/storage, and increase erosion. A stream is incised when downcutting has lowered the channel bed so that two-year flood events cannot overflow the banks. Four typical downcutting indicators are: a) headcuts; b) exposed cultural features (pipelines, bridge footings, culverts, etc.); c) lack of sediment and exposed bedrock; and d) a low, vertical scarp at the bank toe on the inside of a channel bend. Channel incisement can occur in any of several stages (Figure 4). A severe disturbance can initiate downcutting, transforming the system from a steady state of high water table, appropriate floodplain, and high productivity to one of degraded water table, narrow [or no] active floodplain, and low productivity. (These stages of incisement can be categorized in terms of Rosgen Level I channel types [Rosgen 1996].)

A top rating goes to those unincised channels from which the 1-2 year high flow can access its floodplain. These can be meandering meadow streams (Rosgen E-type) and wide valley bottom streams (Rosgen C-type) which access floodplains much wider than the stream channel, or they may be mountain and foothill streams in V-shaped valleys which have limited floodplains because of topography. These latter types are usually armoured (well-rocked) systems with highly stable beds and streambanks that are not susceptible to downcutting. The lowest rating goes to entrenched channels (Rosgen F- or G-type) where even medium high flows which occur at 5-10 year intervals cannot overtop the high banks. Intermediate stages can be improving or degrading and may reflect slightly incised channels not yet so downcut that intermediate floods cannot access the floodplain, or they may be old incisions that are healing and rebuilding floodplain at a new, lower elevation.

Scoring:

9= Channel vertically stable and not incised; 1-2 year high flows access a floodplain appropriate to the stream type. Active downcutting is not evident. Any old incision is characterized by a broad floodplain inside which perennial riparian plant communities are well established. This condition is illustrated in Figure 2 by the following three stages.

Stage A-1. A stable, unincised meandering meadow channel (Rosgen E-type). Flows greater than bankfull (1-2 year event) spread over a floodplain more than twice the bankfull channel width.

Stage A-2. A fairly stable, unincised wide valley bottom stream with broad curves and point bars (Rosgen C-type). Although these streams typically cut laterally on the outside of curves and deposit sediment on inside point bars, bankfull flows (1-2 year events) have access to a floodplain more than twice bankfull channel width.

Stage A-3. A stable, unincised mountain (Rosgen A-type) or foothill (Rosgen B-type) channel with limited sinuosity and slopes greater than 2%. Although bankfull flow stage is reached every 1-2 years, the adjacent floodplain is often narrower than twice the bankfull channel width. Consequently, overflow conditions are not so obvious as in Stages A-1 and A-2 systems.

6 = Either of two incision phases: (a) an improving phase with a sinuous curve/point bar system (Rosgen C-type) or a narrow, meandering stream (E-type) establishing in an old incision which now represents the new floodplain, although this may be much narrower than it will become; (b) an early degrading phase in which a narrow, meandering meadow stream (E-type) is degrading into a curve/point bar type (C-type) or a wide, shallow channel (Rosgen F-type). In either case, the 1-2 year high flow event can access only a narrow floodplain less than or only slightly wider than twice the bankfull channel width. Perennial riparian vegetation is well established along much of the reach. These conditions are represented in **Stage B** of Figure 2.

3 = Two phases of incision fit this rating. (a) A deep incision that is starting to heal. In this phase new floodplain development, though very limited, is key. This phase is characterized by a wide, shallow channel unable to access a floodplain (Rosgen F-type) evolving into a curve/point bar system (C-type) through sediment deposition and lateral cutting. Pioneer perennial plants are beginning to establish on the new depositional surfaces. (b) An intermediate phase with downcutting and headcuts probable. Flows less than a 5-10 year event can access a narrow floodplain less than twice bankfull channel width. These conditions are represented in **Stage C** of Figure 2.

0 = The channel is deeply incised to resemble a ditch or a gully. Downcutting is likely ongoing. Only extreme floods overtop the banks, and no floodplain development has begun. Both **Stages D-1** and **D-2** of Figure 2 fall into this rating.

Stage D-1. An incised stream with a wide, shallow (F-type) channel. Commonly found in fine substrates (sands, silts, and clays), channel banks are very erodible. Only limited vegetation, primarily pioneer species, is present along the side of the stream.

Stage D-2. A narrow, deep "gully" system (Rosgen G-type) downcut to the point that only extreme floods can overtop the banks. Distinguished from narrow mountain streams (A-type) by the presence of a flat floodplain through which the stream has downcut and by banks consisting of fine materials rather than larger rocks, cobbles, or boulders.

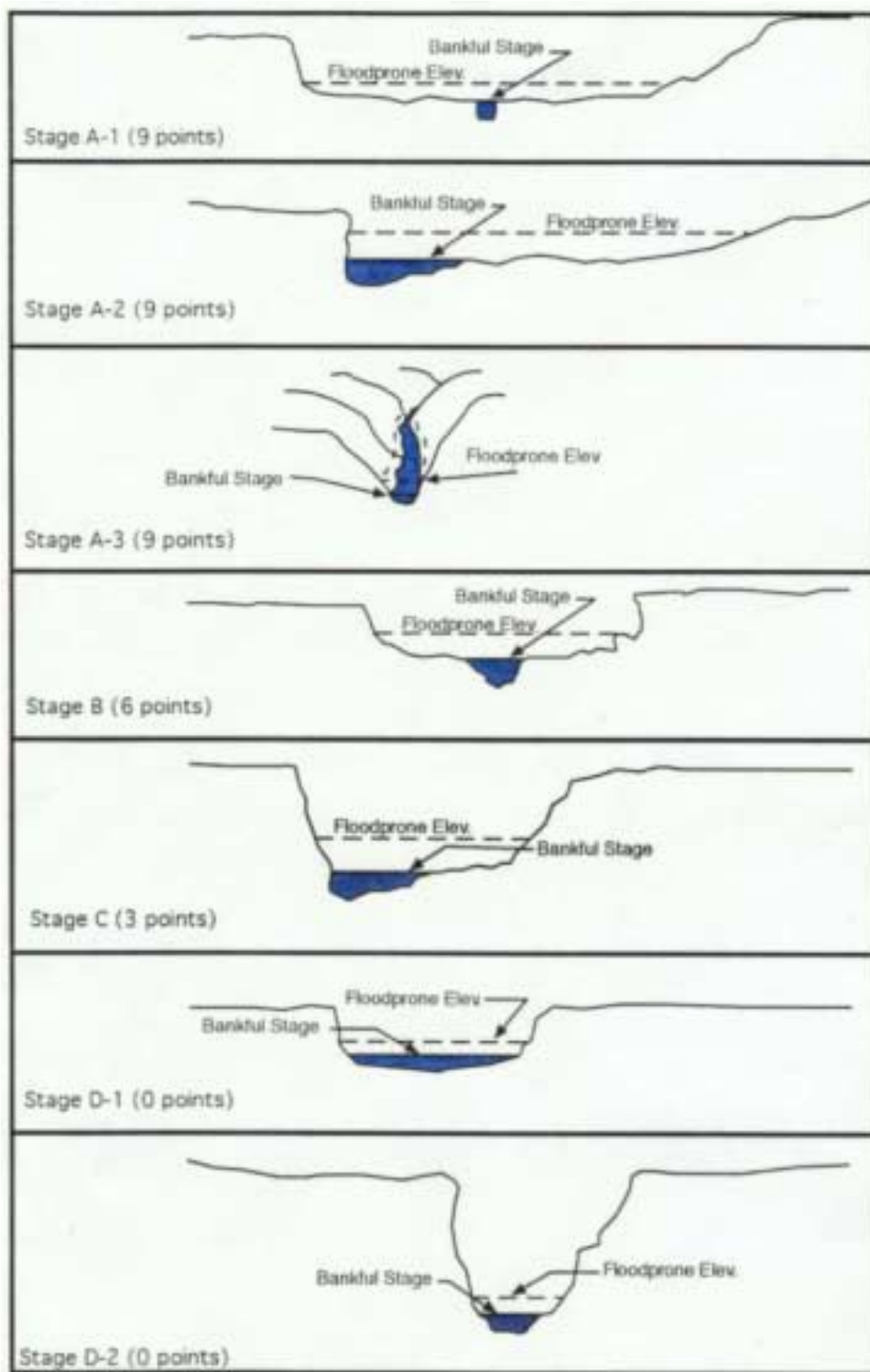


Figure 2. Guides for estimating stage of channel incisement.

APPENDIX C

Riparian Plant Inventory

Riparian Plant Information-Cypress County Watershed Group

Category	Species Common Name (<i>Scientific Name</i>)	Plant Status ¹	% Canopy Cover ² SEV,NIN, MUR,KNX
Trees	Manitoba maple (<i>Acer negundo</i>)	native	1.27
	plains cottonwood (<i>Populus deltoides</i>)	native	0.32
	Tree (Tree)	unknown	0.23
	Russian olive (<i>Elaeagnus angustifolia</i>)	introduced	0.11

Shrubs	common wild rose (<i>Rosa woodsii</i>)	native	5.27
	thorny buffaloberry (<i>Shepherdia argentea</i>)	native	4.25
	buckbrush/snowberry (<i>Symphoricarpos occidentalis</i>)	native	3.49
	silver sagebrush (<i>Artemisia cana</i>)	native	1.29
	prickly rose (<i>Rosa acicularis</i>)	native	0.55
	red-osier dogwood (<i>Cornus stolonifera</i>)	native	0.54
	sandbar willow (<i>Salix exigua</i>)	native	0.46
	yellow willow (<i>Salix lutea</i>)	native	0.45
	choke cherry (<i>Prunus virginiana</i>)	native	0.42
	saskatoon (<i>Amelanchier alnifolia</i>)	native	0.23
	silverberry (<i>Elaeagnus commutata</i>)	native	0.16
	wild red currant (<i>Ribes triste</i>)	native	0.14
	northern gooseberry (<i>Ribes oxycanthoides</i>)	native	0.05
	beaked willow (<i>Salix bebbiana</i>)	native	0.02
Canada buffaloberry (<i>Shepherdia canadensis</i>)	native	0.005	

Grasses (and Grass-like species)	foxtail barley (<i>Hordeum jubatum</i>)	disturbance	10.4
	Kentucky bluegrass (<i>Poa pratensis</i>)	disturbance	7.71
	smooth brome (<i>Bromus inermis</i>)	disturbance	7.34
	western wheat grass (<i>Agropyron smithii</i>)	native	5.95
	crested wheat grass (<i>Agropyron pectiniforme</i>)	disturbance	5.37
	reed canary grass (<i>Phalaris arundinacea</i>)	native	4.37
	salt grass (<i>Distichlis stricta</i>)	native	3.85
	three-square rush (<i>Scirpus pungens</i>)	native	3.1
	common tall manna grass (<i>Glyceria grandis</i>)	native	1.69
	Graminoid (<i>Graminoid</i>)	unknown	1.4
	rough hair grass (<i>Agrostis scabra</i>)	native	1.15
	common great bulrush (<i>Scirpus validus</i>)	native	0.77
	creeping spike-rush (<i>Eleocharis palustris</i>)	native	0.67
	green needle grass (<i>Stipa viridula</i>)	native	0.67
	wire rush (<i>Juncus balticus</i>)	native	0.66
	awned sedge (<i>Carex atherodes</i>)	native	0.64
	woolly sedge (<i>Carex lanuginosa</i>)	native	0.56
	fowl bluegrass (<i>Poa palustris</i>)	native	0.55
	redtop (<i>Agrostis stolonifera</i>)	introduced	0.47
	Sartwell's sedge (<i>Carex sartwellii</i>)	native	0.44
slender wheat grass (<i>Agropyron trachycaulum</i>)	native	0.25	

Grasses (and Grass-like species)	prairie sedge (<i>Carex prairea</i>)	native	0.16
	timothy (<i>Phleum pratense</i>)	disturbance	0.16
	needle-and-thread (<i>Stipa comata</i>)	native	0.12
	sand grass (<i>Calamovilfa longifolia</i>)	native	0.09
	slough grass (<i>Beckmannia syzigachne</i>)	native	0.07
	tufted hair grass (<i>Deschampsia cespitosa</i>)	native	0.07
	alkali cord grass (<i>Spartina gracilis</i>)	native	0.06
	hairy wild rye (<i>Elymus innovatus</i>)	native	0.06
	bluejoint (<i>Calamagrostis canadensis</i>)	native	0.04
	sedge (<i>Carex spp.</i>)	native	0.04
	northern wheat grass (<i>Agropyron dasystachyum</i>)	native	0.04
	blue grama (<i>Bouteloua gracilis</i>)	native	0.04
	quack grass (<i>Agropyron repens</i>)	disturbance	0.03
	small bottle sedge (<i>Carex utriculata</i>)	native	0.03
	wild rye (<i>Elymus spp.</i>)	native	0.01
	short-awned foxtail (<i>Alopecurus aequalis</i>)	native	0.01

Forbs (broad leaf plants)	summer-cypress (<i>Kochia scoparia</i>)	introduced	2.93
	silverweed (<i>Potentilla anserina</i>)	native	2.14
	lamb's-quarters (<i>Chenopodium album</i>)	disturbance	1.76
	perennial sow-thistle (<i>Sonchus arvensis</i>)	invasive	1.2
	Canada thistle (<i>Cirsium arvense</i>)	invasive	1.19
	common cattail (<i>Typha latifolia</i>)	native	1.19
	flixweed (<i>Descurainia sophia</i>)	disturbance	1.09
	common dandelion (<i>Taraxacum officinale</i>)	disturbance	0.83
	wild licorice (<i>Glycyrrhiza lepidota</i>)	native	0.73
	alsike clover (<i>Trifolium hybridum</i>)	disturbance	0.55
	cocklebur (<i>Xanthium strumarium</i>)	native	0.47
	common tall sunflower (<i>Helianthus nuttallii</i>)	native	0.41
	common plantain (<i>Plantago major</i>)	disturbance	0.4
	common burdock (<i>Arctium minus</i>)	disturbance	0.39
	common nettle (<i>Urtica dioica</i>)	native	0.36
	showy milkweed (<i>Asclepias speciosa</i>)	poisonous	0.36
	yellow sweet-clover (<i>Melilotus officinalis</i>)	disturbance	0.35
	white clover (<i>Trifolium repens</i>)	disturbance	0.32
	Canada goldenrod (<i>Solidago canadensis</i>)	native	0.3
	common yarrow (<i>Achillea millefolium</i>)	native	0.28
	curled dock (<i>Rumex crispus</i>)	introduced	0.26
	bull thistle (<i>Cirsium vulgare</i>)	native	0.26
	marsh hedge-nettle (<i>Stachys palustris</i>)	native	0.24
	red clover (<i>Trifolium pratense</i>)	disturbance	0.23
	wild mint (<i>Mentha arvensis</i>)	native	0.22
	alfalfa (<i>Medicago sativa</i>)	introduced	0.2
	prairie coneflower (<i>Ratibida columnifera</i>)	native	0.2
	pasture sagewort (<i>Artemisia frigida</i>)	native	0.17
	common goat's-beard (<i>Tragopogon dubius</i>)	introduced	0.16
	gumweed (<i>Grindelia squarrosa</i>)	native	0.13

Forbs (broad leaf plants)	golden bean (<i>Thermopsis rhombifolia</i>)	native	0.13
	western dock (<i>Rumex occidentalis</i>)	native	0.12
	golden aster (<i>Heterotheca villosa</i>)	native	0.11
	water smartweed (<i>Polygonum coccineum</i>)	native	0.11
	stinkweed (<i>Thlaspi arvense</i>)	<i>disturbance</i>	0.1
	seaside buttercup (<i>Ranunculus cymbalaria</i>)	native	0.1
	low goldenrod (<i>Solidago missouriensis</i>)	native	0.1
	winter-fat (<i>Eurotia lanata</i>)	n/a	0.09
	common horsetail (<i>Equisetum arvense</i>)	<i>poisonous</i>	0.08
	sea milkwort (<i>Glaux maritima</i>)	native	0.07
	western bluebur (<i>Lappula occidentalis</i>)	native	0.07
	wild vetch (<i>Vicia americana</i>)	native	0.07
	water parsnip (<i>Sium suave</i>)	native	0.06
	prairie sagewort (<i>Artemisia ludoviciana</i>)	native	0.06
	western willow aster (<i>Aster hesperius</i>)	native	0.05
	black medick (<i>Medicago lupulina</i>)	<i>disturbance</i>	0.05
	common scouring-rush (<i>Equisetum hyemale</i>)	native	0.04
	Forb (<i>Forb</i>)	n/a	0.04
	wild buckwheat (<i>Polygonum convolvulus</i>)	<i>disturbance</i>	0.04
	Macoun's buttercup (<i>Ranunculus macounii</i>)	native	0.04
	gaillardia (<i>Gaillardia aristata</i>)	native	0.03
	marsh skullcap (<i>Scutellaria galericulata</i>)	native	0.03
	purple prairie-clover (<i>Petalostemon purpureum</i>)	native	0.02
	Philadelphia fleabane (<i>Erigeron philadelphicus</i>)	native	0.02
	prickly-pear (<i>Opuntia polyacantha</i>)	n/a	0.02
	water-hemlock (<i>Cicuta maculata</i>)	<i>poisonous</i>	0.02
	Indian hemp (<i>Apocynum cannabinum</i>)	<i>poisonous</i>	0.01
	smooth scouring-rush (<i>Equisetum laevigatum</i>)	native	0.01
	wild morning-glory (<i>Convolvulus sepium</i>)	<i>disturbance</i>	0.01
	polygonum (<i>Polygonum spp.</i>)	n/a	0.01
	arum-leaved arrowhead (<i>Sagittaria cuneata</i>)	native	0.01
	yellow evening-primrose (<i>Oenothera biennis</i>)	native	0.01
	prostrate amaranth (<i>Amaranthus graecizans</i>)	native	0.01
northern bedstraw (<i>Galium boreale</i>)	native	0.01	
water smartweed (<i>Polygonum amphibium</i>)	native	0.01	

¹ Plant status is designated by Cows and Fish in association with Alberta Public Lands and the Alberta Weed Control Act. Those species with a plant status highlighted in bold (e.g. noxious) are included in the health parameter score for "Invasive Plant Species". 'NA' = plant status not available.

² Based on visual estimates of the amount of ground the canopy of the plant covers. The percent cover values presented are the mid-values for the following ranges: 0.5=less than 1%; 3.0=1%-5%; 10.0=5%-15%; 20.0=15%-25%; 30.0=25%-35%; 40.0=35%-45%; 50.0=45%-55%; 60.0=55%-65%; 70.0=65%-75%; 80.0=75%-85%; 90.0=85%-95%; 97.5=greater than 95%; __ = not observed.