

Review of Riparian Management Policy in Alberta's Forests

Produced by:

**Riparian Management Committee
Alberta Sustainable Resource Development**

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Executive Summary

Alberta Sustainable Resource Development established the Riparian Management Committee to review riparian management policy in Alberta's forests. Riparian management policy here refers to riparian management standards as set out in the *Alberta Timber Harvest Planning and Operating Ground Rules*. The objectives of this review were to:

- 1) Establish SRD goals for riparian management in forested areas in the green zone.
- 2) Describe current riparian management policy and its implementation.
- 3) Assess consistency of policy implementation.
- 4) Assess success of current policy in meeting SRD goals.
- 5) Provide direction for future revisions to riparian management policy.
- 6) Identify knowledge gaps.

The committee prepared a document titled "*Functions and Goals of Riparian Areas in Alberta*" (appended to this report) which provides an explicit statement of riparian area functions and goals in the green zone of Alberta. The committee recommends this report be endorsed by SRD and distributed to staff and industry. These functions and goals provided the basis for assessing the current policy and its implementation.

The current policy most successfully addresses abiotic goals while only partially addressing goals related to biodiversity. Assessment of riparian policy was complicated by the fact that riparian management occurs in the context of other landscape forest management policies that were outside the scope of this review.

Three attributes of Alberta's riparian policy warranted more detailed assessment.

- 1) Designation of fixed-width buffers. Assessment concluded that moving from this rules-based approach to results- or objectives-based approaches required further research, increased landscape scale planning, and a commitment to increasing monitoring and enforcement efforts. This approach should be periodically assessed as new information from research becomes available.
- 2) Lack of buffers on intermittent streams. Assessment concluded that proposed Ground Rules revisions partially address this issue and recommended several additional revisions.
- 3) Variances to buffers. Assessment concluded that current variance provisions are inconsistently applied potentially compromising riparian functions and goals. Recommendation that SRD provide clear direction and criteria on when harvesting in buffers can be considered. In the interim, the committee recommends that SRD staff ensure variance applications conform to current stated policy and "demonstrate fish and wildlife habitat will be maintained and watershed values protected."

SRD should promote research and adaptive management experiments that address SRD riparian management goals. A list of priority topics is provided.

Riparian Management Committee

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Review of Riparian Management Policy in Alberta's Forests

Purpose:

The management of riparian areas in Alberta's forests is guided by the *1994 Alberta Timber Harvest Planning and Operating Ground Rules* (Alberta Sustainable Resource Development 1994). A revised version of this policy will be included in the new *Forest Management Planning Standard Operating Ground Rules*. This policy is either adopted in, or provides the basis for, local ground rules in all Detailed Forest Management Plans in Alberta. This review of the riparian management policy in the provincial Operating Ground Rules is a result of the following:

- The development of a new Forest Management Planning Standard containing a revised version of the "Alberta Timber Harvest Planning and Operating Ground Rules and Framework for Renewal."
- The development of alternate riparian management strategies and local ground rules by some Forest Management Agreement (FMA) holders. Examples include approved local ground rules for Sundance Forest Products and Weldwood's (now West Fraser – Hinton Division) proposed Riparian Strategy.
- On-going research into riparian management. Examples include FORWARD, the Foothills Model Forest, and national projects funded by the Sustainable Forest Management Network. One common theme in many of these research projects is an investigation of fixed-width buffers.
- Department of Fisheries and Oceans Canada increased presence in Alberta.
- The concern expressed by Forest Management Branch and Fish and Wildlife Division staff that riparian management is inconsistent across the province.
- The publication of a number of reviews of riparian management policies in Alberta and other provinces.

Sustainable Resource Development (SRD) is committed to ensuring its policies are science based, providing for the sustainable management of Alberta's natural resources, while at the same time facilitating the achievement of economic and social objectives. In order to meet this goal, senior management in the Forest Management Branch and the Fish and Wildlife Division commissioned a review of the riparian management policy for Alberta's forested area. For this document, riparian management policy refers to the application of fixed-width buffers, the potential for variances to these buffers, and other standards as set out in the Operating Ground Rules.

Objectives and Scope

This review is to address the following objectives:

1. Establish SRD broad goals for riparian management in forested areas in the green zone.
2. Describe the current policy of riparian management in forested areas and its implementation across the province.

3. Assess consistency in the implementation of forest riparian management across Alberta.
4. Assess the success of the current policy and its implementation in meeting functions and goals for riparian management in forested areas.
5. Provide direction for future revisions to riparian management policy, if needed.
6. Identify knowledge gaps relevant to riparian management policy.

This review is limited to riparian management policy as it relates to forest management and does not assess riparian management policies affecting areas outside of the “green zone”. This review includes an assessment of the risks and benefits of applying the current policy. Where risks are identified, this discussion paper provides recommendations for developing future policy. Development of new policy would require a separate process to be initiated at the discretion of SRD Executive.

Review Methods

Senior management in the Forest Management Branch and the Fish and Wildlife Division established a “Riparian Management Review Committee” in December 2003 (see Terms Of Reference in [Appendix 2](#)). This committee was comprised of staff from the Public Lands and Forests Division and the Fish and Wildlife Division. The committee contacted Senior and Area Foresters and Area Biologists to obtain information relating to riparian management practices in the green zone of the province.

Riparian Management Goals

Before evaluating Alberta’s riparian management policy in forested areas, it is important that SRD clearly articulate the values of riparian areas and identify broad goals for their management. Current riparian management policy was developed in the late 1980s when the management objective had a strong focus on fish and aquatic values. Since then, this riparian policy has been linked to a variety of additional functions and values provided by riparian areas. However, there has never been an explicit statement of these riparian functions and goals that we now expect Alberta’s riparian policy to address. To address this gap, the committee prepared a document titled *Functions and Goals of Riparian Areas in Alberta* ([Appendix 1](#)) to identify functions and goals for riparian areas in the green zone of Alberta. The functions of riparian areas include:

1. Trapping and storing sediment.
2. Building and maintaining banks and shorelines.
3. Reducing and dissipating energy.
4. Minimizing changes in stream water chemistry.
5. Regulating water temperature.
6. Providing habitat for aquatic organisms (aquatic biodiversity).
7. Providing habitat for terrestrial organisms (terrestrial biodiversity).

Based on these riparian functions, SRD's management goals for riparian areas include:

1. Maintain the integrity of stream cross-sectional profiles and the integrity of the bed and shore of the water body.
2. Maintain the capacity to reduce and dissipate stream energy over a full range of flows over the length of the watercourse.
3. Maintain the capacity to trap, filter and/or remove sediments from flooding, as well as from down-slope surface flows.
4. Minimize adverse changes in stream water chemistry.
5. Minimize adverse changes in the temperature regime of watercourses.
6. Maintain sources and inputs of organic material and large woody debris to aquatic ecosystems.
7. Maintain permanent and intermittent watercourses and water bodies as habitat for fish and other aquatic biota.
8. Maintain terrestrial habitat for wildlife that use riparian areas.
9. Contribute to the maintenance of landscape connectivity and provide movement corridors for terrestrial animals along riparian areas and throughout watersheds.
10. Maintain the characteristic microclimates, vegetation communities (including riparian old growth forest), and overall biotic diversity of riparian areas.
11. Minimize adverse cumulative effects on riparian area functions.

The functions and goals document also includes a number of strategies that can be used to protect the functions of riparian areas and ensure the identified goals are attained. These functions, goals, and their supporting strategies provide the basis for assessing the current policy and its implementation.

Current Policy and its Implementation

The *1994 Alberta Timber Harvest Planning and Operating Ground Rules* contain two standards relevant to riparian management (see excerpt in [Appendix 3](#)). These standards require watercourses to be classified ([Appendix 3-Table 1](#)) and also provide operational standards and guidelines ([Appendix 3-Table 2](#)). Small and large permanent streams require 30 m and 60 m no-harvest buffers, respectively. Harvesting is permitted adjacent to intermittent and ephemeral streams with some provision for maintaining lesser vegetation and restrictions in road location. Buffers are also required on lakes and water-source areas. The standards provide for harvesting within buffers if a variance is granted within the Annual Operating Plan, and provide conditions for operating within buffers in these cases. These conditions require the operator to “demonstrate that fish and wildlife habitat will be maintained or enhanced and watershed values protected.”

The operating ground rules allow two opportunities for variation in how riparian management is implemented in different FMAs across Alberta. First, Forest Management Agreements allow companies to negotiate their own operating ground rules for riparian areas. Second, SRD regions, along with their forest industry partners, have the option of developing zonal operating ground rules. The riparian provisions within the

locally developed ground rules may thus be different than the 1994 rules presented in [Appendix 3](#).

This significant potential for variation in riparian management makes it important for this review to first determine the current practice of riparian management across the province.

The current practice of riparian management by the Alberta forest industry is summarized in [Table 1](#). Most FMA holders have adopted local operating ground rules ([Table 1](#)). However, in most cases, the riparian management provisions in these local ground rules differ little from the 1994 operating ground rules. Exceptions to this include local ground rules for Sundance Forest Products which adopted a variable width buffer approach and Millar Western where allowance is made for buffer harvesting to implement FORWARD, a large scale research study ([Table 1](#)).

The frequency of approved “variances” for harvest in buffers differs by FMA and region. Companies that harvest regularly in buffers include Sundance (related to variable width approach) and Weldwood (now West Fraser Hinton Division), which applies for variances on most of its buffers. Weldwood is developing a “Riparian Strategy” to allow their riparian harvest strategy to continue without needing to apply for variances. Companies operating in Northwest Region 1 (Grande Prairie) are also granted variances on 1-15% of their buffers. In the rest of the province, variances are rarely, if at all, granted and full buffers are maintained as per the 1994 Operating Ground Rules ([Table 1](#)).

The rationale behind the buffer harvest variance applications and approvals varied, with most of the rationales relating to an opportunity to access wood ([Table 1](#)). “Harvesting to the break (of slope)” is included as an opportunity-to-access-wood rationale; the driver for buffer harvesting in these cases is the availability of desired trees and the not the protection of other values.

Assessment of Current Policy

[Table 2](#) provides an assessment of the effectiveness of current riparian management policy in addressing SRD’s riparian goals ([listed in Appendix 1](#)). The current policy most successfully addresses the abiotic goals (goals 1-5); goals related to biodiversity (goals 6-11) are only partially addressed. Most riparian goals are adequately addressed on permanent streams where buffers are retained. However, many goals may be at risk on streams where riparian policy allows little or no tree cover to be retained.

It is important to note that the current riparian management policy is not sufficient in itself to maintain terrestrial habitat for wildlife that use riparian areas. Some of these wildlife species require larger patches of mature-old forested habitat than provided by the buffer widths specified in the current Ground Rules. Maintenance of suitable habitat for these species requires that riparian buffers be complemented by landscape scale retention strategies. Maintaining biodiversity thus requires a comprehensive landscape scale

approach in which riparian management is only one component. These broader issues are beyond the strict scope of this review, however the development of riparian management policy must consider the interaction between riparian management and other forest management policies.

Three attributes of Alberta's riparian management policy for forested areas warrant closer assessment.

1. The designation of fixed width buffers on permanent streams and lakes.
2. The lack of buffers on intermittent streams.
3. The provision for "variances" allowing harvesting within buffers.

1. Fixed width buffers

The prescription of fixed-width buffers for different classes of watercourses has the advantage of being clear and relatively unambiguous. Field layout by the companies and monitoring by government are straightforward and based on measurable criteria. The buffer widths specified in Alberta's policy generally minimize risks of harvesting to the range of riparian functions and goals outlined in [Appendix 1](#). By reducing management complexity and increasing certainty, the utilization of fixed width buffers reduces the total cost of implementing riparian management.

Fixed-width buffer policies have been increasingly challenged in recent years. These policies have been targeted as being arbitrary, based on limited science, and insensitive to local conditions. Critics say that the 30, 60, and 100m buffers prescribed in Alberta's policy may be far more than is required in many cases and insufficient in others. They advocate less prescriptive approaches in which the focus is on meeting management objectives in a "results-based" policy. Values of individual riparian areas would be identified followed by the design and implementation of site-specific measures to protect these values.

Objective-based or results-based riparian policies would have the benefit of allowing local solutions to local conditions and could better align riparian management to landscape objectives. However, this approach requires an understanding of key riparian values at each site and the knowledge of how to maintain these values. Several recent reviews of riparian management in Alberta ([Lee 2003](#), [MacDonald 2003](#)) have acknowledged that our understanding of these key site values is not yet sufficient to replace the use of fixed-width buffers. Addressing these knowledge gaps at the site level would likely require a significant investment of resources.

The long-term landscape implications of following a fixed-width buffer policy have also been discussed. One expressed concern is that riparian forests will become older through time, experiencing lower disturbance levels than would be expected under a natural disturbance regime. This has led to some investigation of the relative frequency of stand replacing events in riparian areas as compared to the rest of the landscape. Results of these studies have been mixed; some studies show little differences in riparian versus upland disturbance rates while others show lower rates of disturbance in riparian areas. Advocates of natural disturbance approaches cite studies that show little difference in

rates of disturbance as rationale for the need to increase the level of disturbance in riparian areas. The fixed-width riparian buffers policy is seen as a barrier to this approach.

The natural disturbance approach requires increased landscape scale planning to identify the appropriate disturbance regime to inform forest management. Landscape objectives, targets, and operational strategies need to be established. Determining the right target is not at all clear due to the uncertainty in riparian disturbance rates. In addition, it is not certain that the natural disturbance model approach would adequately address the full suite of riparian goals and values given the cumulative impact of activities that have no analog in nature. Finally, there has not been any demonstration of negative ecological consequences arising from potential unrepresentative age distributions in riparian forests. Therefore, while natural disturbance concepts should inform both landscape and stand scale planning, currently these concepts in themselves do not warrant altering fixed-width buffers policies.

Replacing fixed-width buffer policies with more flexible site-level riparian policies raises an important issue that has particular relevance to government. As flexibility in site level riparian management practices increases, monitoring and enforcement becomes more complex, problematic and costly. These costs would be borne by government and industry. If monitoring and corrective actions are not stepped up, there is an increasing risk that riparian goals could be compromised.

2. Intermittent streams

The lack of prescribed buffers on intermittent and non-permanent streams is frequently identified as a gap in Alberta's riparian management policy. Although these streams are often small and may not flow throughout the year, they provide important contributions to water quality and to aquatic and terrestrial biodiversity. These streams often occur in the headwaters of watersheds and therefore influence downstream water and biodiversity attributes. Providing some form of forested buffers on these streams is often advocated to better protect downstream values. However, this change to buffer provisions would increase the impact of riparian policy on timber supply. This impact could be reduced through improved watercourse classification to prevent inappropriate buffer application to snow melt channels and other small watercourses with undefined channels.

Two recommendations are provided to address the above-described gap in Alberta's riparian management policy.

1. Proposed revisions of the Operating Ground Rules may partly address the lack of prescribed buffers on intermittent and non-permanent streams. A new "transitional" subclass of small permanents (0.4 to 0.7 m in width) has been created that captures some of the streams formerly classed as intermittent streams. These "transitional" streams would require a 10-metre buffer. Streams narrower than 0.4m would continue to be classed as intermittent and would still not require buffers.
2. Risks to fish habitat values in small streams could be addressed by adding forested buffers to intermittent streams that are within a specified distance of

known or suspected fish habitat. Intermittent streams meeting the above criteria would be protected with a buffer of 10m, or to the top of the break, whichever is greater.

3. Variances to buffers

Variances that allow harvesting in riparian buffers can be obtained in an annual operating plan where the operator demonstrates that fish and wildlife habitat and watershed values will be maintained (see 1994 OGR [Appendix 3](#)). The provision of variances increases the flexibility of riparian policy to address unique situations and allows management to address site-specific requirements. However, as noted earlier, this variance provision has been inconsistently applied across the province. In many areas of Alberta the variance provision is not used at all, whereas in some areas and with some companies, it is used routinely. In addition, little consistency has been seen in the stated rationales for variance applications. Rationales for variances that focus solely on accessing available timber do not address the Operating Ground Rules requirement of “demonstrating that fish and wildlife habitat will be maintained and watershed values protected.” As a result, the provision for variances, as currently applied, is leading to inconsistent implementation of riparian management across Alberta.

Inconsistency in policy application is a different issue than allowing for diversity in management approaches. When clear management objectives are established, and where effective monitoring and enforcement mechanisms are in place, it is possible to utilize a range of management approaches to achieve these management objectives in a complex environment. However, in the absence of stated management objectives and in the absence of criteria for assessing differing strategies, inconsistency in policy application could result in compromising some riparian area functions and values. This describes the situation in current riparian policy and its implementation in Alberta.

Three options for addressing the current inconsistency in policy implementation include:

1. Remove the variance provisions and require specified buffers with no exceptions.
 - Option 1 is not recommended as it removes any policy flexibility to permit active adaptive management, research, or to deal with special circumstances.
2. Retain existing variance provisions.
 - Option 2, the status quo, is also not recommended as it fails to deal with the increasing inconsistency in policy application.
3. Retain variance provisions but provide clear direction and criteria on when harvesting in buffers can be considered.

Option 3 is recommended as it allows for active adaptive management experiments in riparian areas, provides flexibility for unique circumstances, and resolves the current issue of inconsistent application of the provision for variances. Implementation of this option requires the identification of a process and clear criteria for reviewing applications for variances.

Emerging Issues

Several emerging issues that affect riparian areas and their management in Alberta are not discussed in this paper but do warrant further attention. These issues include implementation of FireSmart and the integration of riparian management in forestry with other land uses such as oil and gas, grazing, recreation, and road crossings.

FireSmart objectives being developed for community protection zones should be assessed for potential conflicts with riparian buffer policies. The large number of proposed community protection zones (~300) has the potential to affect a significant number of watercourses and their riparian areas.

Multiple land uses such as oil and gas, grazing, recreation, and road crossings have not been explicitly considered in the development of current OGR riparian policy. The assessment of additional risks to riparian areas created by the cumulative effects of these impacts is required to determine if existing OGR riparian policy adequately protects riparian function.

Summary of Review Recommendations

- *Riparian Functions and Goals* ([Appendix 1](#)) be endorsed by SRD and distributed to staff and industry.
- Maintain fixed-width buffer provisions in current policy. Periodically assess these provisions as new information becomes available from research and adaptive management projects that address riparian area functions and goals in [Appendix 1](#).
- Revise OGR buffer requirements by providing for buffers on intermittent streams that directly influence downstream fish habitat.
- Identify criteria for variance applications and a process to review these applications. A request for a variance must demonstrate that the functions and values of the riparian area will not be impaired as a result of operations.
- Interim recommendation that variance applications conform to current stated policy to “demonstrate fish and wildlife habitat will be maintained and watershed values protected.”
- Promote research and active adaptive management trials that address the full suite of SRD riparian management goals. Priority topics include:
 - Development of a decision support framework to provide an objective and auditable basis for all riparian management practices.
 - Riparian area contribution to landscape biodiversity. This broad question would address issues such as:
 - Stand level structure retention focused in riparian areas.
 - Landscape level old forest retention focused towards riparian areas.
 - The contribution of riparian buffers to landscape biodiversity objectives.

- Implications to riparian age class structure if riparian areas are not disturbed by forest harvesting. Does lack of harvesting disturbance have any negative ecological implications?
- Implications of the cumulative effect of human activities on riparian area management.
- Improve communication between SRD and riparian related research programs.

References:

Lee, P., Smyth, C. 2003. Riparian forest management: paradigms for ecological management and practices in Alberta. Report produced by the Alberta Research Council (Vegreville, Alberta) and the Alberta Conservation Association (Edmonton, Alberta) for the Northern Watershed Project Stakeholder Committee. Northern Watershed Project Final Report No. 1. 117 pp. (<http://www.ab-conservation.com/>)

MacDonald, Ellen; Burgess, Carl J.; Scrimgeour, Garry; Boutin, Stan; Reedyk, Sharon; Kotak, Brian. 2004. Should riparian buffers be part of forest management based on emulation of natural disturbance? *Forest Ecology and Management*. 187:185-196

Table 1. Timber Harvest Operating Ground Rules adopted by Alberta forest companies and the frequency of harvest in buffers defined in the 1994 Operating Ground Rules.

SRD Area	Company	Ground Rules	Harvesting in 1994 GR buffers	Rationale for harvesting in 1994 GR buffers
SW1	793128 AB Ltd ¹	1994 GR ²	None	
	770538 AB Ltd ¹	1994 GR	2	Opportunity to access wood – top of break
	Spray Lake SM	1994 GR	None	
	Commercial Timber Program ¹	1994 GR	None	
SW2	Sunpine	1994 GR	Rare	<ul style="list-style-type: none"> • Opportunity to access wood – top of break, majority of buffer maintained • F&W request – one instance to protect mountain sheep • Forest Health – mistletoe in pine
	Weyerhaeuser DV	WeyCo DV 1997	None	
	Sundance	Sundance 2001	Common ³	Rationales not required as buffer harvesting permitted in local GR (see note)
SW3	Weldwood (now West Fraser, Hinton Division)	Weldwood 2002	Common	<ul style="list-style-type: none"> • Opportunity to access wood • Trial implementation of proposed Natural Disturbance Model forest management system
	Weyerhaeuser Edson	WeyCo Edson 2002	None	
	Community Timber Program ¹	1994 GR	None	
SW4	ANC Timber	ANC 2001	Rare (1-2/yr)	Compartment design – Opportunity to access wood/windfirmness- majority of buffer maintained
	Millar Western	MW 2002	Rare (1-2/yr) ⁴	<ul style="list-style-type: none"> • Compartment design – Opportunity to access wood/windfirmness- majority of buffer maintained • FORWARD project
	Blue Ridge Lumber	BRL 1988	Rare (1-2/yr)	Compartment design – Opportunity to access wood/windfirmness- majority of buffer maintained
NE1	ALPAC	ALPAC 2000	None	
NE2	ALPAC	ALPAC 2000	None	

¹ Non-FMA (Forest Management Agreement) licence

² Alberta Timber Harvest Planning and Operating Ground Rules 1994

³ Sundance OGR employs a variable width buffer. Any harvest within traditional buffer is offset by upland retention elsewhere.

⁴ Rare – not including buffer harvest treatments under the FORWARD project approved under the DFMP

SRD Area	Company	Ground Rules	Harvesting in 1994 GR buffers	Rationale for harvesting in 1994 GR buffers
NW1	Weyerhaeuser Grande Prairie / Grande Cache	WeyCo GP/GC 1989	~10-12% of blocks adjacent to watercourses	Not known
	Ainsworth	1994 GR	~13-15% of blocks adjacent to watercourses	Not known
	Canfor	Canfor	~1-2% of blocks adjacent to watercourses	Not known
	Community Timber Program ¹	1994 GR or FMA GR	~1-2% of blocks adjacent to watercourses	Not known
NW2	Tolko Buchanen		None	
	Weyerhaeuser		None	
	ALPAC	ALPAC 2000	None	
	Slave Lake Pulp	SLP 2004	None	
	Vanderwell	1994 GR	None	
	DMI (S15)	DMI 1990	None	
NW3	DMI	DMI 1990	None ⁵	
	Boucher Bros.	1994 GR	None ⁵	
	Gordon Buchanen	1994 GR	None ⁵	
	Seehta Forest P.	1994 GR	None ⁵	
	Tolko Buchanen	1994 GR	None ⁵	
	Manning Diversified	1994 GR	None ⁵	
NW4	Tolko Footner	1994 GR	None	
	DTA/Quota ¹	1994 GR	None	

⁵ Senior Forester for NW3 qualifies “None” by noting that “very rarely” an operator will receive permission to “reach in” and remove a few trees from the buffer. The rationale in these cases would be the opportunity to access wood.

Table 2. Assessment of effectiveness of current OGR riparian policy in addressing the 12 riparian goals outlined in “Functions and goals of riparian areas in Alberta” ([Appendix 1](#))

Goal	Effectiveness of current riparian policy in addressing goal	Risks and implications of current policy not addressing goal
1. Maintain the integrity of stream cross-sectional profiles and the integrity of the bed and shore of the water body.	Generally provides adequate protection on streams with buffers (and may exceed goal requirements).	<ul style="list-style-type: none"> • Under-protects in certain cases (e.g. large flood plains where wind throw risk is high • Under-protects on streams with no buffers and streams where buffers are too narrow to prevent excessive windthrow (variances). Risk level depends on energy – higher risk on high-energy streams.
2. Maintain the capacity to reduce and dissipate stream energy over a full range of flows over the length of the watercourse.	Generally provides adequate protection on streams with buffers (and may exceed goal requirements).	<ul style="list-style-type: none"> • Under-protects in certain cases (e.g. large flood plains where wind throw risk is high Under-protects on streams with no buffers and streams where buffers are too narrow to prevent excessive windthrow (variances). Risk level depends on energy – higher risk on high-energy streams.
3. Maintain the capacity to trap, filter and/or remove sediments from flooding, as well as from down-slope surface flows.	May exceed requirements for this goal assuming that trees do not play a significant role in this goal. Goal more affected by soil infiltration capacity, maintenance of forest floor cover, retention of coarse woody debris and non-woody vegetation.	<ul style="list-style-type: none"> • High risk of sediment transport where management activities result in soil compaction, forest floor disturbance, and loss in ground and shrub vegetation. • Reduced effectiveness of trapping coarse woody debris may result from removal of riparian zone trees.
4. Minimize adverse changes in water chemistry	Adequate and may exceed goal requirements.	Low risk

Goal	Effectiveness of current riparian policy in addressing goal	Risks and implications of current policy not addressing goal
5. Minimize adverse changes in temperature regime of watercourses.	Generally provides adequate protection on streams with buffers (and may exceed goal requirements).	Under-protects on streams with no buffers and streams where buffers are too narrow to prevent excessive windthrow (variances) Potential increased variation in temperature in un-buffered streams. Implications for habitat suitability for some aquatic biota.
6. Maintain sources and inputs of organic material and large woody debris to aquatic ecosystems.	Generally provides adequate protection on streams with buffers (and may exceed goal requirements).	Under-protects on streams with no buffers and streams where buffers are too narrow to prevent excessive windthrow (variances) Reduced organic and large wood inputs to un-buffered streams.
7. Maintain permanent and intermittent watercourses and water bodies as habitat for fish and other aquatic biota.	Generally provides adequate protection on streams with buffers (and may exceed goal requirements).	Under-protects on streams with no buffers and streams where buffers are too narrow to prevent excessive windthrow (variances) Loss of aquatic habitat in intermittent streams.
8. Maintain terrestrial habitat for wildlife that use riparian areas.	Species dependent. Adequate protection for some species and inadequate protection for others	Species dependent. Potential loss of habitat and reduced use by some terrestrial species. Potential implications to local biodiversity.
9. Contribute to the maintenance of landscape connectivity and provide movement corridors for terrestrial animals along riparian areas and throughout watersheds.	Inadequate protection for larger mammals	<ul style="list-style-type: none"> • Under-protects on streams without buffers. Buffer widths on permanent streams may provide inadequate hiding cover for use as travel corridors. • Potential for habitat fragmentation and discontinued use of the corridor. • Adequately addressing objective requires an added constraint on timber supply. • Riparian management alone cannot

Goal	Effectiveness of current riparian policy in addressing goal	Risks and implications of current policy not addressing goal
		maintain habitat connectivity; riparian management is one factor that contributes to landscape level biodiversity objectives.
10. Maintain the characteristic microclimates, vegetation communities (including riparian old growth forest), and overall biotic diversity of riparian areas.	Generally provides adequate protection on streams with buffers.	<ul style="list-style-type: none"> • Under-protects on streams with no buffers and streams where buffers are too narrow to prevent excessive windthrow (variances) • Risk of shifting species composition, e.g. interior forested species to edge related species or from tree preferred species to shrub preferred species. • Highest risk associated with loss of old forest dependent species. • Under protects at stream confluences. • Reduction in snags, coarse woody debris, and large diameter trees along un-buffered streams. • Adequately addressing objective requires an added constraint on timber supply.
11. Minimize adverse cumulative effects on riparian area functions.	Partially supports achievement of this goal	<ul style="list-style-type: none"> • Current system does not integrate the impacts of other users (Oil/Gas, Grazing) • Lack of integration makes it difficult to achieve supporting strategies • Difficult to assess achievement of this goal

APPENDICES

- APPENDIX 1: Functions and Goals of Riparian Areas in Alberta**
- APPENDIX 2: Terms Of Reference: Riparian Management Committee**
- APPENDIX 3: Riparian management excerpt from 1994 OGR**
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APPENDIX 1: Functions and Goals of Riparian Areas in Alberta

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March 2005

Functions and Goals of Riparian Areas in Alberta

Purpose of this Document

This document is the result of a collaborative effort by the Public Lands and Forests Division and the Fish and Wildlife Division of Sustainable Resource Development to promote the integrity of riparian areas within the forested regions of the province. With intensification of land uses and the increasing rate of resource development within the Green Area, the identification of clear objectives for management of the various components of the forested landscape is a critical step in achieving integrated resource management and in meeting societal expectations. The importance of riparian areas far exceeds their minor proportion of the landbase because of their prominent location within the landscape and the intricate and inter-related linkages between terrestrial and aquatic ecosystems. Riparian areas are defined as three-dimensional zones of direct interaction between terrestrial and aquatic ecosystems (boundaries of the riparian zone extend outward to the adjacent vegetation, upward into the canopy, and laterally along the channel or bank).

This document identifies management goals for maintaining key riparian functions. The broad riparian management goals and supporting strategies described here are intended to:

- Maintain those key riparian ecological functions and processes that directly influence or affect resources (i.e., water, fish, wildlife and other biota) of management concern.
- Focus on resources that are found primarily in riparian areas or that are dependent upon riparian areas.
- Recognize and maintain the broader role riparian areas have as corridors linking ecosystems.
- Recognize and maintain the range of societal values associated with riparian ecosystems.

The goals and strategies described here are general in nature and are most relevant to forested areas of the province. They should be used to provide a basis for developing more specific and detailed riparian management objectives at a site, watershed or planning area scale. These objectives could be developed independently or as part of an integrated resource management planning exercise such as water management planning, detailed forest and operational planning, or other public land management planning process.

SRD vision for riparian areas

Maintain or enhance the structural and functional integrity of riparian areas and associated aquatic ecosystems to:

- *Maintain water quality and quantity and related ecosystem services,*
- *Maintain fish and wildlife populations, habitat, and biodiversity at all scales (i.e., temporal & spatial, including at site, area, landscape, watershed levels),*
- *Maintain the resilience of riverine and riparian systems to the cumulative impacts and effects of watershed disturbances, and to*
- *Maintain the ecological goods and services provided by healthy riparian areas.*

Riparian Area Functions

Riparian areas are an important part of the landscape - bordering rivers, lakes, wetlands and other water bodies. They form a continuum extending from ephemeral and intermittent streams to large permanent rivers in major river valleys. Riparian areas are the ecotone (i.e., the transition zone) between water and land and therefore have unique ecological processes, functions, structures and species.

Characteristics of riparian areas include:

- High water table.
- High biological productivity and diversity.
- Presence of species restricted to riparian areas.
- Presence of species combinations (ecosystems and plant communities) found only in riparian areas.

Healthy, functioning, natural riparian ecosystems contribute important ecological goods and services and societal benefits such as clean water, erosion and flood control, recreation opportunities, and cultural, historic and aesthetic values.

Key ecological functions “performed” by riparian areas include:

1. Trapping and storing sediment.

Resilient, diverse and multi-aged plant communities, woody debris, and infiltration capacity of soils in the riparian area decrease material transport rates and increase sediment capture rates. This process adds to and builds soils in the riparian area enhancing moisture retention, storage and primary productivity. The structural integrity and density of vegetation, woody debris and soil infiltration rates become more critical at high flow conditions (up to 1:100 year flood flows) and in areas with higher channel gradient and riparian slopes.

2. Building and maintaining banks and shorelines.

Woody debris and roots of resilient, diverse and multi-aged plant communities in riparian areas support bank and shoreline stability. Maintenance of stream bank profiles is a factor in stream channels remaining narrow and overflowing their banks more often thereby maintaining the width of riparian area influenced by a high water. Destabilization of stream banks results in a wider, shallower stream channel and altered habitats for aquatic biota. This can also result in increased anchor ice formation on small streams. Shoreline erosion can adversely affect critical fish habitats through sedimentation of littoral zones.

3. Reducing and dissipating energy.

The area over which the stream channel is expected to move over time is called the channel migration zone. Resilient, diverse and multi-aged plant communities and woody debris present within the riparian area support slower channel meander rates. In addition, riparian areas can function to dissipate energy and trap sediment during flood conditions when bank full capacity is exceeded. Since the energy to be dissipated increases from the headwaters to downstream, the width of the vegetated flood plain

involved in maintaining riparian function and processes is generally wider as one moves downstream.

4. Minimize changes in stream water chemistry

Nutrient concentrations in stream water are typically affected by natural (e.g., fire) and man-made (e.g., harvest) disturbances. Elevated phosphorus (P) concentrations in stream water following disturbances may occur and has been found to be strongly correlated with concentrations of suspended sediments. Significant fluctuations in P concentrations could occur in areas prone to overland sediment flow. The direct role of trees in nutrient filtering within treed buffers is weak. Organic soils within riparian zones may serve to denitrify nitrogen. Actions that enhance runoff from these wetlands may increase the export of nitrogen and dissolved organic carbon.

5. Regulation of water temperature regime

Water temperatures in watercourses are moderated by the shade of adjacent vegetation, especially tall shrubs and trees. There is also new evidence that soil temperature may indirectly affect stream water temperature by moderating the temperature of seepage water. The moderating effect of riparian vegetation begins in the ephemeral and intermittent drainages and is greater on small watercourses than large watercourses.

6. Provide habitat for aquatic organisms (Aquatic biodiversity)

- Woody debris is an important source of carbon for aquatic ecosystem food webs and provides important habitat structure for aquatic biota.
- Ephemeral and intermittent watercourses act as conduits for water, nutrients and food organisms to downstream watercourses and water bodies on a seasonal basis and for longer periods in wet years. Ephemeral and intermittent watercourses can provide important seasonal habitats for fish and intermittent water bodies are also important in the dispersal capability of amphibians and other semi-aquatic organisms.
- Riparian areas are a long-term source of organic matter providing for high rates of detrital-based productivity and transport downstream.

7. Provide habitat for terrestrial organisms (Terrestrial biodiversity)

- **Ungulate habitat:** Riparian areas, particularly along rivers and streams in well-defined valleys, often support high numbers of wildlife. Ungulates concentrate in these areas during winter because of the thermal cover, and because the steep slopes and ravines provide optimal mixes of food, cover and escape terrain. However, many ungulates also use riparian areas during periods of hot weather and drought. Treed riparian areas provide secure areas for bedding, parturition, and foraging.
- **Habitat connectivity:** Within landscapes managed for forest production, watercourse/water body buffers often provide vegetated corridors that link mature patches of forest. Forested corridors facilitate spatial and temporal movement among forest patches and maintain the meta-population dynamics that is important for long-term persistence of many wildlife species.
- **Unique vegetation communities:** Fertile soils and high moisture levels in riparian areas promote vigorous plant growth and a great diversity of biota. These attributes together create unique microclimates and unique species complexes. The biodiversity of the riparian area is a reflection of the complexity and diversity of

vegetation, vegetation age-class structure, vegetation vigor and the supply, orientation and size variation of large woody debris.

- **Large trees:** Larger and older trees often occur in riparian areas compared with upland areas due to differences in disturbance regimes and site productivity. Riparian forests often provide a disproportionate supply of large live trees, snags, and downed logs for use by cavity-nesting birds and other wildlife.
- **Adjacency to water:** Many species are dependent on the coexistence of water bodies, riparian areas, and upland forest.
- The confluence of streams and their associated riparian areas form critical habitat nodes on the landscape. Both aquatic and riparian habitats tend to be more productive and support a more diverse fauna at these nodes.

Riparian Management Goals and Supporting Strategies

Riparian management strategies must be designed to maintain the ecological functions and processes associated with riparian areas. Riparian management must also ensure resilience to single and multiple (cumulative) disturbance events within the watershed over the range of natural variation.

The riparian management goals and supporting strategies described in this document are intended to support existing government initiatives and policies such as:

- *Fish and Wildlife Policy for Alberta* (1982),
- *The Fish and Wildlife Division Strategic Plan* (1991),
- *A Fish Conservation Strategy for Alberta: 2000 – 2005*,
- *Wetland Management in the Settled Area of Alberta – An Interim Policy* (1993),
- *The Framework for Water Management Planning (including the Strategy for Protection of the Aquatic Environment)*,
- *Water for Life: Alberta's Strategy for Sustainability* (2004), and
- *Alberta Forest Management Planning Standard* (1998, in review).

This document describes higher-level goals and supporting strategies for maintaining the ecological functions and processes associated with riparian areas. The goals and supporting strategies are intended to provide a foundation for development of more specific riparian management objectives for a particular area or site.

The goals and supporting strategies are generally intended to apply to all riparian areas bordering watercourses and water bodies, however some may be more relevant to riparian areas bordering watercourses than water bodies, and vice versa. The following broad goals include goals related to physical parameters, goals related to aquatic and terrestrial biota, and goals related to biodiversity. The following list reflects this progression from physical to biological parameters and does not reflect on goal importance or priority.

1. Maintain the integrity of stream cross-sectional profiles and the integrity of the bed and shore of the water body.

Ecological function 1 and 2

Supporting Strategies:

- Retain live root systems of trees, shrubs, and other lesser vegetation as well as downed woody debris:
 - on banks and within the floodplain
 - where combinations of slope, soil type and stratification, and moisture lead to high risk of slope destabilization and mass wasting,
- Protect the soils in banks and floodplains from disturbance by avoidance of duff layer disturbance and soil compaction

2. Maintain the capacity to reduce and dissipate stream energy over a full range of flows over the length of the watercourse.

Ecological function 1, 2, and 3

Supporting Strategy:

- Retain plant communities and woody debris that are representative (i.e., have similar structural characteristics, species composition and age class) of those that would be found naturally:
 - over the width of the channel migration zone or the 1:100 year flood plain, which ever is greater,
 - at widths and densities relative to the energy within the watercourse

3. Maintain the capacity to trap, filter and/or remove sediments from flooding, as well as from down-slope surface flows.

Ecological function 1, 2, and 3

Supporting Strategies:

- Retain plant communities and woody debris that are representative (i.e., have similar structural characteristics, species composition and age class) of those that would be found naturally:
 - over the width of the channel migration zone or the 1:100 year flood plain, which ever is greater,
 - at widths and densities relative to the energy within the watercourse
 - Retain live root systems of trees, shrubs and other lesser vegetation where combinations of slope, soil type and stratification, and moisture lead to high risk of slope destabilization and mass wasting,
- Prevention of forest floor disturbance and soil compaction within a riparian zone.

4. Minimize adverse changes in water chemistry

Ecological function 4

Supporting Strategies:

- Prevention of significant fluctuations in P concentrations should concentrate on actions that prevent sediment transport to streamside, particularly in areas prone to overland sediment flow. The direct role of trees in nutrient filtering within treed buffers is weak.

- Organic soils within riparian zones may serve to denitrify nitrogen. Strategy is therefore to minimize actions that enhance runoff from these wetlands that could increase the export of nitrogen and dissolved organic carbon.

5. Minimize adverse changes in the temperature regime of watercourses.

Ecological function 5

Supporting Strategy:

- Retain the complex vegetation communities that contribute to overhead cover, shading and solar insulation on all water bodies (permanent, intermittent, ephemeral, and water source areas). Low vegetation cover is not as effective as high forest cover in providing shade and moderating water temperature.

6. Maintain sources and inputs of organic material and large woody debris to aquatic ecosystems.

Ecological function 6

Supporting Strategies:

- Retain plant communities over the width of the channel migration zone or the 1:100 year floodplain, whichever is greater,
- Retain plant communities and woody debris that are representative (i.e., have similar structural characteristics, species composition and age class) of those that would be found naturally on upland slopes leading to riparian areas so that woody debris inputs are the same as that which occurs within a natural disturbance regime to ensure:
 - Aquatic habitat structure is maintained
 - inputs of carbon (i.e., allochthonous material such as leaves, insects, branches and large woody debris) to aquatic ecosystems are maintained
 - Provide linkage between structure and function of physical processes and stream environments (River Continuum Concept)
- Retain riparian plants communities by preventing excessive blow down

7. Maintain permanent and intermittent watercourses and water bodies as habitat for fish and other aquatic biota.

Ecological function 6

Discussion - The function and resilience of these watercourse and water bodies is reduced by physical disturbance, sediment, nutrient, and chemical inputs resulting from industrial land use activities, which in turn affects downstream watercourses and water bodies.

Supporting Strategies:

- Retain live root systems of trees, shrubs and other lesser vegetation in the riparian areas adjacent to intermittent and ephemeral streams and water bodies and in riparian areas that are influenced by a high water table or saturated inter-flow.
- Retain the complex vegetation communities that contribute to overhead cover, shading and solar insulation on all water bodies (permanent, intermittent, ephemeral, and water source areas).
- Ensure that fish and aquatic habitat in intermittent and ephemeral water bodies remains connected with permanent water bodies so that aquatic biota can move throughout the watershed.

- Prevent in-stream activities in intermittent and ephemeral water bodies used by fish for spawning and migration. (Note: any activity in or affecting the bed and shore of a water body is regulated under the Water Act and the Public Lands Act; any activity affecting fish habitat is regulated under the Federal Fisheries Act)

8. Maintain terrestrial habitat for wildlife that use riparian areas.

Ecological function 7

Supporting Strategies:

- Retain trees and shrubs in riparian areas to minimize thermal stress on wildlife and for their value as nesting and foraging areas for riparian-dependent birds.
- Retain hiding cover and escape terrain next to water bodies where large mammals can be secure from predators while they forage.

9. Contribute to the maintenance of landscape connectivity and provide movement corridors for terrestrial animals along riparian areas and throughout watersheds.

Ecological function 7

Discussion - Wider corridors are used by more species than small corridors because some species avoid forest edges. Since riparian systems tend to be linear, it often is possible to manage watercourse/water body buffers as extensive travel corridors. Appropriate placement/arrangement of discrete residual patches can also function as stepping-stones in movement corridors. These areas also provide important habitat for a variety of other wildlife including small mammals, furbearers and birds.

Supporting Strategies:

- Provide forested travel corridors on both sides of watercourses throughout and between watersheds for wildlife that require tree cover for secure travel.
- Provide appropriate placement/arrangement of discrete residual patches to function as stepping stones in movement corridors
- Distribute thermal and hiding cover along riparian areas to facilitate ungulate movement throughout and between watersheds

10. Maintain the characteristic microclimates, vegetation communities (including riparian old growth forest), and overall biotic diversity of riparian areas.

Ecological function 7

Supporting Strategies:

- Retain vegetation communities adjacent to water bodies that are representative of the species composition and age class within a natural disturbance regime.
- Retain vegetation communities along the banks of water bodies to provide overhead cover for aquatic species.
- Retain the abundance and diversity of habitat structures (live trees, snags, shrubs, down woody materials) and microclimates within riparian areas.
- Protect special riparian habitats supporting native plants, animals, other biota, (including rare and endangered species) and the unique communities of which they are a part.
- Provide habitat for species that depend on large live trees, snags, and downed logs (e.g. cavity dependent species, raptors, bats, squirrels, wood boring beetles) by retaining areas of old forest adjacent to water bodies and riparian habitat.

- Provide additional habitat protection at tributary confluences to protect the unique habitats found there.

11. Minimize adverse cumulative effects on riparian area functions

Ecological functions 1-7

Discussion – Although forested-riparian buffers help with the management of fish, wildlife and other native biota, buffers by themselves will be insufficient if much of the forests in adjacent lands are degraded in habitat suitability by industrial/human activities. To prevent fragmentation and to provide habitats for interior forest species, old growth forest specialists and species with large home ranges, landscape management strategies must include combined blocks of upland and riparian forest. As well, it may be necessary to set thresholds on the type and amount of human disturbance in managed landscapes (i.e., within watersheds). As part of any strategy to conserve biodiversity by partitioning the landscape into areas subjected to different levels of land management intensity, riparian areas can serve as areas retained primarily for conservation purposes with upland areas providing for more intensive levels of activity.

Supporting strategies:

- Reduce the number of stream crossings.
- Ensure crossings are well-constructed and maintained.
- Minimize human disturbances in riparian areas (well sites, roads, pipelines, gravel extraction).

APPENDIX 2: TERMS OF REFERENCE: Riparian Management Committee

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Authorized by: Senior Management - Forest Management Branch and Fish and Wildlife Division – Alberta Sustainable Resource Development

Date: December 2003

Background context:

The management of riparian areas in Alberta forest operations is guided by the 1994 Ground Rules. The creation of region-specific ground rules and the application for variances are provided for in the current policy. Several forest companies have been developing their own approaches to riparian management. This has resulted in uncertainty on the current practice of riparian management in Alberta. In addition, there is a growing perception that the flexibility in the current policy may be allowing riparian management to evolve with no coherent direction. This uncertainty of practice and potential lack of consistent direction could result in provincial riparian management objectives being compromised.

Purpose:

To address these concerns a review committee will:

- Evaluate current policy and practice of green zone riparian management in Alberta in the context of requests for variances and the development of local ground rules.
- Confirm understanding of the values and objectives of riparian areas.
- Assess need for changes to current policy and practice. Ensure that riparian management occurs within a consistent policy environment that meets provincial objectives.
- Provide general recommendations to senior management in the Forest Management Branch and the Fish and Wildlife Division on future directions. The development of specific policy recommendations would be left to a future process.

Deliverable:

Content of discussion/review paper:

1. Inventory of current operating ground rules around the province. Document the deviation from provincial ground rules (i.e. what proportion of provincially-specified buffers are harvested in some way).
2. Assess benefits/risks of current practice of riparian management.
3. Values and objectives for riparian areas.
4. Riparian terminology and definitions
5. Research priorities
6. Recommend future SRD direction (general)
7. *SRD expectations/criteria (information bulletin format) regarding when variances would be considered. Information bulletin to be included in new Forest Planning Manual. (committee to discuss inclusion in current review)*

The next points could be included in this review but may also be left to a future process in which specific policy recommendations are developed.

8. Watercourse classification issues

Discussion paper to be submitted to senior management of the Forest Management Branch and the Fish and Wildlife Division by spring 2004.

Committee Structure:

Membership: The Riparian Management Review Committee is comprised of representatives from the Public Land and Forest and Fish and Wildlife Divisions of ASRD. The membership is:

- Dave Borutski (Fish and Wildlife Division)
- Jamie Bruha (Forest Management Branch)
- Gerry Haekel (Land Use Operations Branch)
- Terry Kosinski (Fish and Wildlife Division)
- Travis Ripley (Fish and Wildlife Division)
- John Stadt (Forest Management Branch)
- Barry White (Forest Management Branch)

Chair: J. John Stadt

Meetings: No firm meeting schedule has been determined. Meetings will be called when necessary to meet committee objectives.

Term of the committee: Committee disbands once deliverables completed in the spring of 2005.

APPENDIX 3: Riparian management excerpt from *Alberta Timber Harvest Planning and Operating Ground Rules 1994*

Alberta Timber Harvest Planning and Operating Ground Rules 1994

Riparian Management excerpt

3.2 Watershed Protection and Harvest Planning

OBJECTIVE: To design harvest layouts that minimize the impacts of harvest operations on water yield, regime and quality, watercourse structure, soils, cover and riparian habitat for fish and wildlife.

STANDARDS:

1. Watercourses shall be evaluated and classified according to Table 1 (Watercourse Classification).
2. Streamside protection buffers shall be incorporated according to the standards prescribed in Table 2 (Standards and Guidelines for Operating Beside Watercourses).
3. Where water-source areas coincide with highly productive fish and wildlife habitat, timber harvest operations shall be approved only if the impacts can be avoided or mitigated.
4. On sensitive or complex sites, detailed cutblock plans shall be required for road construction, harvest, reforestation and reclamation. The intensity of planning required is determined by the complexity and sensitivity of the site and the degree of disturbance expected (see Subsection 1.3 in Appendix 2).
5. Where watersheds are managed for water regulation, or to support important aquatic resources, watershed assessments shall be provided to the timber operator and harvest designs must meet identified water management objectives.
6. Water-source areas shall be identified using procedures described in the Predisturbance Watershed Assessment Manual (ENR Pub. T/100).

GUIDELINES:

1. Conditions in water-source areas may differ between sites and buffers may be altered from the above standards according to the potential of the source area within the buffer to produce surface water, provided this is approved in the AOP and there are no other resource concerns.
2. Normally, harvesting on sustained slopes steeper than 45 percent should not be approved. In special circumstances where harvesting is approved, it should be done during the time of year and in a manner that will minimize the potential for soil erosion. Detailed cutblock plans are required for these areas.
3. Timber operators should cooperate to plan and coordinate their reclamation activities when separate harvest operations are conducted on the same cutblocks.

For other standards and guidelines that apply to watershed protection, see Subsection 4.3.2.

3.3 Watershed Protection During Operations

OBJECTIVE: To conduct timber harvest, reforestation and reclamation operations in a way that will:

- a. minimize the potential for soil erosion;**
- b. prevent soil, logging debris and deleterious materials from entering watercourses;**
- c. ensure that the capability of the site to support healthy forest tree growth is maintained; and**
- d. minimize the impact of logging on other resources;**

STANDARDS:

1. Watercourse protection buffers are required beside permanent streams, rivers and lakes, and can be required for intermittent watercourses where fisheries values are present, in accordance with Table 2. Logging will not normally be permitted within protection buffers. Where a proposal to harvest is submitted, the operator must demonstrate that fish and wildlife habitat will be maintained or enhanced and watershed values protected. All operations proposed in watercourse protection buffers are to be described in the AOP.
2. Care is to be taken to minimize damage to the soil's structure, density, fertility, drainage or porosity, especially during periods when it is water saturated.
3. Where the capability of the soil to grow trees is reduced, reclamation techniques shall be applied with the objective of restoring site productivity.
4. Forest Superintendent approval is required to harvest timber from streamside or other protection buffers not specifically approved in the AOP. Such requests are subject to the appropriate referral.
5. Soil, logging debris or deleterious materials shall not be deposited into the water or onto the ice of any watercourse or waterbody during road construction, harvest, reclamation or reforestation operations. Such material unavoidably deposited onto the ice surface must be removed immediately.
6. Any previously unknown and unmapped creek(s) encountered during any operations shall be given the protection prescribed in Table 2 for its class.
7. Site preparation equipment shall be permitted to cross permanent and intermittent watercourses only at approved crossings.
8. Every timber operator is responsible for completing reclamation work required as a direct result of his operations.

GUIDELINES:

1. During harvest, reforestation or reclamation operations, activities that cause wheel or track ruts should be avoided or stopped.
2. Logs should not be decked in a manner that causes damages to soils, watercourses or water-source areas. Decks placed on water-source areas during frozen periods should be removed before the ground thaws.

Standards and guidelines for operating beside watercourses, water-source areas and lakes are summarized in Table 2.

Table 1 - Watercourse Classification

Watercourse Classification	Mapping Designation	Physical Description	Portion of Year Water Flows	Channel Development	Fish and Wildlife Concerns	Land Use Impact
Large Permanent	<ul style="list-style-type: none"> • Solid heavy line or double line 	<ul style="list-style-type: none"> • Major streams or rivers. • Well-defined flood plains. • Valley usually exceeds 400m in width. 	<ul style="list-style-type: none"> • All year. 	<ul style="list-style-type: none"> • Unvegetated channel width greater than 5m. 	<ul style="list-style-type: none"> • Resident fish populations. • Important over-wintering habitat. • Important feeding and rearing habitat. 	<ul style="list-style-type: none"> • Water quality often reflects all upstream land use impacts and natural processes. • Primarily sedimentation of stream channels.
Small Permanent	<ul style="list-style-type: none"> • Usually solid although some are heavy broken lines. 	<ul style="list-style-type: none"> • Permanent streams. • Often small valleys. • Bench (floodplain) development. 	<ul style="list-style-type: none"> • All year but may freeze completely in the winter. 	<ul style="list-style-type: none"> • Banks and channel well-defined. • Channel width 0.5m to 5m. 	<ul style="list-style-type: none"> • Significant insect populations. • Important spawning and rearing habitat. • Resident fish populations. • Overwintering for non-migratory species. 	<ul style="list-style-type: none"> • Primarily sedimentation of stream channels. • Water quality. • Fish populations sensitive to siltation. • Loss of streambank fish habitat.
Intermittent	<ul style="list-style-type: none"> • Usually broken light line. • Should be identified on the ground. 	<ul style="list-style-type: none"> • Small stream channels. • Small springs are main source outside periods of spring runoff and heavy rainfall. 	<ul style="list-style-type: none"> • During wet season or storms. • Dries up during drought. 	<ul style="list-style-type: none"> • Distinct channel development. • Usually channel is unvegetated. • Channel width to 0.5m • Some bank development. 	<ul style="list-style-type: none"> • Food production areas. • Potential spawning for spring spawning species. • Drift invertebrate populations in pools and riffles. 	<ul style="list-style-type: none"> • Sedimentation from bank and streambed damage will damage fish habitat downstream.
Ephemeral	<ul style="list-style-type: none"> • Not normally mapped. 	<ul style="list-style-type: none"> • Often a vegetated draw. 	<ul style="list-style-type: none"> • Flows only during or immediately 	<ul style="list-style-type: none"> • Little or no channel development. • Channel is usually 	<ul style="list-style-type: none"> • Siltation may impact fish habitat. 	<ul style="list-style-type: none"> • Sedimentation downstream due to ground disturbance.

			after rainfall and snowmelt.	vegetated.		
Water-source Areas (except muskegs)	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> Areas with saturated soils or surface flow. Seepages. 	<ul style="list-style-type: none"> All year. May or may not freeze in the winter. 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> Potential high value to fall spawners. Potential high-use areas for terrestrial wildlife. 	<ul style="list-style-type: none"> Disturbance may cause stream sedimentation. Interruption of winter flow may disrupt fish egg incubation.
Lakes	<ul style="list-style-type: none"> Solid line outline a waterbody. Reserved areas will be noted on referral map. 	<ul style="list-style-type: none"> Large water collection areas permanently filled with water. 	<ul style="list-style-type: none"> Normally frozen in the winter. 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> Important fish-bearing habitat. 	<ul style="list-style-type: none"> Aesthetic values may be disrupted. Potential for wildlife disturbance. Local sedimentation.

Table 2 - Standards & Guidelines for Operating Beside Watercourses

Watercourse Classification	Roads, Landings and Bared Areas	Watercourse Protective Buffers	Operating Conditions Within Buffers and Water-Source Areas Where Operations are Approved	
			Tree Felling	Equipment Operation
Large Permanent	<ul style="list-style-type: none"> Not permitted with 60 m of the high-water mark or from water-source areas within that buffer. May be permitted within 60 - 100m of the high-water mark with written approval of a Forest Officer. 	<ul style="list-style-type: none"> No disturbance or removal of merchantable timber within 60m of the high-water mark except where specifically approved in the Annual Operating Plan. 	<ul style="list-style-type: none"> Trees will normally be felled so they do not enter the watercourse. The objective is that no slash or debris is to enter the watercourse. Should slash or debris enter the watercourse, immediate removal is required without a machine entering the watercourse. 	<ul style="list-style-type: none"> Where removal of timber within 60m is approved, no machinery is to operate within 20m of the high-water mark. Timber within 20m shall be removed by winching or other means such that the machine stays outside of the 20m strip. Where possible, topographical breaks should be used as protection strip boundaries.
Small Permanent	<ul style="list-style-type: none"> Not permitted within 30 m of the high-water mark or from water-source areas within that buffer. May be permitted within 30- 100 m of the high-water mark with written approval of a Forest Officer. 	<ul style="list-style-type: none"> No disturbance or removal of merchantable timber within 30 m of the high-water mark except where specifically approved in the Annual Operating Plan. 	<ul style="list-style-type: none"> Trees will normally be felled so they do not enter the watercourse. The objective is that no slash or debris enter the watercourse. Should slash or debris enter the watercourse, immediate removal is required without a machine entering the watercourse. 	<ul style="list-style-type: none"> Where removal of timber within 30m is approved, no machinery shall operate within 20m of the high-water mark. Timber within 20 m shall be removed by winching or other means such that the machine will remain outside the 20m strip. Where, possible, topographical breaks should be used as protection boundaries.
Intermittent	<ul style="list-style-type: none"> Not permitted within 30 m of the high-water mark or water-source areas within that buffer. 	<ul style="list-style-type: none"> Buffer of brush and lesser vegetation to be left undisturbed along the channel. Width of buffer will vary according to soils, topography, water-source areas and fisheries values. Treed buffer is not required unless specifically requested by a Forest Officer 	<ul style="list-style-type: none"> Trees will be felled so they do not enter the watercourse unless otherwise approved. Should slash or debris enter the watercourse, immediate removal is required without the machine entering the watercourse. 	<ul style="list-style-type: none"> Heavy equipment may operate within 20 m only during frozen or dry periods. No random, skidding through watercourse channels. Crossings must be planned with adequate crossing structures. Crossings are to be removed on completion of operations. Where fish and spawning movements have been identified, Special crossings that will not obstruct upstream fish passage or cause stream siltation may be required.
Ephemeral	<ul style="list-style-type: none"> Construction not 	<ul style="list-style-type: none"> Buffer of lesser 	<ul style="list-style-type: none"> Large accumulations of slash or debris 	<ul style="list-style-type: none"> Random skidding through watercourse

	permitted within a watercourse or a water-source area.	vegetation in wet gullies to be left undisturbed.	accumulations be removed progressively.	permitted only during frozen or dry ground periods. <ul style="list-style-type: none"> Temporary crossings are to be removed on completion of operations.
Lakes (little or no recreation, waterfowl or sport fishing potential)	<ul style="list-style-type: none"> Not permitted within 100m of the high-water mark without written approval of a Forest Officer. 	<ul style="list-style-type: none"> On lakes exceeding 16ha in area, there will be no disturbance of timber within 100m of the high-water mark except where specifically approved in the Annual Operating Plan. 	<ul style="list-style-type: none"> Trees within these areas shall be felled away from the waterbody. No slash or debris shall enter the waterbody. 	<ul style="list-style-type: none"> If timber removal is approved, no machinery is to operate within 20m of the high-water mark.
Lakes (with recreational, waterfowl or sport fishing potential)	<ul style="list-style-type: none"> For shorelines not located within reserved areas, no disturbances will be permitted within 200 m of the high-water mark without the written approval of the Forest Superintendent. 	<ul style="list-style-type: none"> On lakes exceeding 4 ha in area, there will be no disturbance or removal of timber within 100 m of the high-water mark except where specifically approved in the Annual Operating Plan. 	<ul style="list-style-type: none"> Trees will be felled so they do not enter the waterbody. No slash or debris shall enter the waterbody. 	<ul style="list-style-type: none"> If timber removal is approved, no machinery is to operate within 20 m of the high-water mark. Consideration must be given to aesthetics when harvesting adjacent to lakes with recreational potential. Any timber harvesting within reserved areas shall be conducted subject to specific operating conditions.
Water-source Areas and Areas Subject to Normal Seasonal Flooding.	<ul style="list-style-type: none"> Construction not permitted unless approved in the Annual Operating Plan. No log decks permitted. The number of stream crossings must be minimized. No disturbance of organic duff layers or removal of lesser vegetation. 	<ul style="list-style-type: none"> Treed buffers of at least 20 m on all streams. No harvest of merchantable trees or disturbance of lesser vegetation unless approved in the Annual Operating Plan. Buffer width may be altered according to its potential to produce surface water, provided it is approved in the Annual Operating Plan. 	<ul style="list-style-type: none"> Heavy machinery not permitted in the water-source areas during unfrozen soil conditions. Minimal disturbance or removal of duff or lesser vegetation. Timber may be harvested if stream sedimentation is the only resource concern, provided there is no disturbance of the organic soils and lesser vegetation when harvesting the trees. On unstable areas subject to blowdown, merchantable trees should be carefully harvested from water- source areas to minimize root disturbances of duff layers and watercourse damming. 	<ul style="list-style-type: none"> Road construction, timber harvest, reforestation and reclamation shall be done with equipment capable of operating without causing excessive disturbance to the organic soil layers. Heavy equipment is not permitted during moist or wet soil conditions. May be operated during frozen periods according to specific conditions in the approved Annual Operating Plan. No dirt caps or depositing of soil will be permitted on roads in water-source areas, unless a separation layer is incorporated or the road is designed to provide adequate surface and subsurface drainage away from the road-bed. Where a separation layer is used, the soil cap shall be removed as operations are completed.

NOTE: Limitations on any logging machinery within water-source areas also apply to scarification equipment.

APPENDIX 4: Riparian management excerpt in proposed *Alberta Timber Harvest Planning and Operating Ground Rules and Framework for Renewal* in the December 2004 draft of the *Alberta Forest Management Planning Standard*

Alberta Forest Management Planning Standard (December 2004 draft)

Annex 4: Alberta Timber Harvest Planning and Operating Ground Rules and Framework for Renewal.

Riparian excerpt

6.0 WATERSHED PROTECTION

PURPOSE

To manage the implications of timber operations on water quality, quantity, and flow regime by:

- minimizing the potential for sedimentation in watercourses
- preventing soil, logging debris and deleterious substances from entering watercourses
- maintaining aquatic and terrestrial habitat
- complying with the Water Act.

DISCUSSION

The FMP shall address watershed water quantity and flow issues. Ground rules define operating practices to protect water quality and riparian values.

Riparian areas adjacent to watercourses and water source areas perform a number of ecological functions. Riparian areas help to regulate stream flows (storage and release of surface and groundwater), reduce sheet, rill and gully erosion, and moderate stream temperature. Functional riparian areas provide bank stability, debris for creating aquatic habitats, and provide a source of food and nutrients for aquatic organisms. Riparian areas also provide habitats supporting a high diversity of wildlife species and other terrestrial biota, and provide corridors that can link different landscape and habitat features.

GROUND RULES

- 6.1. Watercourses have been classified according to Table 1, Watercourse Classification.**
In the event the channel classification is not distinctly evident, the width shall be determined by the average of measurements taken at 50m intervals over the length of the watercourse bordering the block. Where the distance bordering the block is not enough for two measurements, reduce the measurement interval distance to 25m.
- 6.2. Predicted average annual water yield increase does not exceed 15% in third-order streams unless otherwise approved in a FMP.**
 - 6.2.1. Predicted change in water yield has been reported annually in a format acceptable to Alberta.**
- 6.3. Measures have been implemented, including temporary and permanent erosion control measures, to minimize erosion and sedimentation into the watercourse or waterbody.**
- 6.4. Riparian protection areas have been established according to Table 2, Standards and Guidelines for Operating beside Watercourses.**

Where uncertainty exists on the classification of the watercourse, the protection area shall default to the larger protection area.

- 6.5. All unmapped or incorrectly classified watercourses encountered during operations have been given the appropriate protection as described in Table 2.**
- 6.6. Proposals that vary from the standards in Table 2 demonstrate that aquatic and terrestrial objectives are met unless otherwise approved in a FMP.**
Any such proposals shall undergo a full review by Alberta prior to being considered for approval.
- 6.7. Road construction, maintenance, harvesting, reclamation or silviculture operations have not deposited sediment, logging debris or deleterious materials into the water or onto the ice of any watercourse or water body.**
Examples of deleterious materials are fuels, oils, greases, industrial and household chemicals and refuse.
- 6.8. Only approved crossings have been used by equipment to cross watercourses.**
- 6.9. Logs have not been decked in watercourses, riparian areas, or seepage areas.**
- 6.10. Authorized in-stream activities in fish-bearing watercourses have been scheduled to avoid disturbing migration, spawning and incubation of fish species, and carried out in such a manner as to avoid stream sedimentation.**
Any in-stream activities may require a letter of advice from the Department of Fisheries and Oceans.
- 6.11. Beaver ponds have been classified the same as the watercourse flowing out of the pond as measured at the smallest width within 50m of the dam.**
- 6.12. Harvesting within water source areas has been conducted during frozen periods only.**

Table 1. Watercourse Classification

Watercourse Classification					Fisheries/Wildlife Values	Potential Impacts
Type	Mapping Designation	Physical Description	Portion of Year Water Flows	Channel Development		
Class "A" Waterbodies	Solid Red Line on Watercourse Crossing Codes of Practice (Water Act)	Not applicable	Not applicable	Not applicable	Known habitats critical to the continued viability of locally or regionally important fish species; Habitat areas are sensitive enough to be damaged by any type of in-stream activity or changes to water quality or flow regime	Fish and fish habitat affected by sediment load, turbidity, disposition of sediment, chemical contamination or alteration of stream flow
Class "B" Waterbodies	Solid (Variable Colour) lines overlain by small circles on Watercourse Crossing Codes of Practice (Water Act)	Not applicable	Not applicable	Not applicable	Key broadly distributed habitat areas important to the continued viability of a population of locally or regionally important fish species; Habitat areas are sensitive enough to be potentially damaged by in-stream activities; Potential short and long-term effects of in-stream activities considered to have detrimental effects on, and are high risk to, the survival of fish populations	Fish and fish habitat affected by sediment load, turbidity, disposition of sediment, chemical contamination or alteration of stream flow
Large Permanent	Solid heavy line or double line	Major streams or rivers; Well-defined flood plains; Often wide valley bottoms	All year	Non-vegetated channel width exceeds 5m	Resident and migratory fish populations; Important over wintering, feeding and rearing habitat; Important wildlife feeding/travel corridors	Water quality often reflects all upstream land use impacts and natural processes; Primarily sedimentation of stream channels; Loss of wildlife habitat, restriction of movement
Small Permanent	Usually solid although are sometimes broken heavy lines	Permanent streams; Often small valley bottoms; Bench floodplain) development	All year but may freeze completely in the winter or dry up during periods of drought. Some are 'transitional' to intermittent and dry up during drought	Banks and channel well-defined Channel width from greater than 0.7m to 5m Transitional streams channel widths are generally between .4 and 0.7 meters	Significant insect populations; Important spawning and rearing habitat; Resident and migratory fish populations; Over wintering for non-migratory species; Important wildlife feeding/travel corridors;	Primarily sedimentation of stream channels; Water quality and water yield; Fish population sensitive to siltation; Loss of stream bank fish habitat; Loss of wildlife habitat, restriction of movement

Continued...

Table 1. Watercourse Classification (continued)

Watercourse Classification					Fisheries/Wildlife Values	Potential Impacts
Type	Mapping Designation	Physical Description	Portion of Year Water Flows	Channel Development		
Intermittent	Usually broken line; To be identified during layout.	Small stream channels; Small springs are main source outside periods of spring runoff and heavy rainfall	During the wet season or storms Dries up during drought	Distinct channel development; Channel usually has no terrestrial vegetation; Channel width less than 0.4m; Usually some bank development	Food production areas; Potential spawning for spring spawning species; Drift invertebrate populations in pools and riffles; Spring fed areas may provide spawning potential for fall spawning species	Sedimentation from bank and streambed damage will damage fish spawning and invertebrate habitat as well as downstream fish habitat; Water quality and water yield
Ephemeral	Not normally mapped	Often a vegetated draw	Flows only during or immediately after rainfall or snowmelt	Little or no channel development; Flow area is usually vegetated	Siltation may impact fish habitat downstream	Sedimentation downstream due to ground disturbance
Water-Source Areas	To be identified during layout	Areas with saturated soils, surface flow or seepages	All year May or may not freeze in winter	No channel development, but may be pronounced vegetation changes	Year-round springs provide potential value to fall spawning fish; Potential high-use areas terrestrial wildlife	Disturbance may cause downstream sedimentation; Interruption of winter flow may disrupt fish egg incubation; Loss of mineral licks
Lakes	Solid outline a water body Reserved areas noted on referral map	Large water collection areas permanently filled with water	Normally frozen in winter	Shorelines defined by absence of permanent terrestrial vegetation	Important fish-bearing habitat; Important bird nesting/rearing areas	Aesthetic values may be disrupted; Potential for wildlife disturbance; Local sedimentation
Oxbow Lakes	Solid Heavy or Outline	Large water collection area formed when oxbow cut off from main river channel.- Often vegetated	Normally frozen in winter	N/A	Important habitat for ungulates	Thermal cover/grazing areas

Table 2. Standards and Guidelines for Operating Beside Watercourses

Watercourse Classification	Roads, Landings, Decking and Bared Areas	Watercourse Protection Areas	Operating Conditions Within Riparian Areas and Water Source Areas Where Operations are Approved	
			Tree Felling	Equipment Operation
Class “A” Waterbodies	Not permitted within 100m of high water mark. Any existing roads may be maintained at present classification standards. Any proposed watercourse crossings within 2 km upstream must be specifically approved in the AOP	No disturbance or removal of timber within 100m of the high water mark; No duff disturbance of intermittent (min 10m vegetated buffer) or ephemeral drainages (minimum 5m vegetated buffer) within 2 km upstream of Class A waterbody.	Not permitted without specific Alberta approval	Not allowed without specific Alberta approval.
Class “B” Waterbodies	Not permitted within 60m of high water mark. Any existing roads may be maintained at present classification standards. Any watercourse crossings within 500m upstream must be specifically approved in the AOP	No disturbance or removal of timber within the appropriate riparian area specified by stream type unless specifically approved in the AOP; No duff disturbance of intermittent (minimum 10m vegetated buffer) or ephemeral drainages (minimum 5m vegetated buffer) within 500m upstream of Class B waterbody.	Trees shall be felled so that they do not enter watercourse. Should slash or debris enter the watercourse immediate removal is required without a machine entering the watercourse.	Where removal of timber within 60m is approved, no machinery is permitted within 30m of the high water mark.
Large Permanent	Not permitted within 100m of the high water mark or water source areas within the riparian management zone unless specifically approved in the AOP.	No disturbance or removal of timber within 60m of high water mark unless specifically approved in the AOP. No removal of timber shall be approved within 10 m of the high water mark.	Trees shall be felled so that they do not enter watercourse. Should slash or debris enter the watercourse immediate removal is required without a machine entering the watercourse.	Where removal of timber within 60m is approved, no machinery is permitted within 20m of the high water mark;
Small Permanent	Not permitted within 30m of the high water mark or water source areas within the riparian management zone unless specifically approved in the AOP	No disturbance or removal of timber within 30m of high water mark unless specifically approved in the AOP. No removal of timber shall be approved within 10 m of the high water mark. Transitional streams: Buffer of treed vegetation will be left for 10m from the high water mark or to the top of the break in slope, which ever is further	Trees shall be felled so that they do not enter watercourse. Should slash or debris enter the watercourse immediate removal is required without a machine entering the watercourse.	Where removal of timber within 30m is approved, no machinery is permitted within 20m of the high water mark;

Continued...

Table 2. Standards and Guidelines for Operating Beside Watercourses (continued)

Watercourse Classification	Roads, Landings, Decking and Bared Areas	Watercourse Protection Areas	Operating Conditions Within Riparian Areas and Water Source Areas Where Operations are Approved	
			Tree Felling	Equipment Operation
Intermittent	Not permitted within 30 m of the high water mark or water source areas within the riparian management zone unless specifically approved in the AOP.	Buffer of brush and lesser vegetation to be left undisturbed along the channel; Width of buffer shall vary according to soils, topographical breaks, water source areas and fisheries values.	Trees shall be felled so they do not enter watercourses, unless otherwise approved by Alberta. Should slash or debris enter the watercourse, immediate removal is required without the machine entering the watercourse.	Heavy equipment may operate within 20 m only during frozen or dry periods. No skidding through watercourse except on snow/ice bridge or logfill. Crossings must be planned with adequate crossings to be removed on completion of operations. Where fish and spawning movements have been identified, special crossings that do not obstruct upstream fish passage or cause stream siltation may be required.
Ephemeral	Construction not permitted within a watercourse or water source area.	Buffer of undisturbed vegetation in wet gullies, Class "A" and "B" waterbody tributaries to be left undisturbed.	Accumulations of slash and debris to be removed progressively	Skidding restrictions apply on Class "A" and "B" waterbody tributaries; Temporary crossings to be removed on completion of operations; On Class "A" and "B" waterbody tributaries, special crossing structures that do not cause stream siltation may be required.
Lakes (little or no recreation, waterfowl or sportfish potential)	Not permitted within 100 m of high water mark unless specifically approved in the AOP.	On lakes exceeding 4 ha in area, no disturbance of timber within 100 m of high water mark except where specifically approved in FHP. Where approval is granted to remove timber within the 100m zones, no timber shall be removed within 30m of the high water mark.	Trees shall be felled so they do not enter watercourses, unless otherwise approved by Alberta. Should slash or debris enter the watercourse, immediate removal is required without the machine entering the watercourse	If timber removal is approved, no machinery to operate within 40 m of the high water mark.

Table 2. Standards and Guidelines for Operating Beside Watercourses (continued)

Watercourse Classification	Roads, Landings, Decking and Bared Areas	Watercourse Protection Areas	Operating Conditions Within Riparian Areas and Water Source Areas Where Operations are Approved	
			Tree Felling	Equipment Operation
Lakes (with recreational, waterfowl or sport fish potential)	For shorelines not located within reserved areas, no disturbances shall be permitted within 200 m of the high water mark unless specifically approved in the AOP.	On lakes exceeding 4 ha in area, no disturbance or removal of timber within 100 m of the high-water mark. Alberta in the FHP may require additional protection. On lakes less than 4 ha, removal of timber prohibited within 30 m of the high-water mark and any removal within 100 m requires Alberta's approval.	Trees shall be felled so they do not enter the waterbody, unless otherwise approved; Should slash or debris enter the watercourse, immediate removal is required without the machine entering the watercourse.	Consideration must be given to aesthetics when harvesting adjacent to lakes with recreational potential.
Water source Areas and Areas Subject to Normal Seasonal Flooding	Construction not permitted unless approved in the AOP; No log decks permitted; The number of stream crossings must be minimized; No disturbance of organic duff layers or removal of lesser vegetation.	Treed riparian management zone of at least 20 m on all water source areas; No harvest of merchantable trees or disturbances of lesser vegetation unless specifically approved in the AOP; Buffer width may be altered according to its potential to produce surface water, provided it is approved in the AOP	Heavy machinery not permitted with in water source areas during unfrozen soil conditions; Minimal disturbance or removal of duff or lesser vegetation; Timber may be harvested if stream sedimentation is the only resource concern, provided there is no disturbance of the organic soils and lesser vegetation when harvesting the trees; On unstable areas subject to blowdown, merchantable trees shall be carefully harvested from water source areas to minimize root disturbances of duff layers and watercourse damming.	Road construction, timber harvest, reforestation and reclamation shall be done with equipment capable of operating without causing excessive disturbance to the soil layers; Heavy equipment is not permitted during moist or wet soil conditions, but may be operated during frozen periods; No soil caps or depositing of soil permitted on roads in water source areas, unless a separation layer is incorporated or the road is designed to provide adequate surface and sub-surface drainage away from the road bed; Where a separation layer is used, the soil cap shall be removed as operations are completed.
Oxbow Lake	Construction not permitted within 100m of oxbow lake unless specifically approved in the FHP.	Operational buffer of brush and lesser vegetation to be left undisturbed along the channel;	Heavy equipment not permitted around oxbow lakes during unfrozen conditions. Trees shall be felled so they do not enter the waterbody, unless otherwise approved; Should slash or debris enter the watercourse, immediate removal is required without the machine entering the watercourse.	Approved activities shall be done with equipment capable of operating without causing excessive disturbance.