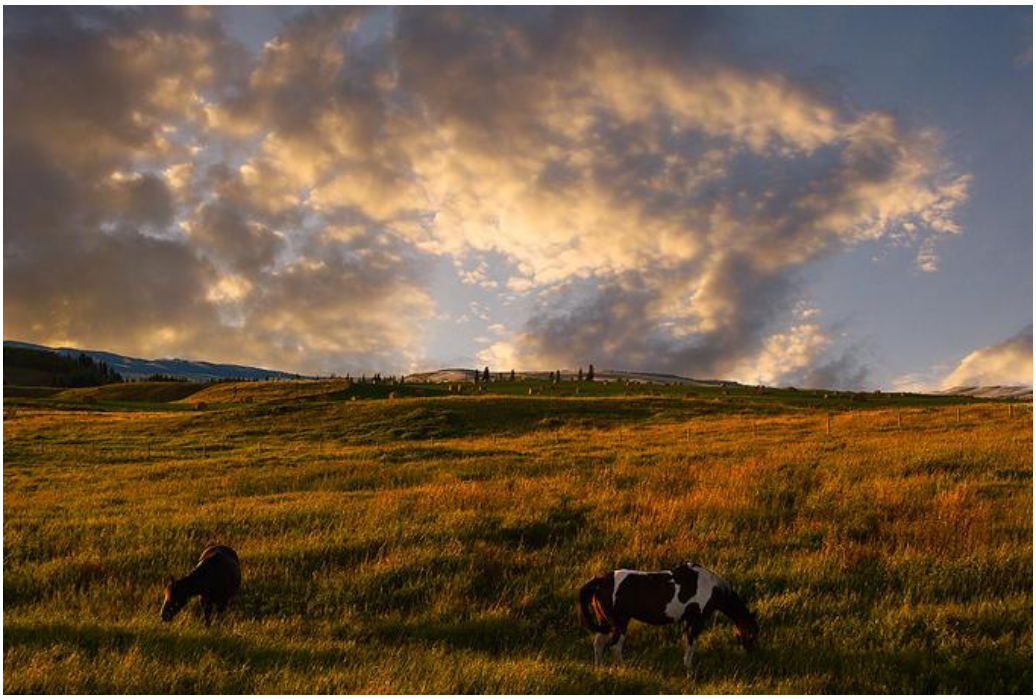
Developer's Guide to the Riparian Setback Matrix Model for The Municipal District of Foothills #31



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The following document is a companion document to the Municipal District of Foothills' *Riparian Setback Matrix Model* and has been prepared to give an overview of the model for those working in the development industry. The Riparian Setback Matrix Model is used by the MD of Foothills to establish unique environmental reserve setbacks to lakes, streams, brooks, creeks, wetlands and intermittent water drainage courses during the development process under authority of Part 17 of the *Municipal Government Act* to sustain watershed and/or watercourses in balance with developmental pressure.

For more details, you can request a copy of the *Riparian Setback Matrix Model* from the Municipal District of Foothills office or online at http://www.mdfoothills.com/.

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Introduction

As the rate of development increases, so does the pressure placed on water bodies and sources of drinking water. In order to help mitigate the impacts of development, the Riparian Setback Matrix Model was created. The model will aid in the protection of shorelines, water quality and riparian areas[1], while allowing for development to occur in a sustainable manner.

The purpose of this document is to help developers understand the need for Environmental Reserve protection to maintain healthy and functional riparian areas free from pollution[2], while providing public access that will not impede natural functions. The Riparian Setback Matrix Model will be used by the Municipal District of Foothills to determine appropriate Environmental Reserve setbacks for all private lands located adjacent to environmentally sensitive and or significant water bodies, inclusive of lakes, streams, brooks, creeks or intermittent water inflows within the Municipal District.

What is the Riparian Setback Matrix Model

The Riparian Setback Matrix Model is a scientifically-based, legally defensible model that allows municipalities to take adequate precautions to prevent the most common forms of water pollution, instead of establishing arbitrary setbacks. Municipalities that adopt this approach will protect source water (drinking water sources) within their jurisdiction and will ultimately save thousands of dollars on long term water treatment costs as well as other benefits. This policy and procedure is in direct alignment with the Municipal Government Act (Section 663 and 664).

To obtain the required information (slope, height of bank, groundwater influence, soil type and texture, and vegetation data) required for the Riparian Setback Matrix Model, applicants will need to retain the services of a qualified professional, registered in the province of Alberta (i.e. surveyor, biologist, engineer, hydrologist, hydrogeologist or a combination thereof) to undertake an assessment of the proposed development. Please see the section entitled "Professional Requirements for Site Assessments" for a guide to the types of professional affiliation that are required for different site conditions based on a cursory initial assessment.

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[1] "Riparian land" means the lands adjacent to a watercourse where the vegetation and soils show evidence of being influenced by the presence of water. Riparian areas are the green zone around a watercourse. They are the vital transitional zone between surface water and the drier uplands and play a vital role in the healthy functioning of both.

[2] "Pollution" means any non-point source impacts on the environment from substances such as sediments, nutrients, pesticides, bacteria, parasites or toxic chemicals that reach a watercourse by surface or subsurface flow though adjacent land, and the unauthorized release of any "deleterious substance" as defined in the *Fisheries Act* (Canada), or the unauthorized release of any substance whether non-point or otherwise that may cause an adverse effect under provisions of the *Environmental Protection and Enhancement Act*.

What is an Environmental Reserve?

An Environmental Reserve is a buffer of natural land that lies between developed/developable land and environmentally sensitive areas such as lakes, rivers, streams, creeks, and wetlands. During subdivision of a parcel of land, under conditions prescribed in the *Municipal Government Ac*t (MGA), a municipality may acquire "reserve lands". Environmental Reserve is "undevelopable" land that must be left in its natural state or used as a public park or for public access to the area (Sec 671 MGA). The strip of land calculated by the RSMM will be dedicated to the MD of Foothills as Environmental Reserve (where the MD takes ownership), or, if the MD agrees, the landowner has the option of entering into an environmental reserve easement (where the landowner retains ownership but must abide by MD bylaws in respect to development and use) with the MD. The use of environmental reserve parcels for exclusive, private purposes will not be tolerated. As the owner of environmental reserve, the MD of Foothills has the responsibility to control access and use to ensure that these sensitive landscapes are sustained for current and future generations.

When do I need to dedicate reserve lands?

The subdivision authority of the MD of Foothills shall require the dedication of Environmental Reserve if the lands proposed for subdivision consist of: a) a swamp, gully, ravine, coulee or natural drainage course, b) land that is subject to flooding, or land that is unstable, or c) land abutting the bed and shore of any lake, river, stream or other body of water. If the lands adjacent to the minimum required 6 meter strip are also subject to subsidence, flooding, contain swamps and natural drainage courses, the required dedication of ER may result in a wider strip than 6 meters.

What is the purpose of an Environmental Reserve?

The strips of land abutting a lake, river/stream or wetland are taken for two purposes: to prevent pollution, or to provide public access to and beside the bed and shore. Environmental Reserve is dedicated to protect provincially owned beds and shores and water resources from "pollution". Therefore, the definition of pollution that a municipality adopts constitutes pollution in their community. The MD of Foothills defines aquatic pollution as the addition of excess nutrients and steps will be taken to protect aquatic systems from additional nutrients from making their way into watercourses via point and non-point source discharges. One of the most effective ways to protect aquatic ecosystems and prevent pollution is to ensure that riparian areas are intact, healthy and functional.

Riparian zones act as buffers and protect water quality. Contaminants are adsorbed onto sediments, taken up by vegetation and transformed by soil microbes into less harmful forms. Defining a riparian area (riparian buffer strip) that is large enough to effectively protect the water and the aquatic ecosystem is necessary. Each water body requires unique set riparian buffer widths and development setbacks. It is essential that municipalities determine appropriate land uses adjacent to bodies of water,

including wetlands, to avoid or minimize development impacts of valuable water resources, as stated in the provincial and municipal *Land Use Bylaws*. The importance of identifying and protecting a properly-sized buffer strip is extremely important for source water protection.

How much land will be taken as an Environmental Reserve?

The amount of land the MD of Foothills will require to be dedicated as Environmental Reserve will range from 15 - 75 meters. The amount of land required will vary with the changing slope, height of banks, groundwater influence, soil type and texture, and vegetative cover present on the land.

Will I be compensated for the land?

While a municipality is not required to compensate the landowner for any lands taken as "reserve" during the subdivision process, there are benefits of Environmental Reserve dedication. Environmental Reserve prevents pollution, including nutrients, from entering a water body. By preventing these nutrients from entering the water body, noxious algal blooms and the chances of winter fish kills from excessive aquatic plant growth and decay are minimized. Other benefits of Environmental Reserve dedication include public access to the water body, wildlife-attracting habitat as well as shoreline erosion prevention.

The trend of residing in an urban subdivision in a rural setting is increasing nationally. As the population shifts to these desirable rural subdivisions, more pressure is placed on the environment. The Riparian Setback Matrix Model gives the community the ability to benefit from the environmental social and economic services of the land.

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How to Use the Riparian Setback Matrix

The amount of Environmental Reserve (ER) will be determined by using the Riparian Setback Matrix Model. Environmental Reserve will be determined at several sites along the water's edge. The area dedicated as ER will vary across the site. Some areas will require more ER and others will require less. The dedicated ER will vary throughout the parcel of land depending on slope of the land, height of any banks present, groundwater influence, soil type and vegetative cover.

The amount of property bordering the water's edge will also affect how Environmental Reserve is determined. To start using the Riparian Setback Matrix, setback points will need to be established. The number of points used to determine Environmental Reserve will vary based on area.

1. **Establish the number and location of setback points required.**
   - 1.1. Whereas the location of the point will be:
     - 1.1.1. At the point where vegetation (living or dead) characteristic of an aquatic environment changes to that of upland vegetation. This vegetation includes but is not limited to; Sedges, Bulrushes, Cattails and Willows.
     - 1.1.2. If no vegetation exists, the setback point will be determined from the current edge of water.
     - 1.1.3. Whereas the length of land bordering the water body, stream or wetland is:
       - 1.1.3.1. **Greater than 200 meters –** The outside setback point will be no more than 100 meters from the property line along the water body, stream or wetland. The subsequent setback points will be equally spaced no more than 200 meters apart.
       - 1.1.3.2. **200 meters to 50 meters –** Two (2) setback points will be required equal distance apart and equal distance from each property line.
       - 1.1.3.3. **Less than 50 meters –** One (1) setback point will be required at the discretion of the Municipal District of Foothills. Please contact MD Foothills administration to determine the location of this setback point.
2. **Slope of the land** must be determined by a legal land surveyor at each of the setback points. From each setback point, determine the slope of the land perpendicular to the water body, stream or wetland. The setback distance for slope is calculated as follows:
   - 2.1. If the slope is **<5%,** the setback distance requirement is 10 m.
   - 2.2. If the slope is **5-9.9%,** the stated % the setback distance will be 10 m + 1 m for every 1 % increase in slope after the minimum.
   - 2.3. If the slope is **10-15%**, consult with MD of Foothills administration to determine if a geotechnical survey will be required.
   - 2.4. If the slope is **≥ 15 %,** then a geological survey is required. The total setback required for this site will be determined by a registered professional. The determined setback must take into

account the slope, height of bank, groundwater influence, soil type and vegetative cover. Setback requirements will be subject to the approval of the subdivision authority.

2.5. Record slope, under measured slope in Step 1 and enter the calculated distance adjustment in the TOTAL Box in Step 1.

2.6. If the determined setback is greater than or equal to 75 m, skip to step 6; otherwise, continue to step 3.

3. **Height of Bank** must be determined by a legal land surveyor at each of the setback points. From each setback point, determine the height of bank perpendicular to the water body, stream or wetland. NOTE: Height of bank will be determined at the same time as slope by the surveyor.

3.1. Put a check mark next to the appropriate bank height in Step 2.

3.2. Identify and enter the required distance adjustment in the TOTAL Box in Step 2.

3.3. If the required distance adjustment is 75 m you can stop here. The required distance adjustment for this site is 75 m. The Environmental Reserve allocation will be determined horizontally, perpendicular to the water body, stream or wetland from the setback point.

3.4. If the determined setback is greater than or equal to 75 m, skip to step 6; otherwise, continue to step 4.

4. Determine the **depth to the water table** for the site. This information can be obtained from a geotechnical report, or from local well data by a qualified hydrogeologist.

4.1. Put a check mark next to the appropriate groundwater depth in Step 3.

4.2. Identify and enter the required distance adjustment in the TOTAL Box in Step 3.

4.3. If the determined setback is greater than or equal to 75 m, skip to step 6; otherwise, continue to step 5.

5. Determine the **vegetation cover of each type** for the site.

5.1. From each setback point, determine the vegetation type perpendicular to the water body, stream or wetland, by creating a 1m x 10m plot.

5.2. Determine the percent of the plot that is grass, shrub, forested, cleared or impermeable.

5.3. Multiply the percentage of each vegetation cover class by the respective distance adjustment for each type.

5.4. Put the required adjusted distance beside the respective vegetation cover.

5.5. Add up the setback requirements from all vegetation cover types to obtain the total vegetation cover setback.

5.6. Continue to step 6.

6. **Determine the baseline setback** based on slope, bank height, groundwater depth, and vegetation cover.

6.1. If any of the setbacks calculated from steps 2 – 5 are equal to 75 m, the baseline setback for that point is 75 m.

6.2. Otherwise, the baseline setback is the maximum of the setbacks determined in steps 2 – 5.

7. Determine the **soil type and texture** for the site.

7.1. The soil type and texture with respect to proportions of sand, silt, clay, organic material (peat), rocks and gravel should be determined by a qualified professional.

7.2. Based on the percentages of each soil particle fraction, determine the soil texture category that the soil at the site falls into, and use this texture/type to determine the setback soil multiplier.

8. Multiply the distance obtained in step 6 by the soil multiplier determined in step 7. This is the final setback for the site.
9. **To establish Environmental Reserve**, determine setback distances from each setback point. Connect setback points. Setback to the property line will be done perpendicularly from the nearest determined setback point. (See diagram on Page 9 for clarification).

Example Setback Calculations

A parcel of land is situated with 75m of shoreline along a lake.

CALCULATING SLOPE SETBACKS

The measured slope at both survey sites on the parcel of land is 9%. This slope falls in the category that does not require a check with MD of Foothills administration. The setback distance will be 10 m + 4m for the additional 4% slope over 5% (10m + 4m = 14m).

CALCULATING BANK HEIGHT SETBACKS

The measured bank height at both survey sites on the parcel of land is 2 m. The setback distance calculated for bank height will be 10 m (all sites with bank heights less than 5 m are assigned a setback of 10 m).

CALCULATING GROUNDWATER DEPTH SETBACKS

Based on a hydrogeological study of the area, reviewed by a qualified hydrogeologist, the depth of the water table for the parcel of land is determined to be approximately 15 m. This places the depth in the 10-19.9 m depth category, and the resulting setback is 15 m.

CALCULATING VEGETATION SETBACKS

Plot 1 is covered by 20% grass & herbaceous vegetation, 30% shrubs, 40% forested, 10% bare ground, and 0% impermeable surfaces.

a. Forested (40% × 0.20)=8 m
b. Shrub (30% × 0.25) = 7.5 m
c. Grass & herbaceous (20% × 0.30) = 6 m
d. Bare ground (10% × 0.50)=5 m
e. Impermeable surfaces (0% × 0.60) = 0 m

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TOTAL Vegetation Setback = (6 m + 7.5 m + 8 m + 5 m + 0 m) = 26.5 meters.

Plot 2 is covered by 20% forested, 0% shrub, 50% grass & herbaceous vegetation, 30% bare ground, and 0% impermeable surfaces.

a. Forested (20% × 0.20)=4 m
b. Shrub (0% × 0.25) = 0 m
c. Grass & herbaceous (50% × 0.30) = 15 m
d. Bare ground (30% × 0.50)=15 m
e. Impermeable surfaces (0% × 0.60) = 0 m

TOTAL Vegetation Setback = (4 m + 0 m + 15 m + 15 m + 0 m) = 34 meters.

CALCULATING SOIL TEXTURE MODIFICATION OF SETBACKS:

Plot 1 (same as Plot 1 above) found to be on a soil with 10% clay, 30% silt, and 60% sand, which corresponds to a sandy loam.

The soil multiplier for a sandy loam is 1.0.

Because the vegetation calculations yielded the largest calculated setback for the plot, the setback calculated for Plot 1 is (26.5 m × 1.0) = 26.5 m.

Plot 2 (same as Plot 2 above) found to be on a soil with 35% clay, 35% silt, and 30% sand, which corresponds to a clay loam.

The soil multiplier for a clay loam is 1.25.

Because the vegetation calculations yielded the largest calculated setback for the plot, the setback calculated for Plot 2 is (34 m × 1.25) = 42.5 m.

See the attached Riparian Setback Matrix Model sample worksheets and the schematic diagrams of two setback point below for more clarification.

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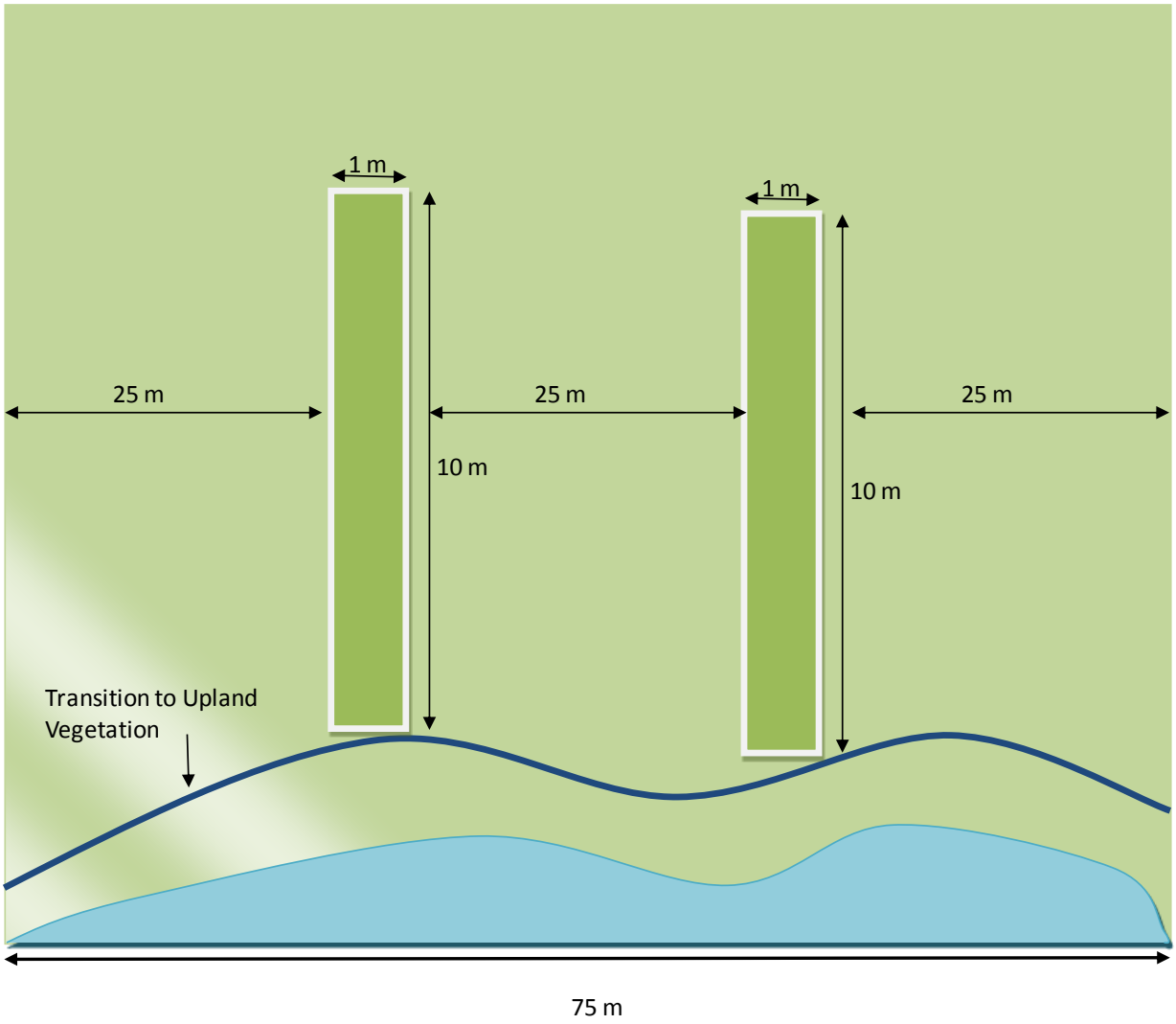

Figure 1. Laying out setback determination sites and vegetation sampling plots for a parcel of land 75 m long.

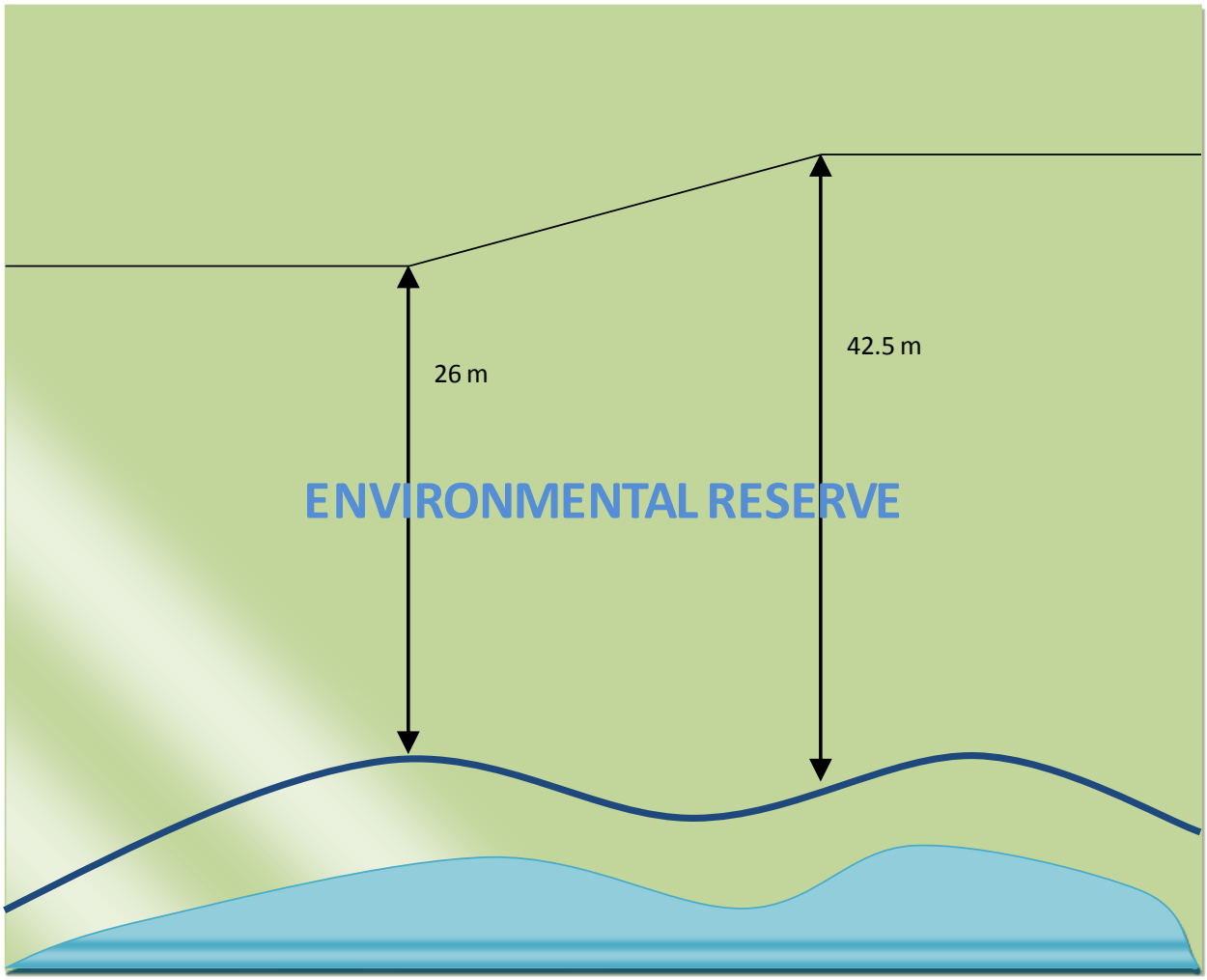

Figure 2. Establishment of Environmental Reserve Boundaries based on the setbacks calculated

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Professional Requirements for Site Assessments

Although every effort has been made to make the Riparian Setback Matrix Model accessible to as wide an audience as possible, the determination of setbacks should not be undertaken without enlisting the assistance of a professional with qualifications appropriate for the conditions and complexity of the site.

Condition	Professional Requirements for setback determination
Low slope, obvious transition from aquatic to upland vegetation, groundwater table known from nearby wells	Professional biologist
Complex vegetation communities with no obvious transition from aquatic to upland vegetation	QAES/QWAES
Moderate slopes (5-15%)	Legal land surveyor
Steep slopes (>15%)	Geotechnical professional (Geological engineer, hydrogeologist)
Extensive river meander or presence of floodplain	QAES/QWAES + Geotechnical professional
Unknown water table depth	Hydrogeologist

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Vegetation Definitions

Grass & Herbaceous Plants: Any grass or non-woody vegetation (including grasses, forbs, rushes, sedges).

Shrub: Shrubs will be defined as woody plants differing from a tree by its low stature (>2m) and by generally producing several basal shoots instead of a single trunk. Tree seedlings (saplings) <2m will also be considered as shrubs.

Forested: A tree or group of trees with an average height of 2 m and an associated understory.

Cleared: An area where the soil is exposed. There may be sporadically occurring plants present.

Aquatic Vegetation: Plants that grow in water or in saturated soils (i.e. bulrushes, sedges, cattails, rushes, willows).

Upland Vegetation: Plants that grow away from the water in drier soils (i.e. aspen, birch, white spruce and pine trees; shrubs such as rose, mountain ash, juniper and Saskatoon; grasses such as fescue, common grass, wild rye and wheat grass).

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SAMPLE RSMM WORKSHEETS FOR EXAMPLE SITE

Waterbody Name: (UNNAMED WATERBODY) - PLOT 1 Waterbody Location: NW-XX-YY-ZZ-W5
Waterbody Type (circle one): Lake/Pond River/Stream Wetland

STEP 1	Slope Category (%)	Slope (%)	Distance Adjustment
	0 - 4.9	_____	10 m
	5 - 9.9	__9%___	10 m + 1 m per % of slope over 5%
	10 - 14.9	_____	Same as above†
	≥ 15	_____	Requires a geotechnical survey††
	SLOPE SETBACK	__14 m__	

STEP 2	Height of Bank	Bank Height (m)	Distance Adjustment
	< 5 m	___2 m__	10 m
	5 to 30 m	_____	2x height of bank
	≥ 30 m	_____	60 m
	BANK HEIGHT SETBACK	___10 m___	

STEP 3	Groundwater Influence	Select one:	Distance Adjustment
	Distance to water table	_____	
	0 - 9.9 m	_____	30 m
	10 - 19.9 m	__X__	15 m
	≥ 20 m	_____	10 m
	GROUNDWATER SETBACK	_____	

STEP 4	Vegetative Cover Type	% Cover	Distance Adjustment (m / % cover type)
	Forested	___40%__	0.15
	Shrub	___30%__	0.25
	Grass and Herbaceous Plants	___20%__	0.30
	Bare Ground	___10%__	0.50
	Impermeable surfaces	___0%___	0.60†††
	VEGETATION SETBACK	_____ ___26.5 m__	

STEP 5	Soil Texture/Type	Select one:	Distance Adjustment (multiplier) ††††
	Peat (minimum 50% organic matter in soil)	_____	1.0
	Sand, Sandy Loam, or Loamy Sand	__X__	1.0
	Loam, Silty Loam, or Silt	_____	1.1
	Clay Loam, Sandy Clay Loam, Silty Clay Loam, Sandy Clay, Silty Clay, or Clay	_____	1.25
	Rock and gravel (more than 50% rock and gravel)	_____	1.25
	SOIL SETBACK MULTIPLIER	___1.0__	

STEP 6	Overall Setback Calculation	
	Determine maximum setback from Steps 1-4 above	__26.5 m_
	Multiply baseline setback by soil texture multiplier	___1.0___
	TOTAL CALCULATED SETBACK:	__26.5 m_

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Waterbody Name: (UNNAMED WATERBODY) - PLOT 2 Waterbody Location: NW-XX-YY-ZZ-W5
Waterbody Type (circle one): Lake/Pond River/Stream Wetland

STEP 1	Slope Category (%)	Slope (%)	Distance Adjustment
	0 - 4.9	_____	10 m
	5 - 9.9	__9%___	10 m + 1 m per % of slope over 5%
	10 - 14.9	_____	Same as above†
	≥ 15	_____	Requires a geotechnical survey††
	SLOPE SETBACK	__14 m__	

STEP 2	Height of Bank	Bank Height (m)	Distance Adjustment
	< 5 m	___2 m__	10 m
	5 to 30 m	_____	2x height of bank
	≥ 30 m	_____	60 m
	BANK HEIGHT SETBACK	___2 m___	

STEP 3	Groundwater Influence	Select one:	Distance Adjustment
	Distance to water table	_____	
	0 - 9.9 m	_____	30 m
	10 - 19.9 m	__X__	15 m
	≥ 20 m	_____	10 m
	GROUNDWATER SETBACK	_____	

STEP 4	Vegetative Cover Type	% Cover	Distance Adjustment (m / % cover type)
	Forested	___20%__	0.15
	Shrub	___0%___	0.25
	Grass and Herbaceous Plants	___50%__	0.30
	Bare Ground	___30%__	0.50
	Impermeable surfaces	___0%___	0.60†††
	VEGETATION SETBACK	_____ ___34 m__	

STEP 5	Soil Texture/Type	Select one:	Distance Adjustment (multiplier) ††††
	Peat (minimum 50% organic matter in soil)	_____	1.0
	Sand, Sandy Loam, or Loamy Sand	_____	1.0
	Loam, Silty Loam, or Silt	_____	1.1
	Clay Loam, Sandy Clay Loam, Silty Clay Loam, Sandy Clay, Silty Clay, or Clay	__X__	1.25
	Rock and gravel (more than 50% rock and gravel)	_____	1.25
	SOIL SETBACK MULTIPLIER	__1.25__	

STEP 6	Overall Setback Calculation		
	Determine maximum setback from Steps 1-4 above	__34 m__	
	Multiply baseline setback by soil texture multiplier	__1.25___	
	TOTAL CALCULATED SETBACK:	_42.5 m__	

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