PROVINCE OF BRITISH COLUMBIA

ORDER OF THE LIEUTENANT GOVERNOR IN COUNCIL

Order in Council No. 837 *, Approved and Ordered* JUL 27 2004

Lieutenant Governor

Executive Council Chambers, Victoria

On the recommendation of the undersigned, the Lieutenant Governor, by and with the advice and consent of the Executive Council, orders that, effective March 31, 2005,

1 the Streamside Protection Regulation, B.C. Reg. 10/2001, is repealed, and

2 the attached Riparian Areas Regulation is made.

Minister of Water, Land and Air Protection

Presiding Member of the Executive Council

(This part is for administrative purposes only and is not part of the Order.)

Authority under which Order is made:

Act and section:- *Fish Protection Act*, S.B.C. 1997, c. 21, ss. 12, 13 (1) and 37 (2)

Other (specify):- oic 34/2001

June 9, 2004

Resub 740/2004/8

RIPARIAN AREAS REGULATION

Contents

Definitions and interpretation

1 (1) In this regulation:

"Act" means the *Fish Protection Act*;

"active floodplain" means an area of land that supports floodplain plant species and is

(a) adjacent to a stream that may be subject to temporary, frequent or seasonal inundation, or

(b) within a boundary that is indicated by the visible high water mark;

"assessment methods" means the methods set out in the Schedule;

"assessment report" means a report prepared in accordance with the assessment methods to assess the potential impact of a proposed development in a riparian assessment area and which is certified for the purposes of this regulation by a qualified environmental professional;

"development" means any of the following associated with or resulting from the local government regulation or approval of residential, commercial or industrial activities or ancillary activities to the extent that they are subject to local government powers under Part 26 of the *Local Government Act*:

(a) removal, alteration, disruption or destruction of vegetation;

(b) disturbance of soils;

(c) construction or erection of buildings and structures;

(d) creation of nonstructural impervious or semi-impervious surfaces;

(e) flood protection works;

(f) construction of roads, trails, docks, wharves and bridges;

(g) provision and maintenance of sewer and water services;

(h) development of drainage systems;

(i) development of utility corridors;

(j) subdivision as defined in section 872 of the *Local Government Act*;

"development proposal" means any development that is proposed in a riparian assessment area that is within or partly within the boundaries of an area administered by a local government;

"fish" means all life stages of

(a) salmonids,

(b) game fish, and

(c) regionally significant fish;

"floodplain plant species" means plant species that are typical of an area of inundated or saturated soil conditions and that are distinct from plant species on freely drained adjacent upland sites;

"high water mark" means the visible high water mark of a stream where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed of the stream a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself, and includes the active floodplain;

"ministry" means the Ministry of Water, Land and Air Protection;

"natural features, functions and conditions" include but are not limited to the following:

(a) large organic debris that falls into the stream or streamside area, including logs, snags and root wads;

(b) areas for channel migration, including active floodplains;

(c) side channels, intermittent streams, seasonally wetted contiguous areas and floodplains;

(d) the multicanopied forest and ground cover adjacent to streams that

(i) moderates water temperatures,

(ii) provides a source of food, nutrients and organic matter to streams,

(iii) establishes root matrices that stabilize soils and stream banks, thereby minimizing erosion, and

(iv) buffers streams from sedimentation and pollution in surface runoff;

(e) a natural source of stream bed substrates;

(f) permeable surfaces that permit infiltration to moderate water volume, timing and velocity and maintain sustained water flows in streams, especially during low flow periods.

"permanent structure" means any building or structure that was lawfully constructed, placed or erected on a secure and long lasting foundation on land in accordance with any local government bylaw or approval condition in effect at the time of construction, placement or erection;

"qualified environmental professional" means an applied scientist or technologist, acting alone or together with another qualified environmental professional, if

(a) the individual is registered and in good standing in British Columbia with an appropriate professional organization constituted under an Act, acting under that association's code of ethics and subject to disciplinary action by that association,

(b) the individual's area of expertise is recognized in the assessment methods as one that is acceptable for the purpose of providing all or part of an assessment report in respect of that development proposal, and

(c) the individual is acting within that individual's area of expertise;

"ravine" means a narrow, steep-sided valley that is commonly eroded by running water and has a slope grade greater than 3:1;

"riparian area" means a streamside protection and enhancement area;

"riparian assessment area" means

(a) for a stream, the 30 meter strip on both sides of the stream, measured from the high water mark,

(b) for a ravine less than 60 meters wide, a strip on both sides of the stream measured from the high water mark to a point that is 30 meters beyond the top of the ravine bank, and

(c) for a ravine 60 meters wide or greater, a strip on both sides of the stream measured from the high water mark to a point that is 10 meters beyond the top of the ravine bank;

"stream" includes any of the following that provides fish habitat:

(a) a watercourse, whether it usually contains water or not;

(b) a pond, lake, river, creek or brook;

(c) a ditch, spring or wetland that is connected by surface flow to something referred to in paragraph (a) or (b);

"streamside protection and enhancement area" means an area

(a) adjacent to a stream that links aquatic to terrestrial ecosystems and includes both existing and potential riparian vegetation and existing and potential adjacent upland vegetation that exerts an influence on the stream, and

(b) the size of which is determined according to this regulation on the basis of an assessment report provided by a qualified environmental professional in respect of a development proposal;

"top of the ravine bank" means the first significant break in a ravine slope where the break occurs such that the grade beyond the break is flatter than 3:1 for a minimum distance of 15 meters measured perpendicularly from the break, and the break does not include a bench within the ravine that could be developed;

"wetland" means land that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, fens, estuaries and similar areas that are not part of the active floodplain of a stream.

(2) For the purposes of the definition of "streamside protection and enhancement area," vegetation must be considered to be "potential" if there is a reasonable ability for regeneration either with assistance through enhancement or naturally, but an area covered by a permanent structure must be considered to be incapable of supporting potential vegetation.

Purposes of this regulation

2 The purposes of this regulation are

(a) to establish directives to protect riparian areas from development so that the areas can provide natural features, functions and conditions that support fish life processes, and

(b) to facilitate an intergovernmental cooperation agreement between the ministry, Fisheries and Oceans Canada and the Union of British Columbia Municipalities including the ability for individual intergovernmental cooperation agreements with local governments for any of the following:

(i) the implementation of this regulation;

(ii) the confirmation of regionally significant fish by the Ministry of Water, Land and Air Protection;

(iii) providing, sharing or confirming information on fish habitat conditions;

(iv) describing roles and responsibilities with reference to applicable and appropriate use of authority and program mandates;

(v) dispute resolution;

(vi) a compliance strategy, including education, training, monitoring, reporting, enforcement and auditing.

Application

3 (1) This regulation applies to the exercise of local government powers by local governments under Part 26 of the *Local Government Act* in those local government areas to which this regulation applies.

(2) This regulation does not apply to a development permit or development variance permit issued only for the purpose of enabling reconstruction or repair of a permanent structure described in section 911 (8) of the *Local Government Act* if the structure remains on its existing foundation.

Assessment reports required before development

4 (1) In respect of development proposals related wholly or partially to riparian assessment areas within the jurisdiction of a local government, a local government must not approve or allow development to proceed in those riparian assessment areas unless the development proceeds in accordance with subsection (2) or (3).

(2) A local government may allow development to proceed if

(a) a qualified environmental professional carries out an assessment and certifies in the assessment report for that proposal that he or she is qualified to carry out the assessment, that the assessment methods have been followed, and provides their professional opinion that

(i) if the development is implemented as proposed there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area, or

(ii) if the streamside protection and enhancement areas identified in the report are protected from the development and the measures identified in the report as necessary to protect the integrity of those areas from the effects of the development are implemented by the developer, there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area, and

(b) the local government is notified by the ministry that Fisheries and Oceans Canada and the ministry have been

(i) notified of the development proposal, and

(ii) provided with a copy of an assessment report prepared by a qualified environmental professional that

(A) certifies that he or she is qualified to carry out the assessment,

(B) certifies that the assessment methods have been followed, and

(C) provides a professional opinion, that meets the requirements of subsection (2) (a) (i) or (ii), as to the potential impact of the development on the natural features, functions and conditions that support fish life processes in the riparian assessment area.

(3) A local government may allow development to proceed if the Minister of Fisheries and Oceans or a regulation under the *Fisheries Act* (Canada) authorizes the harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area that would result from the implementation of the development proposal.

Development of strategies for monitoring, enforcement and education

5 The local government must cooperate in developing strategies with the ministry and Fisheries and Oceans Canada

(a) for obtaining certificates by qualified environmental professionals that the conditions set out in assessment reports have been properly implemented,

(b) for monitoring and enforcement to ensure that assessment reports have been properly prepared in accordance with the assessment methods and properly implemented, and

(c) for public education with respect to the protection of riparian areas.

Use of local government powers for protection and enhancement of areas

6 When exercising its powers with respect to development, a local government must protect its riparian areas in accordance with this regulation.

Preparation of assessment report by qualified environmental professional

7 An assessment report for the purposes of this regulation must employ the assessment methods set out in the Schedule and must report on all of the following:

(a) the width of the streamside protection and enhancement area which must be protected, and

(b) the measures necessary to protect the integrity of the streamside protection and enhancement area.

Transitional

8 (1) In this section, **"former regulation"** means the Streamside Protection Regulation, B.C. Reg 10/2001.

(2) If, before this regulation came into force, a local government had established streamside protection and enhancement areas in accordance with the former regulation, the local government is deemed to have met the requirements of this regulation in respect of those areas.

(3) Despite section 6 (5) of the former regulation, an amendment of a streamside protection and enhancement area referred to in subsection (2) of this section must be in accordance with this regulation.

SCHEDULE

ASSESSMENT METHODS

Assessment Methods

Contents

1 Preparing an Assessment Report

An Assessment Report specifies the appropriate SPEA (streamside protection and enhancement area) width following the applicable methodology (Chapter 2) and outlines the measures required to maintain the integrity of the SPEA. The proponent must prepare an Assessment Report in support of their application to local government for development approval if they are proposing development within 30 meters of a stream or the top of a ravine bank of a stream.

The Assessment Report must be prepared by a Qualified Environmental Professional (QEP) (or group of professionals) who understands the interaction of the various features, functions and conditions that riparian area provides. Specific experts may be called on to provide their relative expertise on site characteristics that may pose specific problems or concerns. For example, highly unstable channels may need assessment by a fluvial geomorphologist to help define the appropriate SPEA and recommend measures that will assist in maintaining the various features, functions and conditions of the riparian area. In addition, a fisheries biologist may be required to determine fish presence or absence.

The Assessment Report is the document used to support the development application as well as notify both FISHERIES AND OCEANS CANADA and the MINSTRY OF WATER LAND AND AIR PROTECTION. This report must be prepared and signed by the QEPs and should integrate the results of the riparian assessment (see Chapter 2) with the proposed development. **The QEP will certify in the assessment report for that proposal that he or she is qualified to carry out the assessment, that the assessment methods have been followed, and provides their professional opinion that**

(i) if the development is implemented as proposed there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area, or

(ii) if the streamside protection and enhancement areas identified in the report are protected from the development and the measures identified in the report as necessary to protect the integrity of those areas from the effects of the development are implemented by the developer, there will be no harmful alteration, disruption or destruction of natural features, functions and conditions that support fish life processes in the riparian assessment area.

If the development cannot accommodate the prescribed SPEA width and measures, local government may be able to exercise some flexibility. In this case local government will sign off any revisions to the Assessment Report required to accommodate the planned development. If the flexibility afforded local government by fisheries agencies is unable to accommodate the development, then the proponent must either redesign the development or apply to FISHERIES AND OCEANS CANADA for a *Fisheries Act (sec 35.2)* authorization. The Assessment Report should accompany the application for authorization.

The Assessment Report has been designed to be commensurate with the nature of the site conditions and the development proposed. It will permit monitoring and auditing by regulatory agencies. It will also allow for a determination of those features, functions and

conditions that are deficient and targets for potential compensation proposals, and/or goals for restoration.

1.1 Components of a Assessment Report

The Assessment Report must be comprised of the following components:

1.1.1 Description of Fisheries Resource Values

A summary description of the existing fisheries resource features associated with the subject riparian area, including location of the watercourse (municipality, regional district etc.), species of fish that frequent the waterbody, fish habitat present (e.g. spawning, rearing, over-wintering or migration) and a description of the present riparian vegetation. This information may assist in determining appropriate measures to protect the SPEA and fish habitat *i.e.* sediment control measures during construction, or the design of compensation if seeking an authorization under the *Fisheries Act* from Fisheries and Oceans Canada.

1.1.2 Results of the Riparian Assessment (SPEA Width)

The results of the Riparian Assessment should be included in this section. The SPEA width for the subject parcel of land should be described, along with the methodology used for its determination. The forms found in *the appendix* should be completed with the results summarized in this section.

1.1.3 Description of Proposed Development

An accurate site plan showing topographic features should form the basis of the description of proposed development. The site plan should be accurate and of the appropriate size and scale to show all of the required features, including the SPEAs and measures to maintain the integrity of the SPEAs. Predevelopment data and land development features will be overlaid onto the base map to provide a visual development plan. The site plan should show both primary development (*i.e.* permanent buildings) and all supporting infrastructure (*i.e.,* servicing, walls, roads, trails, docks, *etc.*). Site plans will vary in their complexity, according to the scale of the development. In general, local government will have requirements for site plan development and the proponent should check with them to ensure the appropriate scale is selected.

The description of the proposed development should also include a schedule outlining major activities with an approximate schedule as to when these activities will be undertaken.

1.1.4 Environmental Monitoring

This section should identify actions to be taken to ensure all proposed activities are completed as described. It should detail the proposed monitoring schedule.

2 Conducting a Riparian Assessment

An Assessment Report contains the results of a Riparian Assessment. Two assessment options are available to the proponent to determine the applicable SPEA width. The first option is a "simple" assessment, based on certain stream characteristics – fish-bearing, nature of stream flows and the status of streamside vegetation. This results in a SPEA width outlined in Table 2-1. The second option is a "detailed" assessment to determine the SPEA width based on a site specific assessment of the features, functions and conditions of the riparian area.

2.1 What is the Assessment Area?

The area subject to assessment has both a width (drawn perpendicularly from the stream) and a length (parallel to the stream). For all assessments except ravines, the width of the assessment area is 30 m (horizontal distance). For streams the 30 m begins at the "high water mark". In ravine situations, slope stability and windthrow concerns must also be addressed by the QEP, so the assessment area extends beyond the top of the ravine bank as follows (see Figure 2-1):

- For ravines greater than 60 m in width (from the top of one ravine bank to the other, excluding the stream width) the assessment area extends to a point 10 m upslope from the top of ravine bank.
- For ravines less than 60 m in width (from the top of one ravine bank to the other, excluding the stream width) the assessment area extends to a point 30 m upslope from the top of ravine bank.

It is important to remember that the Assessment Report will outline any measures required to maintain and protect the SPEA (see section 1.1.4).

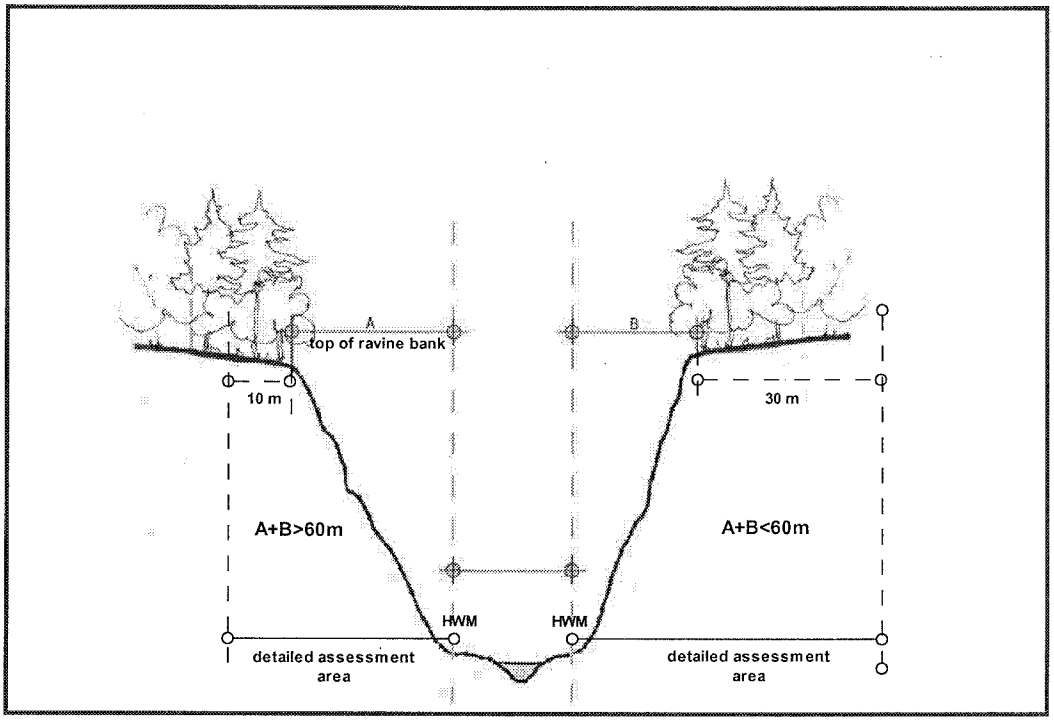


Figure 2-1: Assessment area for ravines

2.2 Option 1 - Simple Assessment

Existing or potential* streamside vegetation conditions	***Streamside Protection and Enhancement Area Width****		
	Fish bearing	***Non-Fish bearing***	
		Permanent	***Non Permanent***
Continuous areas ≥30 m or discontinuous but occasionally > 30 m to 50 m	At least 30 m		At least 15 m
Narrow but continuous areas = 15 m or discontinuous but occasionally > 15 m to 30 m	Greater of: existing width or potential width or 15 m	15 m	
Very narrow but continuous areas up to 5 m or discontinuous but occasionally > 5 m to 15 m		At least 5 m and up to 15 m	

** measured from the high water mark or top of ravine bank*

Table 2-1 Streamside Protection and Enhancement Area (SPEA) Widths

The Simple Assessment sets out widths for SPEAs based on certain stream characteristics – fish-bearing, nature of stream flows and the status of streamside vegetation (Table 2-1).

These widths have been defined for the protection of fish habitat, tempered by the feasibility of applying these widths in developed areas. The "simple assessment" applies a SPEA width based on whether the stream is fish-bearing, the status of streamside vegetation and whether the streamflow is permanent or non-permanent.

2.2.1 SPEA – How is it determined?

Determining a SPEA under Option 1 requires answering four key questions:

The Key Questions:

1. Is it a ***stream*** (as defined by the RIPARIAN AREAS REGULATION)?
2. What is the width and status of the ***existing and potential streamside vegetation***?
3. Is the stream currently or potentially ***fish bearing***? Or is it tributary to a fish-bearing stream?
4. (For a few situations) is the stream ***permanent*** or ***non permanent***?

The following section addresses each of these questions in turn and defines the area where the question needs to be answered, what the default value is and the professional designation of the individual qualified to assist in answering the question. The proponent has the option of assuming the value listed under the default for each question and then applying the buffer width listed in Table 2-1 and outlined in section 3.1.

Question 1: Is it a Stream (under the RIPARIAN AREAS REGULATION)?

Assessment Area:	Stream reach (see definition below) immediately adjacent to the subject parcel.
Default:	It is a stream under the RIPARIAN AREAS REGULATION.
QEP:	R.P.Bio.

The RIPARIAN AREAS REGULATION defines streams to encompass any watercourse – natural or human-made – that provides fish habitat that contains water on a perennial or seasonal basis, is scoured by water or contains observable deposits of mineral alluvium, and has a continuous channel bed, including a watercourse that is obscured by overhanging or bridging vegetation or soil mats. A watercourse may not itself be inhabited by fish, but may provide water, food and nutrients to streams that do support fish.

> **RIPARIAN AREAS REGULATION definition - stream**: "includes any of the following that provides fish habitat:
>
> (a) a watercourse, whether it usually contains water or not;
>
> (b) a pond, lake, river, creek, brook;
>
> (c) a ditch, spring or wetland that is connected by surface flow to a something referred to in paragraph (a) or (b);"

The RIPARIAN AREAS REGULATION does not apply to marine shorelines or to streams which do not contain fish but empty into the ocean. Marine shorelines are still

considered fish habitat under the *Fisheries Act* and FISHERIES AND OCEANS CANADA should be contacted regarding appropriate setback widths to ensure that development activities do not result in a HADD.

This definition is broad but is consistent with the definition of fish habitat under the federal *Fisheries Act*. As such this definition provides the basis for harmonizing municipal, provincial and federal statutory requirements. It also ensures consistency in application and interpretation of streamside protection requirements across the three levels of government. So, when is a watercourse not a stream under the RIPARIAN AREAS REGULATION? When it does not support fish or drain into a watercourse that supports fish; e.g., an isolated wetland that is not connected to a stream system; or a roadside ditch that is not directly connected to a fish bearing stream. Note, however, that these 'non-fish' watercourses may still provide important functions as habitat to other aquatic organisms, food, water and migration corridors for birds and wildlife, water storage and cleansing, and greenway and aesthetic values for people. The fact that the RIPARIAN AREAS REGULATION focuses on fish streams does not prevent local governments from regulating development around these other watercourses in the interests of protecting a wider range of values.

Assessment Methods definition - reach: "A homogeneous segment of a drainage network greater than 100 m characterized by uniform channel pattern, gradient, substrate and channel confinement."

Streams and ditches: Discerning when a "ditch" is a stream as opposed to a conduit of surface drainage only, is a complicated question because not all ditches are created equal. The key question is: is it connected by surface flow to a stream that provides fish habitat? If the answer is yes to both questions then it **is** a stream under the RIPARIAN AREAS REGULATION.

Question 2: What is the Status of Existing and Potential Vegetation?

Assessment Area:	***Width (perpendicular from HWM)***	***Length (along HWM)***
	Greater than or equal to 50 m	Minimum 500 m from midsection of subject parcel or length of subject lot, whichever is greater (see Figure 5-2.)
Default:	Entire 30 m is existing or potential vegetation	
QEP:	R.P.Bio. (for establishing the HWM)	

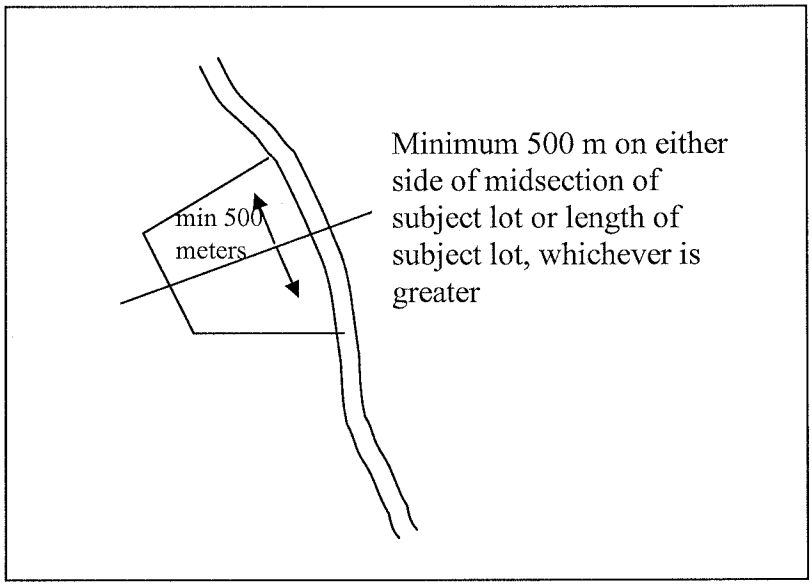


Figure 2-2: Length of Assessment Area for Determining Status of existing or Potential Vegetation

Determining the width and status of streamside vegetation requires three things:

- Defining the high water mark (HWM) (see section 3.1.1.) as the starting point;
- Locating permanent structures; and
- Locating *existing vegetation* and determining areas that have "potential" for re-establishing vegetation.

Permanent structures

Permanent structures include buildings as well as infrastructure such as roads, parking lots, utilities, and recreational facilities that will receive *continuous use*. Table 2-2 provides further details on defining permanent structures.

RIPARIAN AREAS REGULATION definition – permanent structure: "any building or structure that was lawfully constructed, placed or erected on a secure and long lasting foundation on land in accordance with any local government bylaw or approval condition in effect at the time of construction, placement or erection"

Existing and potential vegetation

Existing vegetation means native and non-native vegetation. *Potential* vegetation refers to portions of streamside areas that have been cleared of vegetation but where there are no permanent structures, such that in the short to medium term, with development or a change in land use, the streamside area could be re-vegetated. The RIPARIAN AREAS REGULATION defines four categories of existing and potential vegetation conditions (Figure 2-3).

RIPARIAN AREAS REGULATION definition:

Potential vegetation: "is considered to exist if there is a reasonable ability for regeneration either with assistance through enhancement or naturally, but an area covered by a *permanent structure* must be considered to be incapable of supporting potential vegetation.

Note that a previously developed streamside site could become "potential" vegetation if redevelopment is proposed that involves removing one or more permanent structures. In that case, reclaiming and restoring a streamside area to a vegetated state could form part of the subsequent development approval.

Table 2-2: Examples of permanent structures

Structure	Is it Permanent or Temporary?	Is it Potential Vegetation?
Building	**Permanent** if constructed and compliant with permits, approvals and standards required at the time of construction; this includes buildings that pre-date current permitting processes but which are considered "legal" whether or not they conform to current zoning or building standards.	No
Public road	**Permanent** if the road alignment is consistent with a current transportation plan and cannot be changed.	No
Private road	**Permanent** if it is required as access for an existing use that is not subject to change (*i.e.*, not subject to redevelopment, rezoning or subdivision wherein road alignment could change).	No
Temporary access	**Temporary** if an alternative, permanent access will be developed as part of site development.	Yes
Parking area	**Permanent** if it is associated with a permitted structure and is required to meet minimum local government parking standards for the existing use (*i.e.*, parking area can not be reduced, altered, moved or relocated). **Temporary** if the area is subject to new development, redevelopment, rezoning or subdivision, is not associated with a permanent structure, and/or the parking area can be reduced, or reasonably altered, or relocated.	No Yes
Landscaped area	**Temporary** if it could be modified over time to provide more natural riparian conditions	Yes
Playing field, playground or golf course	**Permanent** - however, there may be room and opportunity to relocate structures or allow streamside areas to be 'naturalized' without compromising the recreational use. **Temporary** if the land is being used in this capacity in the short term, while being held for another recreational or other purpose.	Negotiable
Trail (also see Box 6-3)	**Permanent** if it is an integral part of an existing or approved trail network, has been in use for an extended period of time and/or there is no room or opportunity to relocate it. **Temporary** if it does not have structures (*i.e.*: boardwalks, viewing platforms, access control structures, bridges) associated with it or there is room or opportunity to relocate the trail, especially portions that are degrading streambanks and riparian vegetation.	No Yes
Outdoor storage associated with a commercial, industrial or utility operation	**Permanent** if it is associated with a permitted structure, the existing use of which is to be retained, storage use is in compliance with all other appropriate legislation, and storage area can not be reduced, altered, moved or relocated. **Temporary** if the existing property use will not be retained; the site is subject to new development, redevelopment, rezoning or subdivision; the storage facility would not be considered a permitted structure; and/or the storage area can be reduced altered, moved or relocated.	No Yes
Utility works and services	**Permanent** if it is an authorized use in compliance with all other appropriate legislation. Where the utility is underground for which a right of way exists for servicing purposes, the right of way within the streamside area should be naturalized or revegetated with minimum vegetation clearing to allow service vehicle access to the area.	No
Dykes, levees	**Permanent** if the structure is provincially or federally approved, and intended to provide long-term flood protection to associated properties. **Temporary** if the structure is not intended to provide long term protection, may be feasibly moved back or realigned, or is planned to be decommissioned as part of an infrastructure renewal program.	No Negotiable

Delineating existing and potential vegetation

Mark all permanent structures within 30-50 m of HWM of the riparian area.

Where the 30-50 m wide streamside area is highly developed, highlight areas of existing vegetation and "potential" vegetation as represented by non-permanent structures or restorable clearings in the streamside area.

Draw an approximate or average boundary of existing and potential vegetation that includes all non-permanent structures or restorable areas but excludes permanent structures.

Estimate into which category of existing/potential vegetation condition the streamside area in question falls (see Figure 2-3).

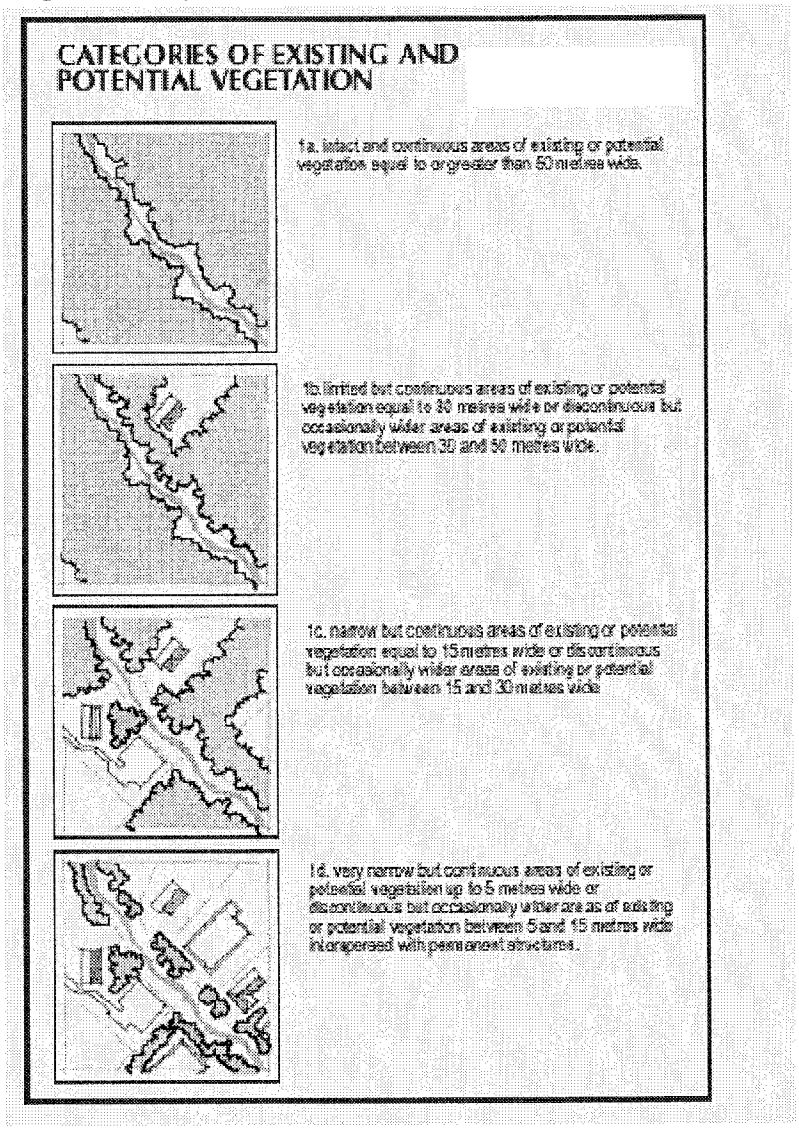


Figure 2-3: Categories of existing and potential vegetation

Field check: Field checking an aerial or orthophoto interpretation is particularly important where land uses have changed or structures and clearings are difficult to interpret.

Question 3: Is the stream fish-bearing?

Assessment Area:	Stream reach(es) immediately adjacent to the subject parcel
Default:	Fish-bearing
QEP:	R.P.Bio.

Fish bearing streams are ones in which fish are present or *potentially* present if introduced obstructions could be made passable.

Determining fish presence

If it is not known whether a stream supports fish, there are a few resources to check:

Note: these are not to be used as a source for determining fish absence. If no information exists that indicates fish presence then the methodology found in the appendix must be employed to determine fish presence/absence.

Stream reaches with a 20% average gradient are not considered fish-bearing for the purposes of applying the simple assessment methodology. However, fish such as cutthroat trout, bull trout, Dolly Varden char and sometimes rainbow trout have been observed to occur in very steep streams, well in excess of 20% gradient, where the reach has a stepped-pool profile and (or) where a lake occurs at the head of the drainage. In these scenarios the methodology found in the appendix must be employed to determine fish presence/absence.

Assessment methods definitions:

Fish-bearing: Means a stream

(a) in which fish are present or potentially present if introduced barriers or obstructions are either removed or made passable for fish, being one or more of the following species of fish:

(i) anadromous salmonids;

(ii) rainbow trout, cutthroat trout, brown trout, bull trout, Dolly Varden char, lake trout, brook trout, kokanee, largemouth bass, smallmouth bass, mountain whitefish, lake whitefish, arctic grayling, burbot, white sturgeon, black crappie, yellow perch, walleye or northern pike;

(iii) regionally significant fish species, as confirmed by the Ministry of Water Land and Air Protection;

(iv) red or blue listed fish, or

(b) which has an average slope gradient of less than 20% for each 100 m, unless an acceptable fish inventory as outlined in the Appendix, carried out by a qualified environmental professional, shows that it is not frequented by any species of fish referred to in paragraph (a),

but does not include any portion of the stream that is located upstream of a proven permanent barrier to fish, if there is no fish habitat beyond that barrier;

Non Fish-Bearing: Means a stream that

(a) is not inhabited by fish, and

(b) provides water, food and nutrients to a downstream fish bearing stream or other water body

When the proponent identifies a situation where an accessible and (or) lake-headed stepped-pool reach of $\geq$ 20% grade occurs in the upper parts of a fish-bearing stream, the proponent is encouraged in the interests of fish population conservation to contact and consult with the MWLAP regional office, and if necessary, the local FISHERIES AND OCEANS CANADA office in order to establish whether the reach might be surveyed for fish.

When fish listed in the definition of fish bearing are found in a given reach, that reach is to be identified, classified and managed as a fish-bearing stream reach regardless of its gradient.

The Fisheries Information Summary System (FISS) is maintained by the B.C. Ministry of Sustainable Resource Management and FISHERIES AND OCEANS CANADA, and can be accessed through their websites (Box 2-1). It provides maps of streams indicating fish presence and habitat value. **However, at a scale of 1:20,000, the FISS misses many small streams that may contain fish in urban and rural areas.**

The Community Mapping Network has fish presence information and other thematic maps at a 1:5,000 scale for the Georgia Basin and Central Okanagan (see Box 2-1).

- Staff at regional MWALP and FISHERIES AND OCEANS CANADA offices or their habitat stewards/community coordinators, or local government environmental staff may have data on fish presence in local streams.
- Stewardship groups or local residents may also be sources of documented or anecdotal information. Though the information may be anecdotal, it can still provide the basis for choosing to do a field assessment.
- It may be necessary to carry out field sampling for fish presence. The Fish presence/absence sampling should be conducted by a *qualified professional* according to the methodology for determining fish presence/absence found in *the appendix*.

Alternatively, one should assume that fish are present and use the applicable SPEA standard for a fish bearing stream. In many situations, whether a stream is fish bearing or not has less effect on the SPEA width than the vegetation conditions.

Box 2-1: Fisheries Information Sources

Fisheries Information Summary System (FISS):

Ministry of Sustainable Resource Management

FISS Data Manager
Resource Information Branch
395 Waterfront Cres.
Victoria, BC V8W 9M2
Phone: (250) 387-9588 Fax: (250) 356-1202
http://www.bcfisheries.gov.bc.ca/fishinv/fishinfobc.html>.

Department of Fisheries and Oceans

327 - 555 West Hastings Street
Vancouver, BC V6B 5G3
Phone: (604) 666-7015 Fax: (604) 666-7907
http://habitat.pac.dfo.ca/heb/FHIIP/index.htm

Salmon Habitat Inventory and Mapping - Community Mapping Network

http://www.shim.bc.ca

Resources Inventory Committee (RIC):

standards for aquatic ecosystems -
http://www.for.gov.bc.ca/ric/PUBS/AQUATIC/index.htm

Determining potential fish presence

For streams that do not contain fish now, finding out if they could potentially support fish requires some investigation. Check with MWALP, FISHERIES AND OCEANS CANADA, local stewardship groups or fisheries consultants for records or personal knowledge about the presence of proven permanent barriers to fish passage. It may be

necessary to commission a QEP to conduct an assessment of instream habitat and barriers to fish passage.

Impassible conditions or barriers where no reasonable potential for fish presence can be expected include:

- Natural impassable barriers such as falls or steep cascades that are too high even in high flow periods for fish to jump.
- Human made permanent barriers that cannot be reasonably modified to allow fish passage; e.g., large weirs or dams, or extensive enclosed or channelized reaches.
- Very low or no flows during critical life history stages that preclude migration and upstream access.

Non fish-bearing streams

Non fish bearing streams are still protected under the RIPARIAN AREAS REGULATION if they provide water, food or nutrients to a fish bearing stream. The only watercourses that are exempt from the RIPARIAN AREAS REGULATION are those that are clearly isolated from a fish bearing system. The Simple Assessment includes a range in protection standards for streamside areas along non fish bearing streams, which decrease as one moves into ephemeral streams or highly developed areas. In the latter case, the SPEA may be as low as 5 meters.

Question 4: Is the stream Permanent?

Assessment Area:	Stream reach(es) immediately adjacent to subject parcel
Default:	Permanent
QEP:	R.P.Bio., P.Geo

Assessment methods definition - permanent stream: "Streams that exhibit visible surface flow throughout the year".

Assessment methods definition - non-permanent stream: "Streams that do not exhibit visible surface flow throughout the year and are not fish bearing".

There is only one situation in which stream permanency is a factor in the Simple Assessment in determining a SPEA - on non fish bearing streams with existing or potential vegetation greater than 30 m in width. Then, the minimum SPEA width is either 15 or 30 m depending on whether the stream is permanent or not. Hence, this characteristic will need to be determined on a more limited basis than the other SPEA factors.

Some streams have flow records and these can be referenced to determine stream permanency. In addition, streams can be field checked during the low summer flow period and documentation provided to establish their permanency. It is important to keep in mind that the default value is permanent and use the applicable SPEA standard. The onus is on the QEP to document otherwise.

2.3 Option 2: Detailed Assessment

The RIPARIAN AREAS REGULATION provides an option to the SPEA widths outlined in Table 2-1. A "detailed assessment" can be conducted by a qualified environmental professional (QEP) to determine the "Zone of Sensitivity" for the features, functions and conditions of the riparian assessment area through a series of assessments. The SPEA width is then the largest "Zone of Sensitivity" resulting from an individual assessment. It must be signed by the QEP certifying that the SPEA width proposed will maintain the features, functions and conditions of the associated riparian assessment area.

2.3.1 What is a Detailed Assessment?

In the simplest terms, a detailed assessment is conducted to determine the "Zone of Sensitivity" (ZOS) for the features, functions and conditions (FFCs) of the riparian assessment area adjacent to a stream. As previously stated, the SPEA width will be the widest ZOS determined through the detailed assessment. The Assessment Report (see Chapter 1) will integrate the results of the assessment with the development and outline the measures required to maintain the appropriate SPEA width.

The ZOS for each FFC is determined by conducting an assessment of the relevant factors that influence that particular FFC. The five main FFCs that this assessment addresses are as follows:

1. Large Woody Debris (LWD) (Assessment 2)
2. Bank stability (Assessment 2)
3. Shade (Assessment 3)
4. Food and nutrients (Assessment 4)
5. Filtration (Assessment 5)

In addition, Assessment 1 establishes the type of vegetation that the riparian area would provide naturally, which is important in determining the outcome of the first four assessments outlined above.

There are other FFCs included within the definition for FFCs in the Riparian Areas Regulation that support fish life processes. Areas for channel migration, side channels, intermittent streams, seasonally wetted contiguous areas and a source of stream substrates are addressed partly by the definition of a stream (includes active floodplain and wetlands) and through the assessment of the five main FFCs. Permeable surfaces that permit infiltration to moderate water volume, timing and velocity and maintain sustained water flows in streams will be addressed by best management practices contained within this and other documents.

2.3.2 Detailed Assessment - Methodology

The detailed assessment comprises six assessments (Figure 2-4) to define the "zone of sensitivity" for the five main features, functions and conditions of riparian areas adjacent to streams, lakes and wetlands, and the measure necessary to maintain the integrity of the SPEA. The largest of the resulting "zones of sensitivity" will then determine the width of the SPEA.

The first assessment determines the type of vegetation that the site should naturally provide. The second assessment looks at the role of large woody debris in providing fish habitat and maintenance of channel type, along with the role of rooted vegetation in providing stability to the stream-banks.

The third assessment determines the zone of sensitivity for the riparian area function of shade. Assessments four and five cover the functions of food and nutrients and filtration respectively. The sixth and final assessment is determining measures to maintain the integrity of the SPEA from the development, this assessment is described in section 1.1.4.

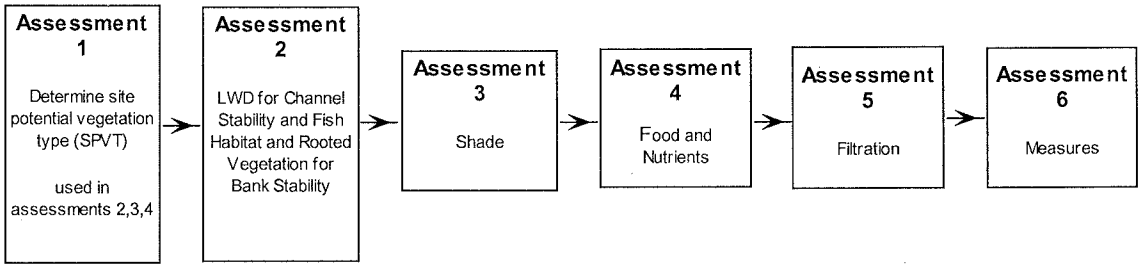


Figure 2-4: Detailed Assessment Process

While streams will be the major focus of the detailed assessment, it also applies to lakes and wetlands (that are connected by surface flow) as they are included under the RIPARIAN AREAS REGULATION definition of a "stream". It is recognized that lakes and wetlands perform different functions (e.g. biogeochemical relating to improving water quality, hydrologic related to maintaining the water regime) than streams; however, the focus of the RIPARIAN AREAS REGULATION is on riparian vegetation and its functional role in maintaining fish habitat.

Figure 2-5 illustrates a conceptual detailed assessment, outlining the "zone of sensitivity" for the various FFCs of a riparian area and the resultant SPEA (largest width from assessments).

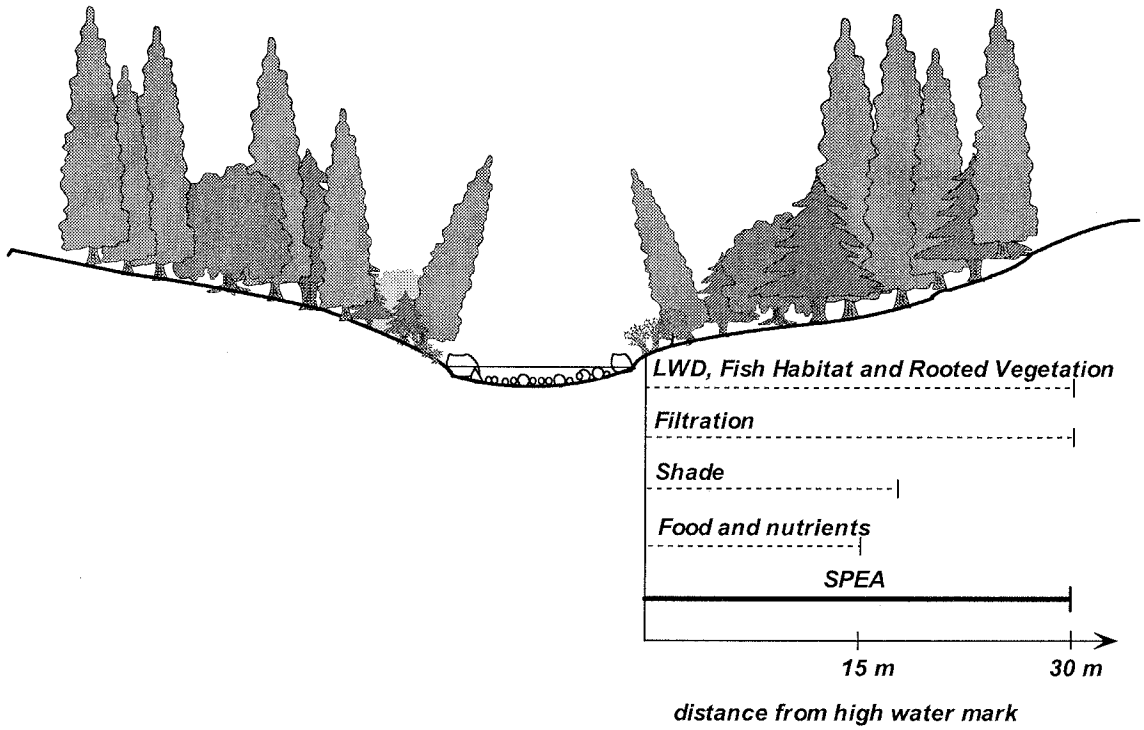


Figure 2-5: Hypothetical "Zone of Sensitivity" determined from detailed assessment

2.3.2.1 Assessment 1: Determine Site Potential Vegetation Height (SPVH)

	Width (perpendicular from HWM)	*Length (along HWM)*
Assessment Area:	30 m	Subject parcel
Default:	Deciduous or Coniferous Cover (TR)	
QEP:	R.P.Bio., RPF	

Assessment 1 involves determining the site potential vegetation type (SPVT) and the corresponding site potential vegetation height (SPVH). *SPVT is defined as the mature seral stage* of the site potential vegetation type. From an ecological perspective, this assessment determines the *capability* (potential) of the vegetation versus the *suitability* (current) of the vegetation. Table 2-3 outlines the three major categories of SPVT and the corresponding heights used in subsequent assessments.

Site Potential Vegetation Type (SPVT)	***Vegetation Code***	***Site Potential Vegetation Height (SPVH)***
Low ground cover (i.e grass/sedge)	LC	1 m
Deciduous or confereous Shrub	SH	5 m
Deciduous or coniferous Tree	TR	30 m

Table 2-3: Site Potential Vegetation Height (SPVH) by Site Potential Vegetation Type (SPVT)

The default SPVT is deciduous or coniferous tree (TR). If this value is used when the SPVT is required in following assessments then no further SPVT assessment is required. It should be noted that coniferous trees, particularly on the coast, often exceed 30 m (default value for TR), however the detailed assessment uses 30 m as this is the value specified by the RIPARIAN AREAS REGULATION.

However, some riparian sites may have another SPVT due to some form of natural disturbance. Larger, more diverse sites may warrant stratifying into smaller homogeneous units. If the QEP wishes to stratify the site into polygons of various SPVTs, then the following methodology should be undertaken. The polygon should meet the minimum polygon size outlined in step 2 below and illustrated in Figure 2-6. Different values will have to be calculated/determined for each assessment that is based on a SPVT. The result will then determine a variable width ZOS for each riparian feature, function and condition.

1. Using airphotos or ground surveys, stratify the area into the various polygons of uniform vegetation. The site plan map produced for the development can be used

as base map and the SPVT polygons shown as an overlay. Polygons identified through air photos should be ground-truthed.

2. The minimum length of the radius from the geometric center of a polygon should be 5 m (see Figure 2-6).
3. The vegetation polygon must contain no more than 20% of another (or combination of) SPVT by area. For the purpose of Assesment 2, if there is a treed component in the polygon, treat the polygon as being TR. For the purpose of Assessment 4, if there is a tree or shrub component in the polygon, treat the polygon as being SH or TR (if both a tree and shrub component treat as TR).

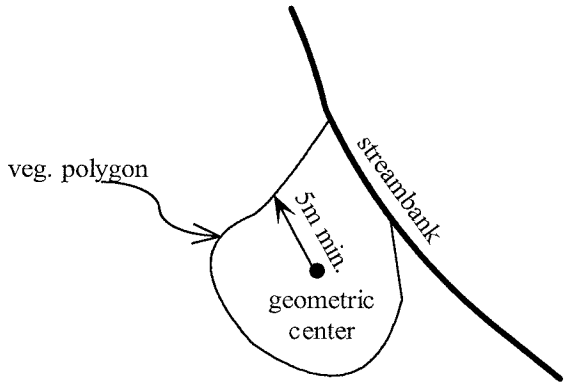


Figure 2-6: Determining the minimum dimension of a SPVT polygon

No distinct methodology is presented here to determine the SPVT; however, the following sources and references (in order of preference) should provide the necessary assistance. It is important that the QEP document how the SPVT was determined.

- Ministry of Forests field guides for site identification and interpretation in forest regions (individual references provided in Reference section)
- Adjacent undisturbed riparian areas with similar ecological characteristics
- Historical air photographs
- Vegetation and/or soils mapping
- Local ecologists

2.3.2.2 Assessment 2: Determine Channel Morphological Type as it relates to LWD for Channel Stability and Fish Habitat and Rooted Vegetation for Bank Stability

	Width (perpendicular from HWM)	*Length (along HWM)*
Assessment Area:	30 m	Reach immediately adjacent to subject parcel
Default:	For streams: riffle/pool For lakes and wetlands: 15 m	
QEP:	P. Geo, R.P. Bio.	

This assessment determines a zone of sensitivity for LWD and riparian vegetation by establishing

- the role of large woody debris in maintaining channel morphology, and
- in providing fish habitat, along with
- the role of riparian vegetation in forming and stabilizing streambanks.

Large woody debris entering the stream channel from adjacent riparian areas influences channel dynamics by diverting flow, creating channel roughness and stabilizing banks. Large woody debris is defined as logs measuring greater than 10 cm in diameter and greater than 1.5 m in length. The riparian forest is the source of most instream wood, which enters stream channels through a variety of means. Though small wood, such as branches and twigs, plays a role in creating and maintaining pool habitats, large woody debris including logs, rootwads and debris jams is considered a key component for maintaining salmon and trout habitat.

Large woody debris play a key role in forming the structural elements of streams and serving to retain small debris that would otherwise be transported downstream during high flow events. Large woody debris is correlated with the formation and maintenance of side channels, pools and low velocity areas. Pools formed by large woody debris provide habitat for fish and act as depositories for sediment and particulate organic material.

Riparian vegetation also plays a strong role in channel migration and morphology. The root systems of riparian vegetation influence the formation of stream banks and gravel bars, and the development and maintenance of undercut banks that provide fish habitat. Vegetation immediately adjacent to the stream channel is considered most important in maintaining bank integrity. Roots of riparian vegetation bind soil particles together, making streams less susceptible to erosion. Because of the variations in root morphology between conifers, deciduous trees, shrubs and herbs, vegetative diversity results in optimal bank stabilization.

Is LWD important in maintaining channel structure?

The importance of LWD to channel structure is related to the channel morphological type - *i.e.* some channel types do not rely on wood to maintain their channel morphology. Three main channel morphologies are used here (riffle-pool, cascade-pool and step-pool) to gain an understanding of the importance of wood to channel structure. This

methodology presented here for determining the channel morphological type and the role of LWD to maintaining channel stability has been adapted from the Channel Assessment Procedure (BC Ministry of Forests, 1996).

Channel morphological types are associated with the slope, relative roughness and relative depth of the stream channel, along with both channel and bank stability (Figure 2-7). The three classic channel morphological types (step-pool, cascade pool, riffle-pool) are easy to distinguish but it becomes more difficult to determine channel types when some form of disturbance is at play: *i.e.* changes in streamflow discharge and sediment/debris loads. This is often the case with urban stream that been highly altered. Figure 2-8 can be used to determine channel type using a surrogate for stream power (channel width and slope). This graph is to be used only where it is difficult to determine channel type for severely altered channels often found in urban areas.

As indicated in Figure 2-7, bank stability is also related to channel type as the channel becomes more confined as slope, relative width, relative depth and channel confinement increases.

Once the channel type has been identified, Table 2-4 provides a summary of the importance of LWD to that channel type.

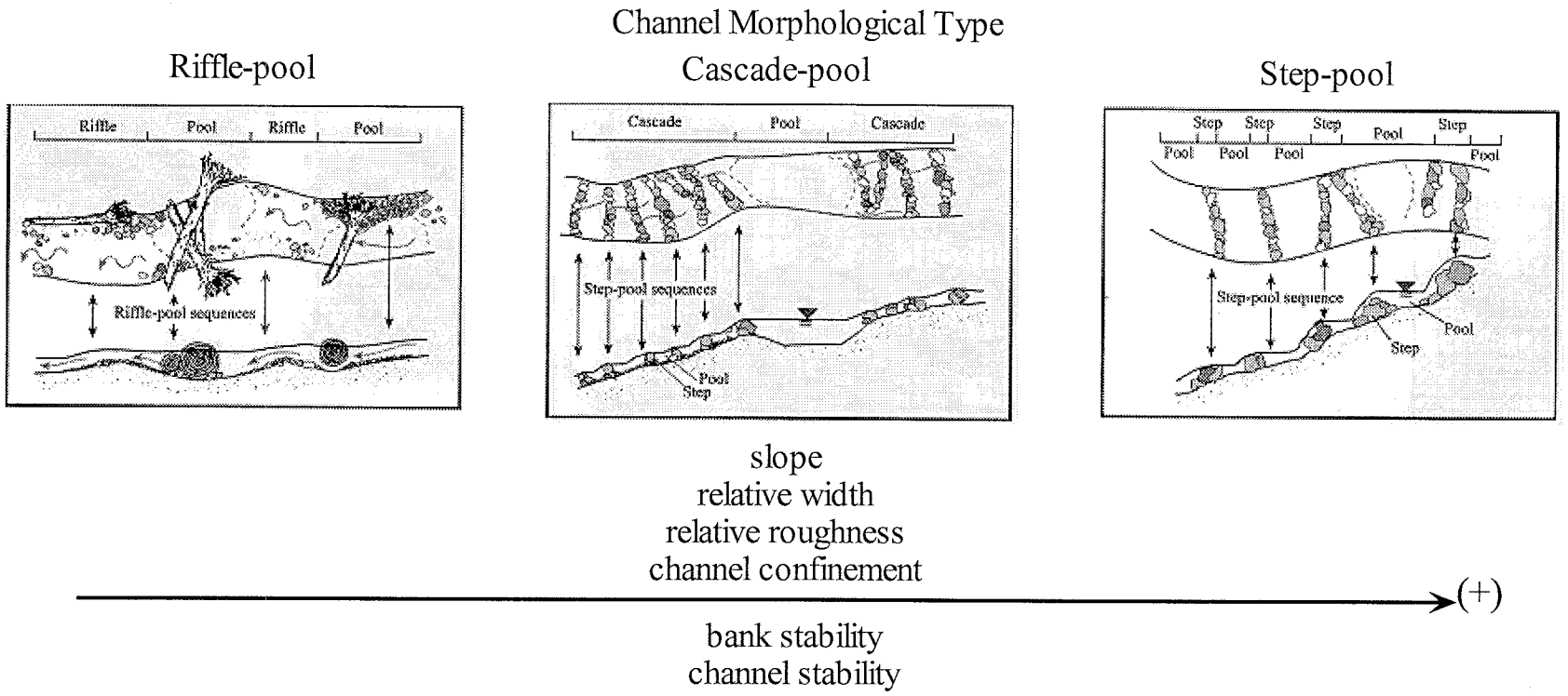


Figure 2-7 Channel morphological types and the relationship to bank and channel stability

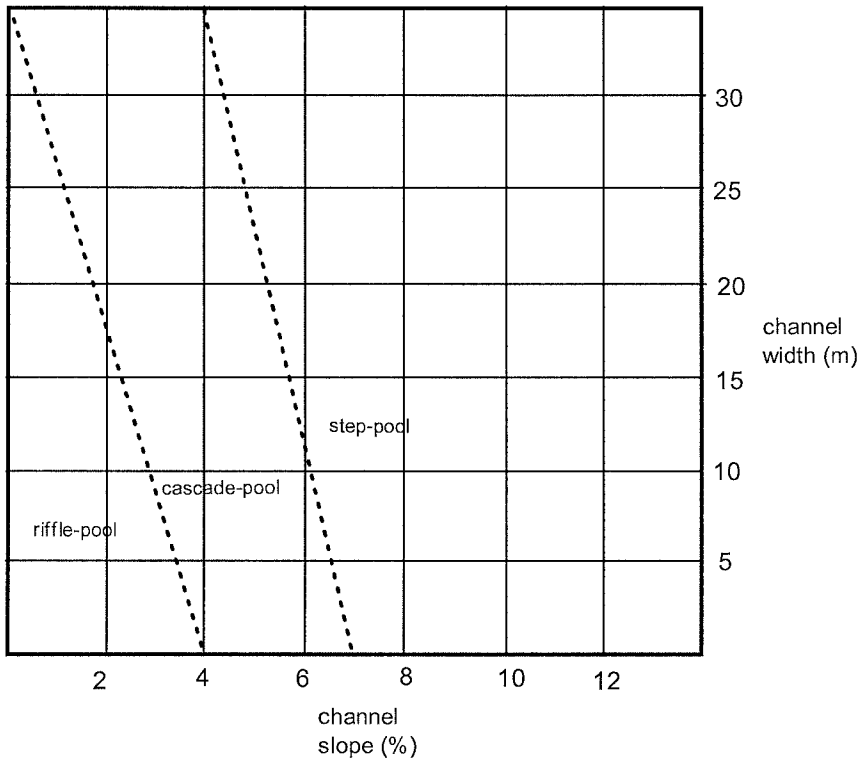


Figure 2-8: Determining Channel type from channel slope and width.

Morphology	*Bed material*	*LWD*
riffle-pool	gravel-cobble	Functioning
cascade-pool	cobble-boulder	LWD is present and functioning to a limited extent (forms steps, traps/scours sediment and protects banks
step pool	boulder-block	5 -13% gradient Occasionally present in stable morphological types with minimal influence on channel morphology
		> 13% gradient LWD not present

LWD important to channel stability

LWD exerts minimal influence on channel morphology but where present is important to fish habitat

Table 2-4: Channel Morphological Types and Importance of LWD.

LWD Important – What is the ZOS (zone of sensitivity)?

Table 2-5 outlines the ZOS associated with bank and channel stability for the various channel types. It assumes that wider channels require more wood than narrower channels and that the SPVT has differing abilities to provide LWD to the channel as low ground cover and deciduous shrubs do not, by definition, provide LWD to the channel. These SPVTs (LC and DS) are included in Table 2-5 to provide for bank stability.

Table 2-5. Zone of sensitivity for channel and bank stability based on channel type and site potential vegetation type

	SPVT		
Channel Type	***LC***	***SH***	***TR***
Riffle-pool	3 times channel width		
	max. of 5 m	max. of 20 m	max. of 30 m
Cascade-pool	2 times channel width		
	max. of 5 m	max. of 10 m	max. of 15 m
Step-pool[1]	1 times channel width		
	max. of 5 m	max. of 10 m	

[1] Although some step-pool channel types contain no LWD, a ZOS is indicated to provide for bank stability and as a source of LWD for morphologically dependent downstream reaches.

2.3.2.3 Assessment 2a: LWD for Lakes and Wetlands

The riparian zone of lakes and wetlands often contains large wood which, as it falls into the water, provides important long-term woody cover for protection of smaller species, fry and juvenile fish. Because their decay rates are slow, especially for conifer species, fallen trunks can provide habitat structure over a long period of time. Further, the vegetation within the riparian zone of a lake provides natural protection from erosion. The riparian zone is particularly important adjacent to small and seepage lakes and wetlands where it may be the only source of LWD as the streams that enter these features do not have the power to move LWD to the feature itself. Foreshore fish habitat in lakes and wetlands often suffers when riparian owners remove aquatic vegetation for pier construction, boat access, swimming or aesthetic reasons. Populations of fry and juvenile fish have been significantly reduced along developed shorelines.

The LWD ZOS for lakes and wetland (Table 2-6) is therefore related to the height of the site potential vegetation type. Although both LC and SH contribute little if any LWD to a lake or wetland, a minimum width is provided for bank protection.

Table 2-6: Lakes and Wetlands ZOS to provide LWD for fish habitat and rooted vegetation for bank stability for

SPVT	*ZOS*
LC	5 m
SH	5 m
TR	15 ms

2.3.2.4 Assessment 3: Shade

	Width (perpendicular from HWM)	*Length (along HWM)*
Assessment Area:	30 m	Subject parcel
Default:	Table: 5-7	
QEP:	R.P.Bio., P.Geo, RPF	

The **relative** ability of vegetation to influence stream temperature (shade) depends on many factors, such as quality of shade, angle of sun, degree of cloud cover, leaf angle, aspect and orientation of watershed, time of year, stream volume, volume of subsurface flows, width and depth of water column, and height, density and species of vegetation.

Solar angle, geographic stream orientation, stream width, the surface-to-volume ratio (width-to-depth ratio) of the stream and the height of the natural vegetation are all factors that determine the importance of shade to a particular stream reach. The following methodology has been adapted from using solar angle, stream aspect and the height of the natural vegetation to calculate the width of riparian buffer required to maintain shading to the stream.

Each day as the sun rises in the east and tracks to the west it follows a predictable path across the sky. At solar noon the sun is at its peak elevation relative to the horizon. At that time it is also shining from due south. On a sunny day this is also about the time when the greatest amount of solar energy is available to streams. This information allows us to determine which trees are providing the most effective shading and to include them in a buffer design.

Two options are available to determine the ZOS for shade. Both options are based on solar angle, stream aspect and slope and the height of the natural vegetation. The first option can be derived from Figure 2-9 and Table 2-7 and provides a default ZOS which uses the above variables to determine the ZOS for shade.

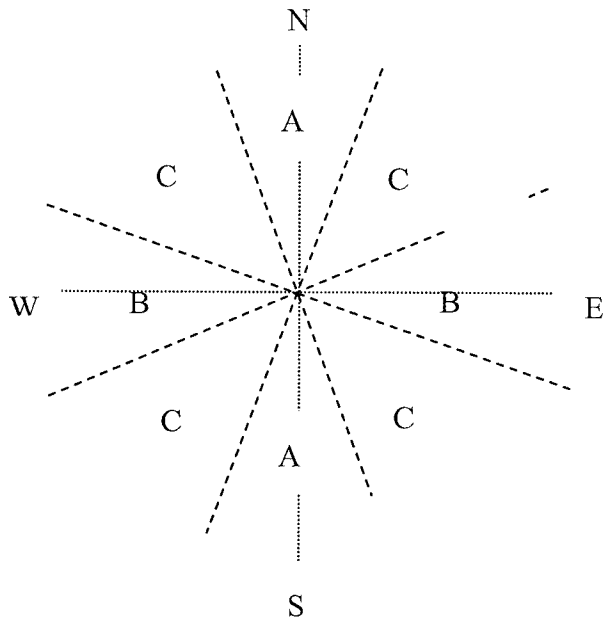


Figure 2-9. Default stream Orientation Zones

SPVT	*Zone A*		*Zone B*		*Zone C*	
	North bank	*South bank*	*North bank*	*South bank*	*North bank*	*South bank*
LC	n/a	n/a	n/a	n/a	n/a	n/a
SH	1 x width[(1)] (max 5 m)	1 x width[(1)] (max 5 m)	1 x width (max 5 m)	2 x width (max 5 m)	1 x width (max 5 m)	1 x width (max 5 m)
TR	2 x width (max 15 m)	2 x width (max 15 m)	2 x width (max 10 m	3 x width (max 30 m)	2 x width (max 10 m)	2 x width (max 15 m)

[(1)] width is defined as either the average channel width or the width of the lake or wetland. The width modifier does not apply to Temperature Sensitive Streams (as determined by WLAP). For temperature sensitive streams apply the maximums.

Table 2-7. Default ZOS for Shade

Some proponents may wish to do the more detailed calculation to determine a site specific ZOS for shade. The following steps outline the detailed procedure for determining the ZOS for shade:

1. Determine the appropriate solar angle referring to Figure 2-10 and Table 2-8 below. August 1st should be selected as the date along with the specific latitude and longitude for the site. Solar angles are available from http://aa.usno.navy.mil/data/docs/AltAz.html. Example - Aug. 1 stream orientation 22° solar angle would be 44.9° for the west bank and 39.6° for the east bank.

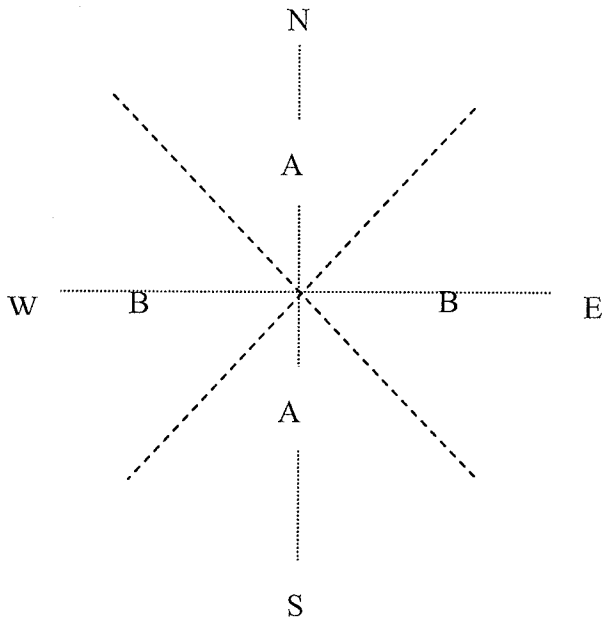


Figure 2-10. Stream Orientation

Zone	*Stream Orientation*	*Modifier*	*Solar Angle*
Zone A	west bank		3 pm
	east bank		9 am
Zone B	south bank		solar noon
	north bank	north of EW	9 am
		south of EW	3 pm

Table 2-8 Detailed Methodology for Shade – Appropriate Solar Angle

2. Determine the solar azimuth for the stream orientation. Example - Aug. 1 stream orientation 22° solar azimuth would be 240.6° for the west bank and 110.1° for the east bank.
3. Conduct a topographic site survey along the determined azimuth to where the azimuth angle intersects the Detailed Assessment area (see Figure 2-11).

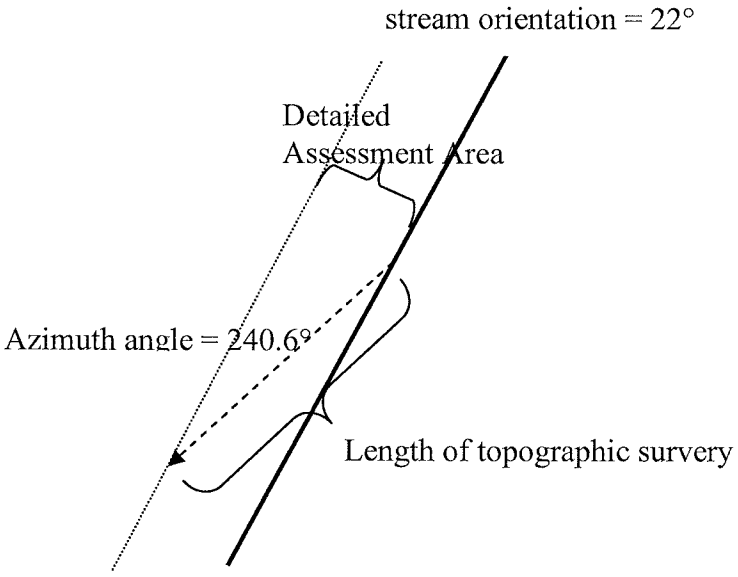
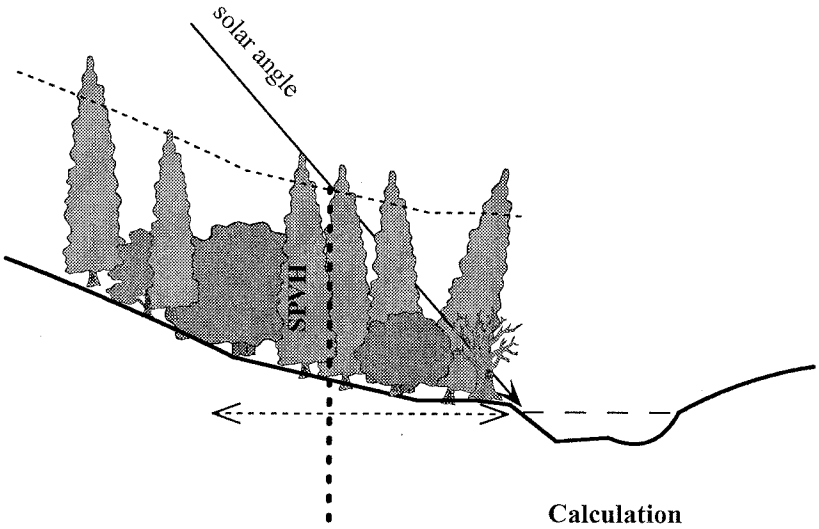


Figure 2-11. Extent of Topographic survey

4. Compute ZOS based on solar angle and overall topographic rise. The simple trig solution to calculate the ZOS is: **Calculated ZOS = Effective Vegetation Height (SPVH –Topographic Rise)/ TAN of the Solar Angle** For example - a stream orientation of 22°, the solar angle would be 44.9° for the west bank. The effective tree height is 45.6 m based on a SPVH of 50 m and a slope rise of 4.4 m The calculated ZOS = 45.6/Tan 44.9 or 45.7 m.

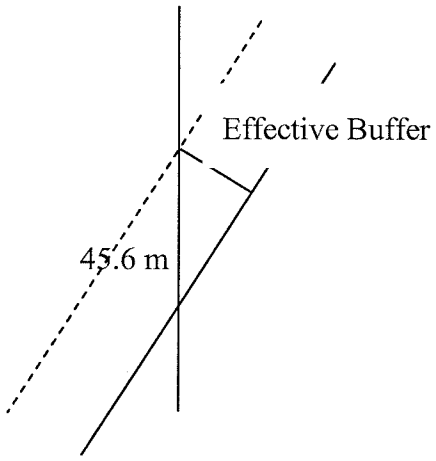


Slope Rise = 4.4 m
Effective tree height=SPVH-slope rise

Calculation
AC = 45.6 m
Angle A = 44.9 degrees
AB = 45.6/ Tan Angle A or 45.7 m

B

5. Calculate the effective ZOS for the stream orientation



Effective ZOS = Sine A (calculated width see example from figure above) x Calculated ZOS

Effective buffer = Sine 22° x 45.6 m

= 17.08 m

2.3.2.5 Assessment 4: Food and Nutrients

	Width (perpendicular from HWM)	*Length (along HWM)*
Assessment Area:	30 m	subject parcel
Default:	Streams: 3x Channel width (min. – 10 m, max.- 15 m) Lakes and wetlands: 15 m	
QEP:	R.P.Bio	

Riparian vegetation influences adjacent aquatic systems by providing important components of the food web. The food web begins as plants convert solar energy to food. A variety of organisms consume living and dead plant material produced from that energy, and these organisms are in turn consumed by larger and larger organisms. At each stage of the food web a transfer of energy from one organism to the next occurs.

Riparian vegetation contributes a large percentage of the energy in aquatic food webs. Natural organic material from riparian plants, known as litterfall, also provides food resources for aquatic organisms, and plays a significant role in the structure of aquatic communities. Litterfall, such as leaves, twigs, bark and needles, can fall to the ground or directly into the stream providing an important food source for insects and other invertebrates. In turn, aquatic and terrestrial insects are an important food source for fish, including juvenile salmon. Terrestrial insects are important in juvenile salmon diets in summer months.

The dominant contribution of riparian vegetation to the food web is *allocthonous* inputs (predominately fine litterfall - leaves, needles, bark, cones and fine wood) that fall directly into the stream. *Allocthonous* inputs (inputs not in their place of origin) can be significant even in incised reaches. The degree to which vegetation contributes food and nutrient inputs is related to the height of the vegetation adjacent to the stream and the stream channel width or size of wetland or lake. Table 2-9 is based on this premise.

The ZOS for food and nutrients is determined by the Site Potential Vegetation Type (and its associated height) or the size of the stream or wetland as depicted in Table 2-9.

SPVT	Zone of Sensitivity	Min.	Max.
LC	5 m	n/a	n/a
SH	2 x width[(1)]	5 m	15 m
TR	3 x width	10 m	15 m

(1) width is defined as either the average channel width or the width of the lake or wetland.

Table 2-9: Determination of "zone of sensitivity" for Food and Nutrients.

2.3.2.6 Assessment 5: Filtration

	Width (perpendicular from HWM)	Length (along HWM)
Assessment Area:	30 m	subject parcel
Default:	30 m	
QEP:	P.Eng	

Vegetation adjacent to the stream improves water quality by filtering pollutants or sediments from runoff and providing shade that moderates stream temperatures. Urban stormwater systems, however, bypass the natural stormwater filtering function of the riparian area by collecting runoff into storm sewers and discharging stormwater directly into stream channels. These systems reduce overland flow and increase concentrated flows of stormwater. Riparian plants function to filter pollutants, nutrients and sediment from stormwater only if the stormwater flows in a dispersed manner through the vegetation. However, riparian vegetation may play a significant role in controlling sheet runoff from construction and development near the stream corridor.

The roots, wood and soils in the riparian area contribute to maintaining water quality. Roots and wood help prevent sediments from entering the stream by moderating the erosive power of floodwaters and holding soils in place. The degree to which a riparian system can perform this function varies depending on vegetation species composition, the degree to which a stream is channelized or decoupled from the floodplain, and other site characteristics. Riparian vegetation acts as a barrier that reduces sediment and debris transport, slows surface flows and encourages infiltration. Riparian areas also serve to filter (from groundwater and surface flows) sediments, pollutants, metals and excess nutrients. Riparian vegetation absorbs and stores nutrients and other dissolved materials as they are transported through the riparian zone. In addition, water quality is influenced by the chemical transformation of nutrients in the stream due to interactions with gravels and in the riparian area.

The impact of development activity on the filtration function of a riparian area can be looked at from two different perspectives – impacts associated with development activity

within and outside of the riparian area. Impacts originating outside of the riparian zone can be addressed through the use of best management practices (BMPs). Most government agencies expect stormwater and construction related runoff to be contained at the site or otherwise addressed. Relying on riparian areas to "treat" stormwater from upland areas is not considered acceptable. However, these areas will provide a buffer or an added level of protection when left in a natural condition.

Stormwater resulting from activity within the assessment area should be treated no differently than the way stormwater is treated for the watershed as a whole. The key to runoff volume reduction and water quality improvement is capturing the small storm runoff from rooftops and paved surfaces. The goal is to return 90% of average annual rainfall volume to natural hydrologic pathways. This can be accomplished through control facilities designed to capture runoff from rooftops, driveways, parking and other impervious areas for infiltration, evapo-transpiration and/or reuse. The provincial government document entitled Stormwater Planning: A Guide for British Columbia, May, 2002 provides a very good reference for this topic and provides examples on how to achieve this goal. This document is available on the web at *http://wlapwww.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.pdf*

For the purposes of this assessment the ZOS for filtration is considered to be the entire assessment area (30 meters). All development planned (assuming other features, functions and conditions of the assessment area have been accommodated) within this 30 meters must be designed to capture the small storm runoff event.

Development activity outside of the assessment area should ensure that the appropriate sediment and erosion control mechanisms are in place.

2.3.2.7 Measures to Protect and Maintain the SPEA

A description of all measures (actions and contingencies) that will be taken to avoid, reduce or eliminate any impacts associated with the proposed development. Many of the solutions to these issues are found in the document entitled "Best Management Practices for Urban and Rural Land Development". This document can be found at the Ministry of Water Land and Air Protection website.

This section will include discussion of the measures employed to maintain and protect the SPEA from development outside the SPEA as well as those that are part of, or a result of, the proposed development within the SPEA

Generally, only hazard tree treatment and tree planting are permitted within the SPEA area. Measures to address the impact of development should include but not be limited to the following items. The QEP must assess the potential impact to the SPEA from these risks and establish measures to ameliorate the risk:

- danger trees and the provision of large trees
- windthrow
- slope stability
- drip zone and rooting strength

- encroachment
- sediment and erosion control measures

Measures required for the provision of large trees, windthrow, slope stability and drip zone and rooting strength may include additional width where certain activities are required or precluded (in addition to the SPEA).

In addition, danger trees located within the SPEA should be assessed. These include standing dead trees that are vertical or lean towards the work area, as well as some live trees with large dead branches or tops. To determine whether to remove a danger tree, an assessment should be completed by a qualified danger tree assessor. If a tree is determined to be unsafe, there are options available to reduce or eliminate the threat to safety. Trees felled within a SPEA should be left as coarse woody debris. The following reference, though prepared for use in parks, will be of assistance when conducting a danger tree assessment. http://www.for.gov.bc.ca/hfp/wlt/Parks-Rec-June2003-web.pdf .

Addressing all of these issues may involve retaining a professional with specific expertise as may be the case in addressing slope stability issues. The QEP is cautioned to ensure that they address only those issues that they are qualified to address.

3 Locating and Measuring the SPEA

It is important to note that there are two contexts for measuring the SPEA. For local government planning purposes of designating an applicable SPEA standard to a stream, it may be possible to estimate the HWM from 1:5,000 or larger scale topographic maps. The HWM can generally be outlined where the contour density changes dramatically, such that the distance between contours increases significantly (Figure 3-1). Where there is no obvious change in contour density, indicating that the land is basically flat, estimating the HWM based on the active floodplain edge would require some analysis of floodplain mapping and/or vegetation mapping by a QEP.

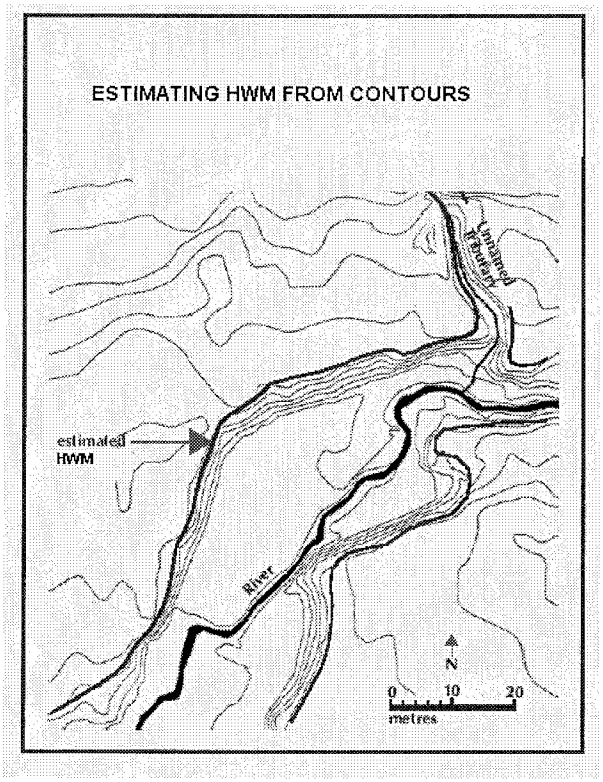


Figure 3-1: Estimating HWM from Contours

Prior to construction commencing and for subsequent monitoring, the appropriate SPEA width must be located on the ground. For this purpose, the QEP is needed to locate the HWM.

This section outlines how to establish the SPEA on the ground once the appropriate SPEA width is determined using either the simple or detailed method. Regardless which assessment method is used (simple or detailed), the SPEA width always starts from the high water mark (HWM).

3.1 Simple Assessment

The SPEA captures the area immediately adjacent to the "high water mark" and, where slopes are greater than 3:1, the SPEA width is measured from the "top of ravine bank". Ravines that are greater than 60 metres wide at the top of ravine bank receive a SPEA width of 10 metres from the top of ravine bank under the Simple Assessment.

RIPARIAN AREAS REGULATION definitions

"streamside protection and enhancement area" means an area

(a) adjacent to a stream that links aquatic to terrestrial ecosystems and includes both existing and potential riparian vegetation and existing and potential adjacent upland vegetation that exerts an influence on the stream, and

(b)the size of which is determined according to this regulation on the basis of an assessment report provided by a qualified environmental professional in respect of a development proposal;

"ravine" means a narrow, steep-sided valley that is commonly eroded by running water and has a slope grade greater than 3:1

The Key Questions?

Where is the **high water mark** (HWM)?

Is there a **top of ravine bank** and where is it?

Is it a **ravine** with a width at the top of ravine bank greater than 60 m?

Assessment Methods definition :

Simple Assessment SPEA width: "The SPEA width is measured perpendicularly from the "high water mark" unless the slope adjacent to the "high water mark" is greater than 3:1 within the specified SPEA width in which case the SPEA extends beyond the "top of ravine bank" for a distance specified in Table 2-2 and includes the area between the "top of ravine bank" and the "high water mark"

3.1.1 High Water Mark

The high water mark needs to be determined as the starting point for laying out the SPEA area as well as the starting point for measuring the width of existing or potential streamside vegetation.

RIPARIAN AREAS REGULATION definition – high water mark: "means the visible high water mark of a stream where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed of the body of water a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself. The high water mark includes the active floodplain"

On site, the high water mark is determined based on these site characteristics. For flowing watercourses, it is indicated by a distinct change in vegetation and sediment texture. Above the high water mark, the soils and terrestrial plants appear undisturbed by recent stream erosion. Bank areas below the top of the bank typically have freshly moved sediment (e.g., clean sands, gravels and cobbles) and show signs of both sediment deposition and scouring. Where stream channels and their banks are distinct, this may be fairly easy; however, in flatter areas, identifying the high water mark based on riparian vegetation in the active floodplain can be more challenging. In these situations, the HWM should be identified and flagged by a *qualified environmental professional* before being surveyed by a land surveyor or GPS technician

The outer edge of wetlands can be determined from on-the-ground surveys by mapping the upslope extent of the following combinations of conditions:

- Predominance of plant species that normally grow in water or water-saturated soils or in peat soils (plant communities that indicate subhydric or hydric ecological moisture regimes).
- Soils that are water-saturated or show evidence of prolonged water saturation (gleying) within 30 cm of the surface or are peat soils.
- For shrub-carrs, the transition between shrub dominated and tree dominated vegetation.

3.1.2 Top of ravine bank

Top of ravine bank is important where the slope of the land adjacent to the high water mark is greater than 3:1. In these situations the SPEA width starts where the slope of the land becomes flatter than 3:1 for a minimum of 15 metres

RIPARIAN AREAS REGULATION definition - "top of the ravine bank" means the first significant break in a ravine slope where the break occurs such that the grade beyond the break is flatter than 3:1 for a minimum distance of 15 meters measured perpendicularly from the break, and the break does not include a bench within the ravine that could be developed

There are three potential stream configurations as illustrated in Figure 3-2. In addition, ravines greater than 60 metres wide at the top of ravine bank receive a minimum 10 meter SPEA (see section 3.1.3).

- Streams flowing in well-defined channels where the slope of the stream bank is quite distinct from the surrounding land (Figure 3-2a).
- Streams situated in ravines with abrupt breaks in the slope. Short benches encountered along the slope are not counted (Figure 3-2b).
- Streams in flat terrain where the stream channel is not well defined; the HWM is defined less by a break in slope and more by changes in soil composition and vegetation communities; from riparian vegetation that is characteristic of the active floodplain to upland vegetation (Figure 3-2c).

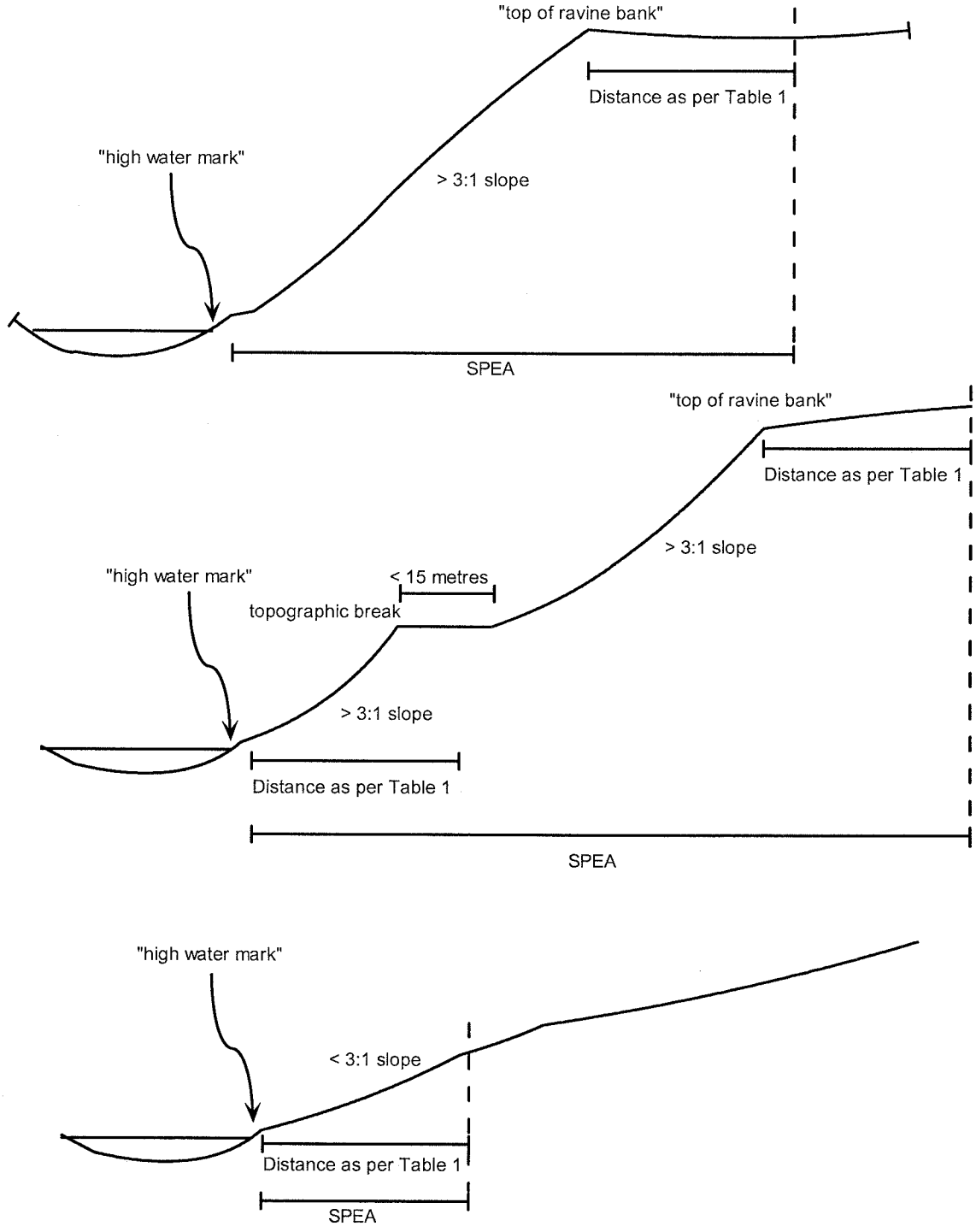


Figure 3-2: Variations in topography in determining the Streamside Protection and Enhancement Area (SPEA)

3.1.3 Ravines greater than 60 meters wide

On streams located in gullies or ravines, it is important to locate the top of ravine bank, as the SPEA width is measured from where the slope breaks (becomes less than 3:1). The Simple Assessment adds a refinement to these standards that addresses streams in large ravines (Figure 3-3). For ravines that are greater than 60 m in width (from the top of one ravine bank to the other, excluding the wetted stream width), the SPEA is established by measuring 10 meters from the top of ravine bank. The SPEA also includes the area from the top of ravine bank down-slope to the high water mark. Streams that are in ravines of lesser width are subject to the normal SPEA widths set out in Table 2-1, measured from the top of the ravine bank.

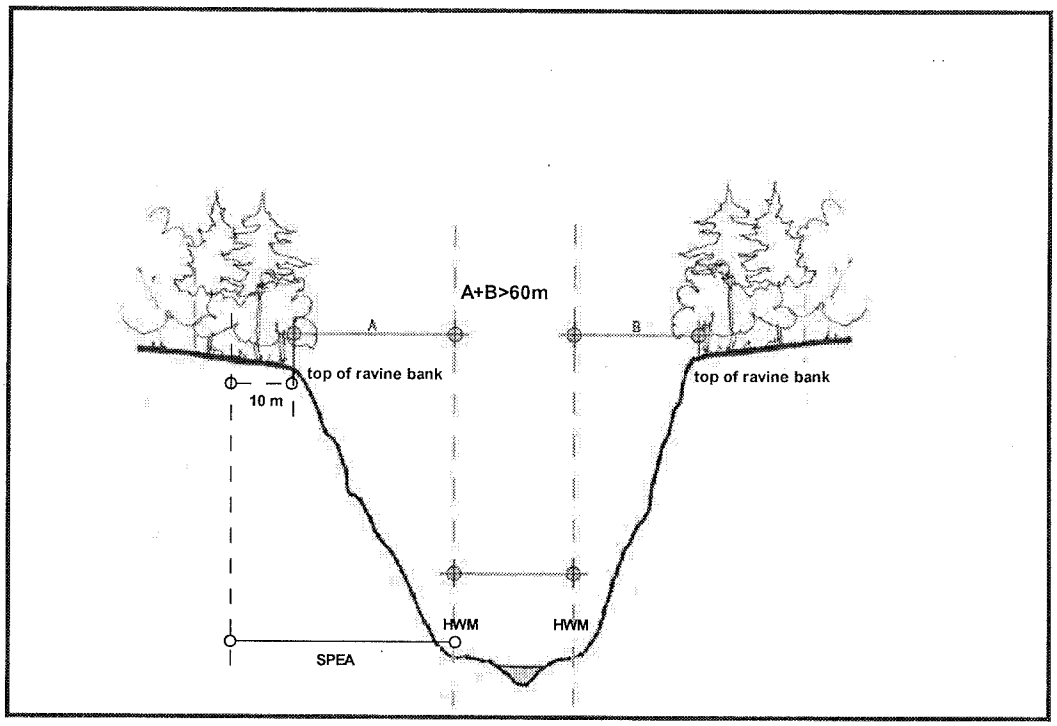


Figure 3-3: SPEA on Large Ravines

3.2 Detailed Assessment

The SPEA width resulting from the Detailed Assessment as outlined in the section 2.3 is measured from the HWM. It is the largest ""zone of sensitivity"" determined from the Detailed Assessment. However, the QEP must also determine any appropriate "measures" to maintain the integrity of the SPEA, including additional area if required (see section 1.1.4). This may involve retaining additional professionals to provide their expertise, particularly in the case of slope stability.

3.3 Special Situations

There are a few special stream situations that warrant some discussion in terms of how to address them under the RIPARIAN AREAS REGULATION.

3.3.1 Daylighting streams

There is interest in some urban areas to open up culverted and buried stream channels and bring them back above ground. However, there is also a perception that such daylighted streams would immediately be subject to the RIPARIAN AREAS REGULATION standards. Having to meet these standards in urban settings, where often there is limited room to re-establish a stream channel not to mention a significant riparian area, would cause many daylighting projects to be discarded.

Local governments and community groups who wish to daylight streams, however, need to consider carefully the objectives of the project. If it is to re-introduce a stream "greenway" for its natural and aesthetic qualities as a community amenity, with little expectation of re-establishing fish populations, than certainly the RIPARIAN AREAS REGULATION would not apply.

If, however, the aim is to bring back fish populations, and particularly salmon, then also re-establishing a viable streamside area is vital. Otherwise, the project will simply result in a fish "death trap"; for instance, if it cannot provide sufficient shade, food sources or areas to rest and hide from predators in and along the stream to allow fish to survive.

As with any other circumstance, a variance from the SPEA standards may be considered by DFO; however, based on the best scientific knowledge, daylighting projects with fish re-establishment in mind should strive to achieve riparian widths that approach the RIPARIAN AREAS REGULATION standards. Other approvals may be required to carry out such projects such as under the *Water Act* and the *Fisheries Act.*

3.3.2 Dikes

Dikes that are federally or provincially approved structures and perform an acknowledged, long-term role in preventing flooding of settlement areas are characterized as "permanent structures". In most situations, the top of a dike would be considered to form the high water mark, from which a SPEA width would then be measured. Guidelines (March, 1999) on preferred practices related to vegetation management on dikes have been prepared by the MINISTRY OF WATER LAND AND AIR PROTECTION and FISHERIES AND OCEANS CANADA and are available at the following website: http://wlapwww.gov.bc.ca/wat/flood/env_gd_veg_man.pdf

Appendix: Fish Sampling Methodology

Either of the two alternative methods detailed below in the subsection "Acceptable survey methods." will satisfy the requirements for an acceptable fish inventory, as legally referenced in paragraph (b) (i) of the definition of "fish stream" in section 2.2. Either the *systematic-sample method* (Option 1) or the *first-fish-captured method* (Option 2) must be employed to demonstrate fish absence in reaches of < 20% gradient

Fish collection permits and the requirements discussed previously under "Qualifications and training" are also mandatory. RIC standard data forms, recording and data management are recommended but not mandatory for the purpose of determining whether or not a stream is fish-bearing.

The following protocols should be followed in order to conduct an acceptable survey to confirm the absence of fish from stream reaches if the decision has been made to undertake a fish sampling program. Fish presence can be determined by a number of acceptable techniques that cover a range of efficiency and sampling intensity. The simplest technique might be sufficient to determine fish presence. Fish presence is confirmed once an individual specimen of the appropriate species is properly identified. Sampling information and results are then recorded and kept on file.

Determination of the absence of fish from a body of water is much more difficult. While no fish may be captured at successively greater levels of sampling intensity, the ultimate "proof" of absence must be associated with the most intensive and efficient procedure appropriate for the species, life stage and time of year. For example, when sampling for quantitative purposes, baited traps are ideally set over 24 hours for juvenile fish, or two-trial electrofishing is performed. It is recognized that these levels of effort are sometimes difficult to achieve.

In order to establish absence acceptably, a reasonable balance between sampling effort and risk of error must be achieved to produce satisfactory results consistent with the intent of this guidebook.

Sampling effort must include a significant portion of the stream reach and be applied in the seasons appropriate for the geographical area and habitat types present (main channel, off-channel, seasonal). The proper equipment must be used under appropriate environmental conditions. For example, electrofishing will be much less effective in cold water (*i.e.*, < 5°C) or where electrical conductivity is low.

It is recommended that sampling be done in a systematic and repeatable way so that results can be accepted with confidence. This appendix presents a series of sampling techniques and gear types that generally reflect intensity levels. The intent is ***not*** to identify electrofishing as the only acceptable and final "technique of choice," although this gear type has become singularly advocated to determine fish presence or absence for fish-stream identification. Biologists and technicians conducting fish surveys must be aware that alternative techniques and gear are available, and in many cases may be more appropriate to the habitats, environmental conditions and species present.

Ultimately, an acceptable survey has been performed when there is, in total, sufficient evidence to support the conclusion that fish do not occur in a given stream reach. The evidence must include, ***in addition to fish capture results:***

1. any known information on fish presence upstream and downstream of the reach sampled
2. type and location of obstructions to fish migrations
3. sampling conditions including stream flow, temperature and conductivity
4. sampling methods and effort (include gear selection and sample timing)
5. judgment of seasonal habitat availability
6. evaluation of seasonal fish use of stream and off-channel habitats.

Evidence that justifies the designation of a stream reach as non-fish bearing is signed off by the QEP indicating the method of inventory that was used or the source of information. This brief summary may include results of any acceptable fish inventory already conducted in the watershed. It is recommended that fish sampling results and methods used be recorded in the field on standard fish collection forms. QEPs that have the capability to enter the information into the FDIS database management system are encouraged to do so. These data standards will ensure data are captured and available for future uses including the review of the stream classifications.

Sampling techniques and gear

Several fish sampling techniques are available including: visual sightings of readily identifiable species, angling, pole seining, trapping and electrofishing.

Visual sightings are particularly useful for surveying adult salmonids during spawning periods. The seasonal timing of surveys is critical. For example, anadromous salmon spawn most frequently from mid-July (e.g., some interior sockeye stocks) to December (e.g., some coastal coho and chum stocks). Other salmonids such as steelhead trout have different populations that collectively spawn at times that include virtually the entire year. Consult with MINSTRY OF WATER LAND AND AIR PROTECTION regional offices and FISHERIES AND OCEANS CANADA divisional offices for normal salmonid migration times and spawning periods within the region of concern.

Visual surveys conducted while snorkeling can frequently be employed in both large and small streams to locate and identify adult and juvenile fishes. Use portable lights to inspect areas frequented by stream fish such as overhanging banks, tree-root masses and logjams. Visual survey results are not appropriate to use as evidence of fish absence. Apart from viewing fish, the simplest methods are angling and trapping. These methods employ light-weight equipment and have the advantages of being relatively cheap and safe.

Angling is straightforward and effective for older juvenile fish and larger specimens. It may not be effective for catching fry. A collapsible rod which can fit in a cruiser vest is convenient gear. An angling license is required for each person who uses this method. Again, angling surveys are not appropriate to use as evidence of fish absence.

Pole seines are most effective in relatively small, shallow and slow-moving streams with relatively few obstructions. This equipment is most frequently used for collecting juvenile fishes (e.g., salmonid fry, parr and smolts). Larger, fast-swimming fish are more difficult to catch. Seining is also ineffective and difficult where water is > 1.5 m deep, stream velocities exceed about 0.8 m/s, banks are deeply undercut, and in areas with large amounts of small organic debris, tree root masses, and tree branches embedded in the stream substrate.

Pole seines about 3 m long and 1.5 m deep are frequently employed for sampling fish in streams. For most stream work, larger nets are difficult to transport and awkward to use. Because of their disadvantages, pole seines are usually used in combination with other techniques such as electrofishing.

Before seining, use a pair of barrier nets to enclose a habitat unit (e.g., a pool or riffle) to prevent fish from escaping the site. Employ two fishing trials per site. If no fish are captured in the first trial, a second trial might succeed. Fish are often easily caught in the second pass if the stream becomes cloudy and disorients the fish due to reduced visibility. Some fishes such as young coho salmon are attracted to suspended sediments because invertebrate prey is also stirred up from the steam bottom by the first seining effort.

Baited Gee-type traps (commonly known as minnow or fry traps) will not catch fish too large to enter the trap but will catch fry, parr, smolts and other juvenile fishes easily.

1. To use the trap, open it, put in some bait (e.g., salted fish roe or pierced cans of either shrimp or sardines), add a small rock for ballast, and close the trap.

2. Attach a long tether string and drop the trap into the stream. Make sure the trap is in water deep enough to be sufficiently submerged. Tie off the tether string so that the trap is secured to the stream bank, and mark the site with a piece of high-visibility flagging tape. Take care to select locations where trap recovery will be easy.

3. Gee traps work well in stream pools or in the quieter water downstream of boulders or debris, but tend to roll around too much if placed in a fast current and, therefore, will not fish effectively. If possible, orient the trap lengthwise into the flow (the apertures will then be in line with the flow).

Gee traps should be set during daylight hours on one day and ideally left to fish overnight at minimum, preferably for 24 hours. This requirement may be logistically difficult when crews are attempting to cover many reaches in the quickest possible time, however try to set traps so that fishing occurs during a period including either dawn or dusk. Fish are usually the most active at these times. In most cases, fish are caught within a few hours after the traps have been set.

If this method is employed, sufficient traps should be obtained to cover a significant part of a stream reach. Trap number and spacing will depend on professional judgment. As a guide, try to achieve a trapping density of at least one trap per 10 lineal metres of stream, or place traps in the following key sites, especially when the features occur within high-gradient reaches containing fast-flowing water and stepped pools. These features represent prime habitats for stream fishes:

- main channel pools, especially those on the downstream edge of large boulders or those downstream of stable, large woody debris
- off-channel pools near woody debris or overhanging banks
- logjam pools
- undercut banks
- riffle-pool junctions, especially under the cover of banks.

Observe the pools for a while to see if there are larger fish present that are too big to enter the traps. Also check the stream margins for the presence of small fry because these sites are too shallow to be fished effectively with Gee traps.

Be sure to make every reasonable effort to recover all traps because they will continue to catch fish if they are not taken out of the stream. If any trap cannot be recovered, the trap location and reasons why recovery was not possible should be reported.

Electrofishing is a relatively complex procedure that requires training and technical certification to high standards by the Workers' Compensation Board. This procedure is not discussed in detail here. (See the RIC inventory manual *Fish Collection Methods and Standards*, Version 4.0) The same key habitats discussed under fish trapping should be covered when electrofishing is undertaken. Electrofishing is advantageous because entire stream reaches can usually be covered relatively quickly within one day. Unlike trapping, no overnight sampling is required. Use a small barrier net when electrofishing in streams, especially fast-flowing ones. Place the net just downstream of the riffle or pool being sampled so that any shocked fish collect against the net. In some steep stream reaches, shocked fish may be difficult to detect at the site where the probe is used because of turbulent water. The effectiveness of electrofishing varies not only with environmental conditions and the species and size of fish, but also with the voltage, electric pulse frequency, and the experience of the electrofishing operator. If a single fishing trial fails to capture any fish, consider adjusting the frequency or voltage settings for a second trial.

Survey timing

Fisheries resource agencies usually sample for fish during mid-summer periods of low flows (July–August). This period is also recommended for surveys of fish presence or absence because (a) low flows may concentrate fish in stream pools at this time, and (b) juveniles of most species will be present in streams, lakes and wetlands. Exceptions in coastal streams include the fry of pink and chum salmon. These fry migrate downstream almost immediately after they emerge from the stream gravels in spring, however both pink and chum occur most frequently in relatively low gradient reaches where the probability of anadromous and game fish presence is very high.

If seasonally flooded channels, wetlands, and other off-channel sites are to be confirmed for fish absence, an additional survey will be required (a) for the fall or spring in interior watersheds when water bodies are free of ice but contain seasonally elevated volumes, and (b) in the fall or winter in coastal drainages. Channels that are dry during summer, but flooded at these other times of the year, are potential fish habitats if the adjacent main channel contains fish. These sites must be checked at the times noted here for extent and duration of flooding, fish access and fish presence or absence.

Acceptable survey methods

The two alternative procedures detailed below will satisfy the requirements for an acceptable fish inventory as legally referenced in paragraph (b) of the fish-bearing definition.

For sampling stream reaches and off-channel sites to determine fish presence or absence, it is recommended that sampling be done in a systematic and repeatable manner. Be sure to cover the best of the available habitat within a stream reach. Studies have shown that to establish the presence of certain species such as bull trout in some high-gradient, high-elevation reaches, as much as 1.2 km of stream coverage is necessary. Because of this pattern of distribution, the recommended sampling method for fish-bearing identification has required the coverage of as much as 500 m to 1 km of stream to confirm the absence of species such as bull trout. This procedure, which involves fishing until the first fish caught is retained, is one of two alternate survey methods recommended for fish-stream identification.

To reduce the costs and simplify the logistics associated with the **"first-fish captured"** method, an alternative **"systematic-sample method"** is recommended that involves sampling the entire length of a representative portion of a stream reach. This portion surveyed will be 100 m long or have a length equivalent to 10 bankfull channel widths (whichever is greater). The entire length of the selected segment does not have to be sampled if fish are captured in abundance, even within the first few metres of coverage (see below).

The systematic-sample method offers important advantages. First, the total length of stream that needs to be covered within each survey will be substantially reduced in most cases. For example, the results of a single-trial systematic survey performed competently in the sample site will be acceptable if:

1. the sample site selected represents the available habitat in the reach

2. the site is sampled thoroughly at the right time of year by using gear suitable for the season, habitat, species and life stage

3. observations on habitat quality and accessibility to fish support the fish survey results.

Second, the results of the systematic survey generate useful data on the **probabilities** of fish presence or absence in streams of given size, gradient and location within a watershed. These data can be added to the base of knowledge from reconnaissance fish and fish habitat inventories. Systematic-survey results are even more important in areas where no reconnaissance inventories are available. Information accumulated from systematic surveys can be used to predict the likelihood of fish presence in similar streams in unsurveyed areas of a watershed.

Regardless of the method adopted, the first step is to determine the likelihood of fish presence from a review of the existing knowledge on fish distribution for the specific areas to be affected by development. If no information is available, then fish surveys must be conducted in reaches of < 20% gradient to confirm fish absence.

When known information is reviewed, look for information on the potential occurrence of bull trout or other very rare (*i.e.* low density) fish for the sites that will be sampled.

Fish are more difficult to detect if they are at very low population densities. If the data review suggests this is probable, a more rigorous sampling intensity is justified (see step 5 in the systematic method below).

One of the two sequences detailed below may be employed in the season most appropriate for fish presence considering the type of available habitat, species and life stage.

Option 1: Systematic-sample method

1. The first site recommended to be sampled is a representative length within the uppermost reach included in the affected area. Fish distributions downstream of the reach, taking barriers and other features into account, can be assumed from the results of this survey.

2. The length of the selected site will be equal to 10 bankfull channel widths, or 100 lineal metres (whichever is greater). The entire length of the site is sampled for fish. Sampling must systematically cover all available habitat types and employ techniques appropriate to the anticipated species and habitats present. Use the technique most appropriate for the season and physical conditions.

If no fish are caught in the first trial, but there are doubts about sampling efficiency, sample again with a second method. Sampling methods and results are recorded on the standard fish collection forms.

If electrofishing is employed and fish are caught in abundance, even within the first few metres of coverage, stop sampling. For example, if 10 to 20 specimens are captured within the first 5 to 10 metres, the reach clearly supports fish in abundance.

3. If no fish are captured in the initial sample site, the QEP must make a professional judgment as to whether and how much further fish sampling should be conducted.

If sampling at a different time of year is warranted due to water temperatures that are too low, or if ephemeral habitats that are accessible to fish are present but dry, sampling should be terminated in favor of a follow-up survey at a more appropriate time.

4. Sampling is finished when the surveyor is confident that there is enough evidence to support the conclusion that no fish inhabit the reach. If the evidence to support fish absence is insufficient, then further sampling is required.

5. If no fish are found in the initial sample site, but habitat quality appears good and no barriers to fish access are evident, a second site of a length equal to the first site must be sampled within the same reach, again covering all habitat types. The most appropriate sampling method must be employed. Sampling methods and results are recorded on the standard fish collection forms.

6. In cases where it has been previously determined that populations of fish occur in the area at very low densities, and if no fish have been captured in the initial sampling site, additional sampling is recommended. Consult with the local MINISTRY OF WATER LAND AND AIR PROTECTION representative prior to initiating surveys. It is expected that these situations will be relatively uncommon; however, sampling the remainder of

the reach might be recommended for reaches < 500 m long. Sampling methods and results are recorded on the standard fish collection forms.

7. Evidence for justification of a non-fish bearing stream reach is reported as a "non-fish-bearing status report." An example of this report is provided at this link: http://www.for.gov.bc.ca/tasb/legsregs/fpc/FPCGUIDE/FISH/FishStream.pdf.

This may include results of any 1:20 000 reconnaissance fish and fish habitat inventory previously conducted in the watershed.

Option 2: First-fish-captured method

1. To sample for fish, begin at the downstream end of the reach and proceed sequentially upstream until a fish is caught and identified as one of the species of concern.

2. If no fish are caught, continue upstream and cover the entire length of reaches up to 500 m long. For reaches 1 km long or longer, surveys focused on the deepest pools and other key habitats noted above are recommended for an additional 500 m. Be sure to cover the available habitat. Studies have shown that to establish the presence of bull trout in some high-gradient, high-elevation reaches, as much as 1.2 km of stream coverage is necessary. In order to establish absence, sampling according to the procedures of this guidebook must be thorough enough to produce reliable results that minimize the likelihood of error.

3. Document sampling methods and results on the recommended fish collection form.

4. Evidence for justification of a non-fish bearing stream reach is reported as a "non-fish-bearing status report."