LIVESTOCK GRAZING NEAR WATER

Whenever agriculture and riparian issues are discussed, attention soon turns to livestock access to water bodies.

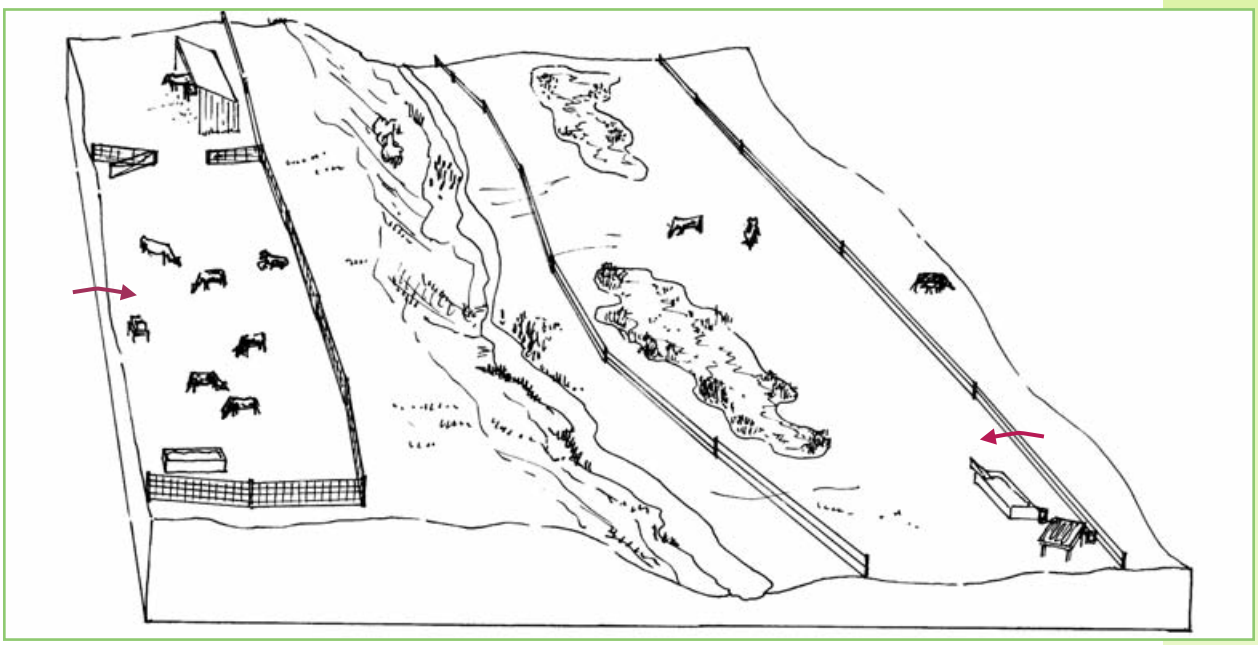
Historically, riparian areas have been viewed as important parts of grazing or livestock-holding systems. Today, our focus has shifted to the risks of allowing livestock free access to streams, wetlands, ponds, etc. Our shared concern for water quality is enough to discourage free access, and in some cases cut off access altogether.

INTENSIVE OR HIGH-DENSITY GRAZING

The risk of riparian degradation increases with livestock density. If density exceeds 1 nutrient unit (NU) per acre per year, it's considered intensive. Density at a level of more than 1 NU per acre per year is more commonly associated with livestock-holding areas, dry lots and exercise yards (e.g., for dairy). Most pastures cannot be sustained and feed has to be imported.

What also happens at this density is that deposited manure and runoff from intensive areas will have to be managed to reduce the risks to adjacent surface water and groundwater.

The BMP for livestock-holding and intensively pastured areas is to **restrict access from riparian areas.** In most cases, a permanent fence is best!



Streamside grazing can be defined by density. INTENSIVE GRAZING (or high-density grazing) describes grazing densities equal to or greater than 1 NU/ac/yr. EXTENSIVE GRAZING refers to densities less than 1 NU/ac/yr. On the left side of the stream, intensively grazed livestock have been excluded with a permanent fence. On the right side of the stream, extensively grazed livestock are kept away from the stream using a combination of temporary fencing, alternative water sources and rotational grazing practices.

Livestock may have access to areas of sheetwater where runoff has temporarily collected – provided BMPs such as shade structures and alternative water sources have been established.

WHAT THE NUTRIENT MANAGEMENT ACT SAYS ABOUT OUTDOOR CONFINEMENT AREAS AND LIVESTOCK ACCESS TO SURFACE WATER

If you have a high-density permanent outdoor confinement area or areas (OCA), the *Nutrient Management Act* requires you to ensure that livestock have no access to surface water.

OCAs are housing systems where the animals are kept outdoors, and grazing and foraging provide less than 50 percent of dry matter intake. In other words, more than half of the animals' feed requirements is supplied rather than provided by the pasture.

A **permanent OCA** is one to which livestock have access for 4800 hours (200 full days) a year. A **high-density permanent OCA** is more than 120 nutrient units per hectare (NU/ha). This confinement type also includes operations that are 300 NU or greater and that contain livestock for less than 4800 hours per year, but have a livestock density of more than 5 NU/ha/yr. Under section 57 of the Act, "No person shall permit animals to have access to surface water if the animals are kept in a high-density permanent outdoor confinement area or a permanent outdoor confinement area used in the course of an agricultural operation that is carried out on a farm unit, on which the number of farm animals is sufficient to generate 300 or more nutrient units annually."

Please refer to the *Nutrient Management Act*, 2002, Ontario Regulation 267/03 for more information.

EXTENSIVE OR LOW-DENSITY GRAZING

The rest of this chapter pertains to lower densities, i.e., less than 1 NU per acre per year.

First of all, conduct a risk assessment for impact on surface and ground water quality. A risk assessment will identify problem areas.

Secondly, fix the problems! Let this book be your guide.

RISK ASSESSMENT FOR EXTENSIVELY PASTURED RIPARIAN AREAS

Undergoing a risk assessment process will help you identify the degree and sources of risk posed by your set of circumstances. It will give you a solid foundation on which to plan the right BMPs where they're needed most.

Risk assessment will also help you in grazing management planning for streamside areas.

Risk assessment has several dimensions. You'll be asked to consider the following criteria.

SITE LIMITATIONS – physical characteristics you can't change but need to take into account

CRITERIA	IMPORTANCE
SOIL TEXTURE	• texture affects how quickly water moves through soil to water table (water permeates more quickly through gravelly soils) • also affects how likely water will flow overland (runoff)
VALLEY SLOPE	• length and steepness of slope will affect runoff to surface water areas
BEDROCK DEPTH	• shallow soils are a higher risk for ground and surface water contamination
FLOOD RISK	• frequently flooded areas are a higher risk as a source for contamination
NEARBY WELLS	• improperly abandoned or poorly maintained wells near grazing areas pose a risk to groundwater quality

MANAGEMENT RISKS – characteristics you can control but relate to potential problems	
CRITERIA	**IMPORTANCE**
BUFFER STRIPS	• the wider the buffer, the lower the risk
LOCATION OF FEED, SALT, ETC.	• locating feed, salt and shade structures away from the riparian area will reduce impact
DRINKING WATER	• providing an alternative water source will reduce need for access
GRAZING MANAGEMENT	• the density and duration of grazing in or near the riparian area will affect the risk of impact on water quality
LIVESTOCK ACCESS/ CROSSING	• less access = less impact • consider differences among livestock behaviours, e.g., sheep are less likely to choose to access surface water than other livestock

SITE CONDITIONS – evidence of problems in the water or on the banks or shoreline	
CRITERIA	**IMPORTANCE**
BANK CONDITION	• bare soils, trampled and slumping banks are evidence of severe access problems
WATER CONDITIONS	• if the water leaving your property looks worse than when it entered, this could indicate severe access problems
VEGETATION QUALITY	• trampled, over-browsed and damaged vegetation indicates a high, rather than low, grazing density
HABITAT QUALITY	• diversity and quality of aquatic life reflect the habitat condition

OFF-SITE USES – concerns regarding downstream or nearby users of the same resource	
CRITERIA	**IMPORTANCE**
IRRIGATION	• there's a higher risk of produce contamination if the water is used for irrigation downstream
HABITAT DESIGNATION	• if the riparian area is part of a designated fishery or other habitat area, it's at risk of impact from livestock access
WATER RETENTION	• how well does your riparian area store water to supply surface water?
DRINKING WATER	• how close is the nearest urban centre?
RECREATIONAL USE	• are you near a recreational area that uses the same water?

INTERPRETING THE RISK ASSESSMENT

Once the risk assessment is completed, your next plan of action will in large part depend on the nature and extent of any problem areas on your property.

If, according to your risk assessment results, the problem is **severe**, you should tackle the problem in the same manner as intensive grazing, and manage it similarly (i.e., no access).

If your results indicate a **moderate risk**, you should use the risk assessment to determine which impacts are most severe. Then, deploy BMPs to gain a benefit similar to what is achieved through exclusion.

If your risk assessment indicates few concerns, the problem is **minor**. Use BMPs to address critical spots or key functions of interest.

There will be very few situations where the risk assessment is so low that no corrective measures are necessary. However, BMPs for grazing near riparian areas that reduce access are always recommended.*

Risk assessment as part of your grazing management planning will help you develop a clearly defined set of planning steps that integrate production targets with environmental goals and practicality.

This is an example of a severe rating based on a risk assessment. Note the high density, poor site conditions, and lack of management. These cattle should be excluded.*

This situation warrants a moderate-risk rating. The density is moderately high. There are no BMPs in place to encourage alternative behaviour. Site conditions reveal a wide channel, turbid water and some bank damage. Streamside-grazing BMPs, such as temporary fencing, are needed here to reduce the impact of livestock access.*

Low-density lakeside grazing has little impact on limestone shores; hence, the minor-risk rating. Alternative watering BMPs, such as temporary fencing, could be introduced to keep cattle away from the shore altogether.*

* Please note that allowing livestock access is not in full compliance with the *Fisheries Act*.

WHAT'S INVOLVED IN A GRAZING MANAGEMENT PLAN

Grazing management planning is recommended for rotational grazing systems near riparian areas. Here are some of the things to consider.

▸ Step 1. Estimate the forage demand.

The forage demand is the amount of forage dry matter (DM) required to feed the herd/flock for one day. It is calculated based on the rule of thumb that grazing animals require an amount of forage dry matter equal to about 2.5% of their body weight per day.

FORMULA

Average weight per animal X 0.025* = requirement X no. of animals = forage demand

CALCULATION

_____ X .025* = _____ X _____ = LBS/DAY
AVG. WEIGHT/ANIMAL (LBS) LBS DM/HEAD/DAY HEAD

** Please note: For lactating dairy cows, use 0.03*

▸ Step 2. Estimate the forage supply.

This is the amount of forage dry matter that is predicted to be available for grazing after a 15-day growth period in the spring and a 30-day growth period in the summer and fall. Please note: Actual pasture growth rates are extremely variable. As a result, the numbers presented are for planning purposes only. Optimum growth periods may be longer or shorter than those indicated.

Unless actual measured yields are available, use estimated yields data for grass–legume hay. Use the following table to convert to forage availability on a rotational basis.

FORAGE AVAILABILITY ESTIMATES

HAY YIELD TONS/ACRE/YEAR	5.5	5.0	4.5	4.0	3.5	3.0	2.5
FORAGE AVAILABILITY LBS/ACRE/ROTATION	2200	2000	1800	1600	1400	1200	1000

FORAGE SUPPLY _____ LBS/ACRE/ROTATION

▸ Step 3. Select residency period.

In other words, decide how long you want your livestock to remain in a particular paddock. One to two days is recommended for lactating dairy cows, three to seven days for all other livestock. Please note: For maximizing harvest efficiency, use the shortest residency period indicated for the type of livestock operation.

RESIDENCY PERIOD _____ DAYS

▸ Step 4. Determine paddock size.

The paddock size is based on meeting the total forage demand for the number of days of grazing indicated by the residency period.

FORMULA

Forage demand X residency = total forage demand ÷ forage supply = paddock size

CALCULATION

_____	**X**	_____	**=**	_____	**÷**	_____	**= ACRES**
LBS/DAY		**DAYS/ROTATION**		**LBS/ROTATION**		**LBS/ACRE/ROTATION**	

▸ Step 5. Calculate the number of paddocks.

The number of paddocks required is based on meeting the longest regrowth interval recommended, i.e., 30 days.

FORMULA

Required regrowth ÷ residency period = # of paddocks + 1* = total # of paddocks required

CALCULATION

30 DAYS/PADDOCK ÷	_____	**=**	_____	**= TOTAL # OF PADDOCKS**	
	DAYS		**PADDOCKS +1**		

** The extra paddock is included because you need to give all paddocks the prescribed rest. If you determine the rest period is 30 days and the animals are in the paddock for one day and you have 30 paddocks, then there are only 29 days of rest/regrowth. By adding one, you give each paddock 30 days rest and one day for harvest.*

▸ Step 6. Estimate the total number of acres.

FORMULA

Size of paddock X number of paddocks = total acreage required for rotational grazing

CALCULATION

_____ X _____ = ACRES
ACRES/PADDOCK PADDOCKS

▸ Step 7. Complete the risk assessment for extensively grazed riparian paddock areas. Consider:

- site limitations (e.g., soil type, depth to bedrock, slope), and
- management risks (e.g., water source, grazing practices), or characteristics you can control, and
- site condition (e.g., water quality, bank or shoreline damage) – otherwise, evidence of problems, and
- off-site problems (e.g., downstream fisheries, waterfowl habitat area, etc.) to address concerns about downstream or nearby users of the same resource.

▸ Step 8. Determine what needs attention.

PADDOCK #	ACREAGE	CURRENT PROBLEMS/RISKS	CURRENT MANAGEMENT PRACTICES	BMP OPTIONS

▸ Step 9. Assess options:

- which options match problems/risks?
- which are suitable for the situation and site?
- which are practical and affordable?

▸ Step 10. Schedule plan.

1. List the BMP options decided upon in order of sequence and by paddock area.
2. Take action and keep records.
3. Observe results – one week, one month and one season after putting into action.

GRAZING NEAR RIPARIAN AREAS

Grazing livestock is all about management – trying to get the best production on the hoof while sustaining pasture quality and minimizing environmental impact. This is especially true in pastures near riparian areas.

We've all seen it – chronic overgrazing around riparian areas. It looks bad, it's harmful to water quality, and it's a completely inefficient use of pasture resources!

In riparian areas with high stocking rates, the BMP for grazing livestock is exclusion.

The BMP for low-density areas is to exclude where evidence warrants, according to the results of your risk assessment.

Otherwise, the strategy for low-density grazing near riparian areas should be to mimic exclusion by using a suite of BMPs. Use the risk assessment and grazing management plan to pinpoint where access-related problems exist and which BMPs would be best to address them.

Complement these measures with a well-planned grazing system, high quality pasture, a suitable fencing system, and non-fencing approaches such as alternative water sources.

PRINCIPLES

Grazing management alone can reduce much of the impact of livestock on most environmentally sensitive areas and improve productivity. But it's most effective when used with other BMPs for pastures near riparian areas. Understanding the principles is the key to identifying which grazing management system will work in your operation.

Stocking Rate

Each acre of pasture has the capacity to sustain a certain number of livestock over the grazing season – beyond which the pasture can't recover quickly enough or site damage is severe (e.g., compaction). Stocking rate is influenced by site type (floodplain vs. upland), soil type and quality, and weather conditions. By managing for stocking rates, graziers can maintain production and minimize impact.

Site Conditions

Even at lower densities, grazing in a fragile riparian area can be harmful. "Low-order" streams, ponds and wetlands that are saturated most of the time may not be able to withstand much grazing pressure without being damaged. The situation is considerably different in large, broad floodplains of the middle and upper reaches of rivers. These sites can withstand higher livestock densities for very short periods if grazing is delayed until conditions are drier.

"Stream order" refers to a numerical system that ranks streams from headwaters to river end. It's used to designate the position of a stream or stream segment in a drainage basin. A low-order stream is the smallest stream in a watershed with year-round flow and few tributaries.

Grazing Frequency

Pasture and riparian species require rest periods for regrowth. Otherwise, they can be grazed out and replaced by weeds, or even bare soils. Progressive graziers monitor regrowth patterns and manage grazing frequency to maintain production.

Livestock Distribution

Livestock may have preferred areas in the pasture, and riparian zones are commonly at the top of the list. This is more noticeable in drought years, when there's more to eat in the riparian zone.

Graziers can use a wide range of fencing options (e.g., temporary fencing, controlled access) or non-fencing options (e.g., location of water, salt, shade, etc.) to help distribute livestock more evenly or on a preferred-site basis.

Livestock with access to riparian areas will often congregate in preferred areas with shade, ease of access, and/ or rich pasture growth.

Grazing Season

When managing grazing near riparian areas, not all seasons are equal.

- **Spring** – In most cases, try to avoid access in spring. High soil-moisture content leads to compaction and bank damage.
- **Early summer** – Without other BMPs in place, summer grazing can be the most damaging time for vegetation. The grazed area doesn't have sufficient recovery time before winter.
- **Late summer and fall** – These are usually the preferred seasons for access. Plants are mature, root reserves are up, and winter hardiness should not be affected. Moreover, low soil moisture content at this time reduces the risk of compaction and bank damage.
- **Winter** – Grazing is site-specific. Grazing grassy buffers in open winters will have minimal impact, similar to fall grazing. However, grazing treed or forested riparian areas can be devastating to vegetation.

Late summer and fall are the best seasons for low-density streamside grazing. BMPs to consider are short-duration or deferred grazing systems with water, shade and salt kept away from surface water.

BMPS FOR LOW-DENSITY GRAZING ON PASTURES NEAR RIPARIAN AREAS

A SEASON-LONG grazing system allows animals maximum forage selectivity. However, livestock should not spend too much time near or in riparian areas. In some cases they may need to be excluded, as is the case for pastures near wetlands, ponds, narrow-channel watercourses and drainage ditches. Another drawback is that some forage species can be over-grazed and damaged.

Repeated seasonal or SITE-SPECIFIC grazing involves paddocks designed to maximize grazing efficiency and minimize risk to riparian areas. Pasture species, growing season, and site position are factored in. Drier sites are grazed early and for short durations; wetter sites are deferred and also grazed for short intervals. The system can work well in grassed ravines, floodplains and adjacent to wetland areas. Here, access can be limited to the preferred (drier) season, and for very short periods to control weedy vegetation.

A well-planned and fenced REST–ROTATION system provides at least one season's rest for each paddock. It's well-suited for pastures near riparian areas. Riparian areas can be favoured to allow for restoration or for improvements to become established.

In a SHORT-DURATION grazing system, livestock are rotated through several paddocks over short intervals. Stocking rates are high for short periods of time, with rest periods for recovery. The system is suitable for grassy pastures near riparian areas with permanent or temporarily fenced paddocks. Note that the rest periods must be long enough for sufficient recovery, and grazing times must be short enough to prevent rapid re-grazing. There is also potential for damage in spring.

PASTURE MANAGEMENT

Pasture management is a planned system of pasture production that includes establishment and improvement as part of a grazing management system.

PRINCIPLES

Pastures are forage crops managed specifically for grazing. They are subject to the forces of natural succession, i.e., the shift of plant communities from grass/legumes to grasses to non-forage or undesirable pasture plants, shrubs and trees. To combat this natural process, and to reduce the need for costly renovation, pastures need to be managed intensively. Intensively managed pastures are more efficient (for meat and milk production) and deter natural succession.Your pasture management goals should include the following: proper soil fertility, careful pasture crop selection, effective weed control, sustained grazing, a well-planned fencing system (intensive grazing management), planned water–shade–mineral supply, attention to animal health, and protection of riparian areas.

Proper Soil Fertility

Forage grasses and legumes are competitive plants. But they need a continual supply of crop nutrients to out-compete weeds and provide sustained forage production. Fertile pastures are an environmentally friendly land use.

Crop Selection

Pasture species and mixtures should be selected to meet your site conditions, animal requirements and management expectations. Mixes that are durable, nitrogen-efficient and provide sustained yields are the best choices for pastures near riparian areas.

Grazing Management

Here, your aim is to leave enough recovery time for sufficient top growth and root reserves for regrowth following grazing. Managed pastures, with the judicious use of fenced paddocks, are one of the most sustainable forms of agricultural crop production – hence the term “permaculture”.

Advantages of Pasture Management

Cropland converted to managed pasture can be more productive, profitable and environmentally responsible. As you can see by the long list below, the advantages are many!

- ▸ erosion rates are drastically reduced
- ▸ nutrient loadings to surface waters are decreased
- ▸ nitrogen loss to atmosphere and groundwater is less than in croplands
- ▸ pesticide use and runoff are reduced
- ▸ energy consumption is lowered considerably
- ▸ soil carbon sequestration rates are higher than with unmanaged pastures
- ▸ quality of surface water and groundwater is improved
- ▸ wildlife habitat and corridor opportunities are greater
- ▸ production and profitability are higher than on unimproved pasture
- ▸ weeds are controlled

In a DEFERRED GRAZING system, grazing is put off until key pasture plants have reached desired growth and soil conditions are less damage-prone. Suitable for low-density stocking in riparian areas near wide-channel streams and middle-reach rivers, it helps prevent springtime damage and minimizes plant stress in mid-summer. This system also helps newly planted buffer areas get established.

BMPS FOR PASTURE

In this section we'll list tips for establishing pastures, improving grazing management, and protecting the environment.

Test for phosphorus and potassium levels one year prior to establishment.

Establishment

- ▸ **1. Test soils.** Fertile pasture soils will help pasture crops become established, grow and compete with weeds. Test one year before establishment. Keep phosphorus and potassium levels high – forage/pasture species are big feeders. Sample unique areas separately, e.g., eroded knolls for retirement.
- ▸ **2. Match seed mixture to goals.** Select a mixture that meets your goals for site conditions, growth, gain targets, and use. Species that are durable, fast-growing, and nitrogen- and water-efficient will help lower greenhouse gas emissions.

- **3. Seed with care.** Plant seeds less than 1 cm deep. Use companion crops such as spring cereals only in areas prone to erosion. No-till planting disturbs less soil. Consider using it after a cover crop is killed prior to establishment
- **4. Get an early jump on weeds.** Kill perennial weeds prior to establishment. Clip weeds during early establishment.

Use recommended weed control methods prior to establishment.

Improvement

To improve a pasture, you can choose between rejuvenating it or renovating it.

Rejuvenation is a quick way to improve undergrazed areas with low fertility. Test soils and improve fertility to increase survivorship and production of desired species. Develop and follow a grazing management plan to sustain production.

Renovation means increasing productivity by introducing pasture species without disturbing the soil. Successful renovation depends on these elements:

- proper pasture mix selection
- site preparation
- timing of seeding
- legume inoculation
- soil fertility and moisture levels during establishment, and
- weed control during establishment.

For a more detailed approach to pasture management, please refer to *Pasture Production* (OMAF Publication 19).

To decide which path to take, you should:

- assess pasture condition
- determine production goals and timeframe
- determine conditions that limit improvement (soil depth, etc.)
- assess costs.

FENCING

FENCING FOR EXCLUSION

As the term suggests, fencing for exclusion means livestock have no access to a watercourse, pond, lake or wetland. Fencing doesn't have to be permanent and expensive – but it must be effective.

Functions and Benefits

Exclusion fencing is the first step towards rehabilitation of riparian areas. There's less sediment disturbance and no direct manure deposition. Bank, bed, and local riparian erosion are also reduced. Water quality improves. Fish and wildlife habitat begins to come back.

Suitable For

Permanent fencing is suitable for these circumstances:

- dry lots, exercise yards, and holding areas (low density, oudoor confinement areas) adjacent to riparian areas
- intensively grazed areas where the density exceeds 1 NU per acre in a given year
- extensively grazed areas with severe problems or with moderate problems where fencing is the most suitable solution
- extensively grazed areas where fencing for exclusion is determined to be the only effective long-term solution
- most watercourses, wetlands, ponds and lakeshores.

In some cases, permanent fencing is the most suitable solution. This site in Norfolk County shows remarkable improvement since the watercourse was fenced to restrict livestock access.

If your watercourse is a municipal drain, you must confirm the appropriateness of your plans with the engineer's report for the municipal drain. Check with your local municipality.

Permanent fencing is NOT suitable for:

- riparian areas prone to ice floes
- riparian areas subject to frequent and extensive flooding.

Permanent or seasonal fencing to restrict livestock access may not be practical in areas with frequent high water conditions and seasonal ice floes. If there is substantial forest cover in upstream riparian areas, logs and debris carried by high water can destroy fences downstream.

On this Oxford County pasture, the level of the creek often rises a metre or more from normal summer levels, sometimes several times from late spring to early fall (as indicated by the water line on the trees). Frequent and costly repairs to the fence would be required.

The landowner has found a better approach by carefully managing stocking rates and applying other techniques that minimize the time spent by livestock in the watercourse. As a result, the streambanks are stable and minimal risk is posed to water quality. As evidenced by the bass, there are still good angling opportunities in the watercourse.

Design Considerations

Consider a setback of 5 metres (16 ft.) or greater if you're planning to install a permanent fence.

As you plan, consider the following:

- ▸ size of area and length of fence
- ▸ 5-metre (16-ft.) minimum buffer (recommended) between fence and top of bank
- ▸ square-off for maintenance ease
- ▸ electric fencing with flexible posts for ice floes
- ▸ cedar rail designs for shallow to bedrock or extensively stony areas
- ▸ special fencing for high water table conditions – e.g., fencepost cemented in steel drum.

Maintenance Checklist

- ✔ inspect permanent fences seasonally for repair
- ✔ inspect posts regularly
- ✔ manage vegetation near electric fences

Enhancements and Complementary BMPs

Permanent fencing can and should be complemented with any of the following:

- ▸ controlled access
- ▸ buffer strip and treed buffer establishment
- ▸ alternative source of drinking water
- ▸ relocating shade, salt and feeding
- ▸ temporary grazing of riparian areas.

If previous access provided drinking water for livestock, you must provide an alternative source. See page 60 for suggestions.

FENCE TYPES

TYPE	DESCRIPTION	WHERE	ESTABLISHMENT TIPS	ADVANTAGES	DISADVANTAGES
RAIL 	• permanent • traditional fencing method	• most riparian areas • not suitable in areas subject to flooding or ice floes	• place a strand of electric or barbed wire along fence • some styles rest on top of ground, thus a good choice on shallow bedrock or groundwater • allow space for drain maintenance – leave at least 5 metres (16 ft.) from top of bank / shore as buffer	• permanent • minimal inspection and maintenance • moderate cost	• construction can be time-consuming • not suitable for ice floes and floods
PAGE WIRE 	• permanent • page wire	• most riparian areas • not suitable in areas subject to flooding or ice floes	• select fence height and wire spacing based on animal type to be excluded • fence must be adequately anchored • allow space for drain maintenance – leave at least 5 metres (16 ft.) from top of bank / shore as buffer	• permanent • minimal inspection and maintenance	• construction can be time-consuming • not suitable for ice floes and floods • expensive
SUSPENSION 	• permanent • high-tensile smooth wire	• best on level terrain • can be installed quickly • suitable in areas subject to flooding or ice floes	• 3–8 strands of wire on posts set at 27-metre (90-ft.) centres • can be electrified, i.e., 1 or 2 strands 12.5 gauge – smooth wire is most common • allow space for drain maintenance – leave at least 5 metres (16 ft.) from top of bank / shore as buffer	• permanent • relatively quick and easy to install in floodplain areas • moderate cost	• electrified fence requires some vegetation maintenance

TYPE	DESCRIPTION	WHERE	ESTABLISHMENT TIPS	ADVANTAGES	DISADVANTAGES
ELECTRIC	• temporary or permanent • polywire / polytape	• in areas prone to severe flooding and ice floes – such as narrow and wide channels in upper reaches and some mid-reach floodplains • highly accessible areas	• can be installed quickly • posts usually spaced at 17 metres (56 ft.) • tape, wire or combinations with easy-to-install posts • must be properly grounded • train livestock to use	• easily installed and moved • suitable for flood-prone areas • low cost	• requires power source • some maintenance / management requirement with vegetation • requires regular checking

NOTE: *Never electrify barbed wire fence.*

VIRTUAL FENCE – AN INNOVATIVE IDEA

During spring melt and intense summer storms, this site becomes prone to high water flows. Keeping an effective fence in place to restrict livestock access proved frustrating and expensive.

A farmer worked with the local conservation authority and other partners to investigate the idea of a "virtual fence." Wire was installed underground along the top of the banks on both sides of the watercourse. A trough fed by the barn was strategically placed to provide an alternative water source. Radio-activated collars or ear tags were to be fitted to the cattle to receive an audio signal as they ventured towards the creek or a correction if they attempted to cross over the hidden fence.

It's an innovative new management option that is still in the testing stage. Only after repeated success will it be considered a BMP, but the concept shows promise. For more information, contact the Upper Thames River Conservation Authority in London at tel: 519-451-2800, or www.thamesriver.on.ca

FENCING TO REDUCE ACCESS

Controlled access involves fencing with openings that permit livestock access to the water for drinking or crossing. It is not intended for high-density grazing areas.

Allowing livestock access is not in full compliance with the *Fisheries Act.* However, it may be a necessary step where total exclusion is not possible.

Fencing one side of the stream is suitable for low-density streamside grazing where access does not cause severe bank erosion problems.

Suitable For

- low-density riparian grazing areas where access is causing moderate problems
- upper and middle reaches, and some ponds
- where pasture length is long and/or stream meanders, making it difficult to establish continuous fencing
- where there are pastures on both sides
- where creating a reliable water supply would be difficult and expensive
- where streambed materials are coarse enough (e.g., gravels, stones, cobbles) to reduce impact or to reduce appeal for livestock crossing

This pond is fenced to control access from grazing beef cattle.

Management Tips

- use permanent or temporary fence as part of your grazing management system
- leave at least a 5-metre (16-ft.) setback from the top of bank
- determine approach to crossing
  - don't focus all livestock to one crossing in extensive pastures
  - distribute crossings to points that currently exist – this distributes the smaller impacts to several areas and allows for stream recovery between crossings (see page 58)
- monitor livestock movement in the pasture to determine favoured access points
  - place planned crossings nearby, and use limited fencing to funnel livestock to the new crossing
- consider a planting strategy on streambanks and setbacks (see page 102)
- consider improvements to fish and wildlife habitat – leaving wider buffers can create productive habitats and opportunities for assistance (e.g., Wetland Habitat Fund)

Advantages

- makes water available for drinking
- reduces time that livestock are in water
- stabilizes banks

Disadvantages

- can increase impacts at focal points
- may require maintenance at entry points
- top of bank trailing can cause impact unless fence is set back from top of bank

LIMITED ACCESS POINTS

Limited access allows livestock to reach water for drinking but does not permit crossing. Again, strictly speaking, access is not allowed under the *Fisheries Act*. However, it's better to do whatever possible to protect water quality, than to do nothing at all.

Limited access points with added protection of erosion-resistant base materials is a reasonable BMP in some circumstances.

Suitable For

- pasture systems where livestock pasture on only one side of a watercourse
- pastures where there's already a bridge or culvert crossing that can be used by livestock to get to other pastures
- areas where alternative watering isn't feasible
- upper reach areas where ice damage or flooding hasn't been a concern

Management Tips

- construct a fence corral with fence that can be moved during high water periods
- make it large enough for several livestock to water at once
- protect with erosion-resistant materials

Advantages

- low cost
- livestock don't get in flowing water
- livestock are not permitted to access the entire channel
- livestock are concentrated in only a few areas

Disadvantages

- only access one side
- impact on sloped entry to water
- limited use for pastures on both sides
- susceptible to ice and floods
- requires fencing along entire access
- should also include stabilization work in area where livestock have access to drink (ramp, shore, upstream and downstream)

CROSSINGS

When pastures are located on either side of a watercourse, you may need to manage access while minimizing damage.

Closely monitor livestock movement in the pasture to determine favoured watercourse access points. Establish crossings nearby, and consider using limited fencing to funnel livestock to preferred access sites. Trees along the banks have proven water quality benefits, but may also be detrimental to riparian areas. They attract livestock who enjoy rubbing against the trunks and are seeking shade.

Remember that structural features should be designed to reduce access, but should not cause damage to fish habitat or prevent others from using navigable waters. Poorly designed crossings can obstruct fish movement in flowing waters and limit navigation by small watercraft.

You must check with regulatory authorities to obtain approvals before creating any type of crossing structure. Start with your local Conservation Authority or Ministry of Natural Resources (MNR) office. Remember that work in and around water may require assistance from an engineer or other professional.

If there are no environmental concerns with a natural crossing between extensively grazed areas, then you may want to consider leaving well enough alone. Sometimes the siltation that could result from improvements can make things worse.

FEATURE TYPE	DESCRIPTION	ESTABLISHMENT TIPS	ADVANTAGES	DISADVANTAGES
BRIDGE CROSSING	• wood or steel bridge adequately designed as crossing • suitable for upper reach watercourses with excessive flooding or ice floes	• check with federal Dept. of Fisheries, local Conservation Authority and MNR • should span from the top of the banks of both sides	• permanent or seasonal • dry crossing • can be used by machinery	• expensive • can be a risk to fish habitat, flooding and navigable waters • requires permits and approval • not suitable for drains • must be professionally designed

FEATURE TYPE	DESCRIPTION	ESTABLISHMENT TIPS	ADVANTAGES	DISADVANTAGES
MID-LEVEL CROSSING WITH LOW FLOW CULVERTS	• culverts and concrete are used to construct these bridge-like crossings at mid-bank level • culverts are usually placed at bed-level (embedded to 10% diameter) • may be suitable for narrow-channel streams and drains	• check with federal Dept. of Fisheries, local Conservation Authority, MNR and municipality • approvals are required from the various agencies for work in and around water • key features include: culverts; gated entrances; erosion-resistant materials on travel surfaces underlaid by geotextiles	• permanent dry crossing for most of the year • will convey water from most storm events through culverts	• relatively high cost • can cause flooding upstream • poorly designed mid-level crossings can obstruct flow during periods of low water • requires approval
BED-LEVEL CROSSING	• crossing is established at watercourse bed-level • materials used are concrete slats, coarse, angular stone and other prefabricated materials • suitable for wide-channel streams and some drains	• check with federal Dept. of Fisheries and local Conservation Authority, MNR and municipality • approvals are required from the various agencies for work in and around water • key features include: locate at straight part of stream; avoid riffles, pools or bends – this will prevent erosion; attain proper bed-level elevation	• permanent • moderate cost • no negative impact on water flow if built properly	• should be gated and part of rotational grazing system to be effective • livestock still have impact while crossing
LEAVE NATURAL CROSSING AS IS	• livestock use one or multiple natural (non-constructed) crossing areas • bed is firm and contains >50% coarse materials • suitable for very low-density grazing systems with coarse-textured beds	• use other BMPs to alter grazing and traffic behaviour • use rock or boulder deflectors or thorn-shrubs to direct livestock to preferred crossing areas • try in-stream BMPs to improve fish habitat in these situations • check with federal Dept. of Fisheries, local Conservation Authority, MNR and municipality	• minimal cost • minimal input • minimal risk	• could be in violation of *Fisheries Act* • livestock still have impact while crossing

ALTERNATIVE WATER SOURCES

Providing an alternative water source alone can dramatically reduce the amount of time livestock spend in and around water. Depending on the circumstances, livestock even show a preference to water troughs over the stream. Alternative water may come from streams, wells or groundwater springs.

Your alternative water system will be most effective if you complement it with other BMPs aimed at reducing livestock access.

ALTERNATIVE WATER SYSTEM	DETAILS
NOSE PUMPS	• place foot valve in water source • place pump less than 6 metres (20 ft.) above the water source • livestock drink individually so it is limited to fewer than 20 animals per pump • not suitable for calves or sheep
WATER FROM BARN	• bury line below frost level and use frost-free waterers for winter use • bring intake pipe up through bottom of watering tank • select water pipe size to carry required flows • lay pipe along uniform grade to avoid air locks • stabilize the area with good drainage around the water tank to provide firm footing and avoid erosion • consider shading the trough to limit algal growth if this is a permanent site • if water trough is not used in winter, drain the tank and pipes

This diaphragm pump is mechanically activated by a lever. The pumping action draws water through an intake line and foot valve.

If a barn is nearby, this is the simplest approach to accessing groundwater supplied through an existing well.

ALTERNATIVE WATER SYSTEM	DETAILS
WINDMILL	• determine size of windmill and pumping capacity by water requirements and prevailing wind • provide batteries or a storage reservoir as backup to supply water during low wind periods • locate windmill to obtain maximum exposure

A windmill can be expensive, but is reliable and low maintenance. Old mills can be rebuilt to keep costs down.

SEEPAGE TROUGHS	• construct interceptor drain network with tile or perforated pipe laid at right angles to flow • backfill with gravel trench • construct spring box to trap sediment – clean regularly • gravity-feed water to supply tank farther downslope • if used year-round, place inlet and outlet pipes close together to increase surface turbulence so as to keep ice-free

Seepage troughs intercept groundwater from seepage areas on hill slopes.

RAM PUMPS	• select an area that provides flowing water and sufficient water to supply herd • estimate the stream slope and amount of flowing water • determine the height that water must be pumped to a trough • based on these numbers, get a supplier to help you determine the appropriate pump for your situation • must have sufficient water depth, stream slope

This trough, fed by a ram pump, takes advantage of falling or flowing water to drive the pumping mechanism.

SOLAR-POWERED PUMPS	• determine the amount of water needed to supply herd • ensure storage is available to manage for high water demand • if batteries are not used, ensure an adequate storage is provided in low sunlight times • be aware that solar panels aren't needed if you're prepared to change batteries regularly • consider a storage tank to help distribute to more than one paddock

Recent designs of more efficient pumps and solar power panels result in a feasible, reliable source. Solar panels can recharge deep-cycle marine batteries in periods of low sunlight intensity.

ALTERNATIVE WATER SYSTEM	DETAILS
DUGOUT POND	• if using groundwater, dig a test hole to determine final water elevation during the driest time of the year (this may change over the year and from year to year) • create a buffer of plants and trees to protect water quality and shade the water (cows prefer cold clear water) • keep livestock out of pond through limited access points or pump to water trough

Dugout ponds are excavated to collect surface runoff, groundwater and tile drainage water as an alternative water source. Buffer areas around the pond and fencing should be considered to protect the quality of the water source. Conduct a soils investigation prior to excavation to be sure water will stay in the pond – otherwise you'll need artificial liners of bentonite clay or synthetic materials.

NON-FENCING OPTIONS TO REDUCE ACCESS

In extensively grazed areas with moderate-to-minimal risks, sometimes just a combination of a few BMPs can make all the difference. For example, moving feed, salt and water away from the riparian area can be as effective and less costly than permanent fencing. In areas of low risk, placing deflectors in areas of habitual access and adding alternative watering may be sufficient to reduce the risk of environmental impact.

VEGETATIVE BARRIERS

Thorny shrubs or very dense evergreen trees can deter livestock from riparian areas. In addition to those trees and shrubs that are already thriving, consider species such as wild rose, black locust, wild apple, red pine, white spruce, white cedar and tamarack. Temporary fencing and some weed control practices must be used to protect the trees until they're established, especially on floodplains.This approach is suitable for low risk areas where livestock have access at several points. Use this BMP in combination with other non-fencing options to increase its effectiveness.

Well-established evergreen trees and thorny shrubs can deter livestock from accessing riparian areas.

STONE DEFLECTORS AND BARRIERS

Place stones and other materials in the path leading to riparian areas. Livestock will gain access at a different place, or go to an alternative watering facility.

To deflect livestock, try these materials:

- large natural stone (cobbles or larger) on the top of bank – space them far enough apart to permit plants to grow
- permanent fence in segments – this keeps livestock completely out of sections to permit permanent plant cover, tree growth and root stabilization.

RELOCATING SHADE, WATER, SALT AND FEEDING AREAS

Livestock are attracted to shade, drinking water, salt and feeding areas. Moving them away from riparian areas will reduce the risk of impact in moderate-to-low risk areas. Again, these BMPs work best if done in combination. To be effective, salt, feed and shelter(s) should be located more than 50 metres (164 ft.) from surface water (ponds, lakes, watercourses or wetlands) where there is no fencing.
Trees planted in riparian areas where extensive fencing is not planned may eventually encourage access by livestock seeking shade.

Moving salt from traditional access points provides incentive for livestock to graze away from riparian areas.

On this farm, a slab of concrete is positioned at channel grade at the down-stream end of a culvert. This provides comfortable footing for cattle to drink from the intermittent watercourse. Even before planned fencing is in place downslope to restrict access, cattle show a clear preference for the protected watering access point, and the environmental impact is minimal.