Policy and Practice Report: Overview of Freshwater Urbanization Impacts and Management

May 11, 2011

Table of contents

Introduction

1. Freshwater urbanization from a fisheries perspective encompasses all types of "land alienation for residential, commercial and industrial purposes within a watershed supporting salmonid populations".[1] The effects of urbanization fall into two main categories: The loss or alteration of physical fish habitat and impacts on water flow and quality.[2]

2. The focus of this Policy and Practice Report ("PPR") is the management and regulation of the effects of freshwater urbanization on Fraser sockeye habitat. Although many topics could fall within this overarching theme of freshwater urbanization effects, for the purpose of the commission's hearings on this theme, this PPR addresses the following topics:

    a. Physical habitat impacts through development and other land uses;
    b. Impacts on water quality by non-point source contaminants, including:
        i. Pesticides;
        ii. Atmospheric pollution;
        iii. Greywater;
        iv. Agriculture run-off;
        v. Fire and flame retardants;
        vi. Wood preservatives;
        vii. Urban development;
        viii. Linear development; and
    c. Physical and water quality impacts through sedimentation.

[1] Ringtail Document BCP000233 at 174.
[2] Ringtail Document BCP000233 at 175.

3. The information in this PPR is derived from documents and information disclosed to the commission or otherwise publicly available.[3] Appendix 1 provides a list of all documents and websites cited in this PPR.

4. The following topics are not addressed by this PPR:

   a. Habitat loss through forestry, including fish passage issues;

   b. Contaminants and effluents collected in municipal sewers and treatment systems ("municipal wastewater"),

   c. Point-source contaminants from pulp mills and mining activities;

   d. Sedimentation from gravel mining, gravel removal for flood protection and logging;

   e. Effect on water quality and flow from water use and extraction; and

   f. Habitat enhancement and restoration.

5. Habitat management and enforcement policies and processes are addressed by the commission's habitat management and enforcement theme and related PPRs on habitat management and enforcement.[4] Policies, practices and impacts on Fraser sockeye from forestry are described in the commission's forthcoming PPR on this topic and will be addressed in the commission hearings on logging. Policies, practices and impacts on Fraser sockeye from contaminants and effluents collected in municipal wastewater systems or originating from pulp mills and mining are intended to be set out in a forthcoming commission PPR and will be covered during the commission's hearings on these topics. In addition, policies, practices and impacts on Fraser sockeye from water

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[3] The commission's Terms of Reference direct the Commissioner to use the automated documents management program specified by the Attorney General of Canada, Ringtail Legal. Many references in this PPR list the unique document identifier attached to a given document by the Ringtail database, such as "CAN001234". These documents are denoted as "Ringtail Documents". Note: Where Ringtail Documents are cited to a page number it is the Ringtail page number and not the document page number that is provided.

[4] Cohen Commission Policy and Practice Report: The Department of Fisheries and Oceans' Habitat Management Policies and Practices (Cohen Commission Exhibit PPR8) [Habitat Management PPR] and Cohen Commission Policy and Practice Report: Enforcement of the Habitat Protection and Pollution Prevention Provisions of the *Fisheries Act*, March 7, 2011 (Cohen Commission Exhibit PPR9) [Habitat Enforcement PPR].

use and extraction will be dealt with in hearings on hydroelectric power and water flow and temperature and the intended PPR on this theme. Gravel removal is the subject of other hearings and is intended to be the focus of a subsequent PPR. An overview of Department of Fisheries and Oceans ("DFO") policies and programs relating to salmon habitat enhancement and restoration is provided in the PPR for that theme.[5]

6. In terms of science, the following commission technical reports evaluate the possible impacts of a number of freshwater urbanization effects:

   a. Technical Report 2 (Exhibit 826): Effects of contaminants on Fraser River sockeye salmon;

   b. Technical Report 3 (Exhibit 562): Evaluation the status of Fraser River sockeye salmon and the role of freshwater ecology in their decline; and

   c. Technical Report 12 (Exhibit 735): Sockeye habitat analysis in the Lower Fraser River and Strait of Georgia.

7. In addition, Commission Technical Report 6 addresses cumulative impacts.

Sockeye freshwater habitat

8. Sockeye salmon rely on three classes of freshwater-related habitat: Wetted, riparian and upslope habitat.

Wetted habitat

9. Wetted habitat includes streams, lakes and estuaries.

10. In-stream habitat consists of a large number of micro-habitats with different attributes (e.g., flow, depth, and substrate), however the use of such habitat by Fraser River sockeye is only partially understood, and inter-specific and intra-specific (amongst different life-stages) competition for such habitat has not been

[5] Cohen Commission Policy and Practice Report: Overview of Habitat Enhancement and Restoration, April 1, 2011 (Cohen Commission Exhibit PPR11).

fully evaluated.[6] Streams provide flowing water which is crucial in helping spawning salmon build redds, in keeping redds clear of fine silt, fertilizing eggs, providing oxygen to eggs and larvae in the redds, stabilizing steam beds and moving debris to create hiding habitat.[7] Moving water distributes nutrients and leafy debris which provides insect habitat and in turn, produces food for juvenile salmon.[8] Salmon have adapted to patterns of stream discharge through the watershed and so disruptions to this flow may impact survival.[9]

11. Lakes provide rearing habitat for many Conservation Units of juvenile sockeye salmon. The productivity of nursery lakes depends on a number of factors including, temperature, nutrients, competitors and predators, basin topography and hydrology.[10]

12. Estuaries are the link between the freshwater and marine environment. The lower Fraser River and estuary are primarily used by both adult and juvenile sockeye over periods of days as migratory corridors, with some exceptions.[11] River-type sockeye aged 0+ originating from Harrison Lake use various sloughs and off-channel areas in the lower Fraser River above the tidal area, for rearing for a period of 2 to 6 months.[12] These sockeye fry are small sized and migrate slowly out of the Fraser River and estuary across the Strait of Georgia to use rearing habitats around the southern Gulf Islands.[13]

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[6] Ringtail Document CAN002592 at 8.
[7] Ringtail Document CAN002592 at 8-9.
[8] Ringtail Document CAN002592 at 8.
[9] Ringtail Document CAN002592 at 9.
[10] Ringtail Document CAN002592 at 9.
[11] Cohen Commission Exhibit 735 (Commission Technical Report 12) at 3.
[12] Cohen Commission Exhibit 735 (Commission Technical Report 12) at 20.
[13] Cohen Commission Exhibit 735 (Commission Technical Report 12) at 20.

Riparian habitat

13. Riparian areas are regions adjacent to ditches, streams, lakes and wetlands.[14] These areas are often very productive and contain vegetation that both provides and directly influences fish habitat by building and stabilizing stream banks and channels, providing shade, shelter for fish and food (leaves and insects falling into the river).[15] Preventing damage to riparian habitat is simpler than restoring that habitat once damage is done.[16]

Upslope Habitat

14. Upslope habitat (i.e., the habitat beyond the wetted and riparian areas) influences stream conditions such as hydrology, temperature and types and concentrations of nutrients.[17]

Urbanization effects on freshwater habitat generally

15. Freshwater urbanization as it relates to sockeye can have two types of effects: The physical loss or alteration of habitat and changes in water quality.

Effect on physical habitat

16. The Fraser Valley was colonized during the first half of the twentieth century, a process that destroyed much of the region's ecology.[18] Floodplains were levelled and drained to become agricultural fields leaving only a small border of sockeye-supporting habitat surrounding the Fraser.[19] Adverse physical alterations to freshwater habitat associated with urbanization result in increased sedimentation, in-stream gravel removal or displacement, removal of streamside vegetation,

[14] Ringtail Document CAN002916 at 5.
[15] Ringtail Document CAN002916 at 5.
[16] Ringtail Document CAN002916 at 5.
[17] Ringtail Document CAN002592 at 10-11.
[18] Ringtail Document CAN002600 at 22.
[19] Ringtail Document CAN002600 at 22.

channelization and the formation of obstructions.[20] Alteration of fish habitat may increase water flow and may physically alter the stream bed and riverine areas.[21] The removal or alteration of streamside vegetation can reduce available cover, shade and food for salmonids and reduce bank stability.[22]

17. Negative impacts from urbanization can also result from measures that attempt to protect habitat or mitigate other urbanization effects. For example, stream banks are commonly stabilized with loose rock to prevent erosion ("rip-rap").[23] This may have both positive and negative effects on fish and fish habitat as it can reduce sediment inputs, increase cover, create deep pools and improve fish passage, but it can also result in a loss of riparian vegetation, nutrients and food sources, reduce the amount of large woody debris making it into streams and reduce available shade.[24] DFO sometimes considers rip-rap to be a "harmful alteration, disruption, or destruction to fish habitat" requiring mitigation or compensation, but DFO may also consider rip-rap to be a restoration or creation project.[25]

Effect on water flow and quality

18. Production of salmon and steelhead is often reduced when water discharges are disrupted from natural patterns because salmonids are adapted to particular flow regimes and behave in certain ways based on historic average discharges through a normal year.[26] In addition, changes to the temperature regime in streams and lakes will potentially affect salmonid survival and production.[27] The presence of contaminants in the Fraser watershed may have immediate or long-

[20] Ringtail Document BCP000233 at 175.
[21] Ringtail Document BCP000233 at 176-177.
[22] Ringtail Document BCP000233 at 178.
[23] Ringtail Document CAN024181 at 17.
[24] Ringtail Document CAN024181 at 17.
[25] Ringtail Document CAN024181 at 17.
[26] Ringtail Document CAN002592 at 15.
[27] Ringtail Document CAN002592 at 11.

term effects on sockeye, including effects on growth, reproduction, behaviour and survival (see section "Contaminants and Fraser River sockeye", below).

Cumulative effects

19. Many impacts of urbanization are complex and not clearly linked to declines of Fraser sockeye. For example, a 2009 study on spawning and incubation environments as they pertain to declines in Stuart sockeye showed no clear patterns between levels of land-use change, road densities or stream-crossings and sockeye abundance trends at a sub-watershed level.[28]

20. In many cases detrimental consequences of freshwater urbanization are often rooted in cumulative effects, rather than in a single factor.[29] According to some fisheries scientists, the cumulative effects of land use practices, including urbanization and agriculture have all contributed to the significant decline in salmon abundance in British Columbia.[30] For example, the negative impacts of logging on sockeye freshwater habitat can be intensified by agricultural development.[31]

21. The commission's Technical Report 6 evaluates the cumulative effects of a number of possible stressors on sockeye, including stressors arising from freshwater urbanization.

Legislative framework

22. The Constitution Act, 1982, being Schedule B to the Canada Act 1982 (U.K.), 1982, c. 11, enumerates powers of the federal and provincial governments. Pursuant to ss. 91 and 92, protecting and conserving Canada's fish and fish

[28] Ringtail Document CAN284881 at 7. See also Exhibits 826, 562 and 735 (Commission Technical Reports 2, 3 and 12, respectively).
[29] Ringtail Document CAN000377 at 12.
[30] Ringtail Document BCP002164 at 36 (citing Hartman, G.F., Groot, C. and Northcote, T.G. 2000. The Ball is Not in Our court, In: Sustainable Fisheries Management: Pacific Salmon, E. Eric Knudsen, C.R. Steward, D.D. MacDonald, J.E. Williams and D.W. Reiser, eds., Lewis Publishers, Boca Raton, FL, pp. 31-49).
[31] Ringtail Document CAN002582 at 41.

habitat is the domain of the federal government insofar as it is a fisheries resource and within the provincial government's domain insofar as it relates to control over natural resources and the management of provincial lands. Local governments have the delegated authority to regulate land use through provincial legislation such as the Local Government Act, R.S.B.C. 1996, c. 323, Community Charter, S.B.C. 2003, c. 26 and Vancouver Charter, R.S.B.C. 1996, c. 55.

23. For a more detailed discussion of the legislative framework governing fisheries, see the commission's PPR, titled, "Legislative Framework Overview", October 19, 2010.[32]

Physical impacts on sockeye habitat: Development and other land-uses

Federal management context

24. Federal policies relevant to habitat management are described in the commission's Habitat Management PPR. Key policies and processes include the 1986 Policy for the Management of Fish Habitat (the "1986 Habitat Policy") and no net loss principle, the Environmental Process Modernization Plan (the "EPMP") and the habitat referral process.

DFO

25. DFO's Oceans, Habitat and Enhancement Branch ("OHEB") is responsible for two complementary mandates, the first of which can involve the regulation of freshwater urbanization effects:[33]

    a. Conserving, protecting and restoring fish habitat to support sustainable recreational, Aboriginal and commercial fisheries through the provision of scientific information and advice; and

    b. Conserving and protecting oceans, ocean resources and biodiversity on an ecosystem basis through integrated management, a precautionary approach and sustainable development principles.

[32] Cohen Commission Exhibit PPR3.
[33] Cohen Commission Exhibits 33-27 at 6 and 33-28 at 6.

26. There are four major programs in OHEB: The Salmon Enhancement Program, the Habitat Management Program, the Oceans Program and the Species at Risk Program. The Habitat Management Program is responsible for the regulation and management of freshwater urbanization effects through:[34]

> ... delivery of habitat provisions of the *Fisheries Act*; implementation and management of the Department's requirements for environmental review of ongoing and proposed development in the assigned Area that may affect aquatic resources; developing, advising on and assisting the development of departmental recommendations for mitigation or compensation requirements if habitat is affected or lost; recommending the conditions of approval for *Fisheries Act* authorizations; overseeing the delivery of monitoring and reporting requirements in relation to Section 35 delivery in the Area; participating in and assist in the development of effective review processes with partnering agencies; representing the department in interagency meetings; and participating and leading in the communication of program delivery and objectives to stakeholders and the public. With respect to restoration, actively develop partnerships and proposals to restore damaged habitat to restore productive capacity of the habitats found in the area.

27. DFO's habitat referral process is discussed in detail in the commission's Habitat Management PPR. As stated in that PPR, the Habitat Management Program's work has been predominantly regulatory and focused on ensuring compliance with the prohibition against physical destruction of fish habitat in s. 35(1) of the *Fisheries Act*, R.S.C. 1985, c. F-14 and other statutory provisions.[35]

28. Habitat Management staff review development proposals (or "referrals").[36] Proponents do not have an affirmative duty to submit information about proposed works or undertakings, however, failure to do so may expose the proponent to liability under the *Fisheries Act*.[37] Upon receiving a referral, DFO provides

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[34] Cohen Commission Exhibits 33-27 at 6-7 and 33-28 at 6-7.
[35] Habitat Management PPR at 31 and for a review of the referral process see pp. 31-47; Ringtail Documents CAN180495 at 16 and CAN027763 at 16; The Annual Report on the Implementation of the *Riparian Areas Regulation* (*RAR*) 2008-09, May 5, 2009 at 6 [2008/2009 Annual Report].
[36] Ringtail Document CAN180495 at 22; 2008/2009 Annual Report at 12.
[37] Ringtail Document CAN180495 at 22.

comments and advice to assist the proponent to ensure that proposed activities do not contravene the *Fisheries Act,* commonly in the form of a Letter of Advice, Operational Statement or an Authorization pursuant to s.35(2) of the *Fisheries Act*.[38] DFO has implemented a number of activity-specific Operational Statements ("OS") for low risk projects that outline conditions and measures for avoiding impacts on fish habitat.[39] A proponent who complies with an OS does not have to submit a proposal for review by DFO.[40] However, proponents are encouraged to notify DFO of their project 10 days before commencing work using a standard notification form.[41]

29. For works or undertakings in an area covered by the provincial *Riparian Areas Regulation*, B.C. Reg. 376/2004 (the "*RAR*"), DFO accepts that a "proponent who has fully implemented the recommendations certified by a QEP [Qualified Environmental Professional; see section "*Riparian Areas Regulation*", below] who has correctly and fully followed the *RAR* Assessment Methods and measures, will be considered to have exercised all due diligence in preventing a HADD [a harmful alteration, disruption or destruction of fish habitat under s. 35 of the *Fisheries Act*] due to the removal of riparian vegetation".[42] But, compliance with the *RAR* does not exempt anyone from needing to comply with other applicable federal, provincial or local government legislation.[43] For more on the regulation of development under the *RAR*, see below (see sections "The *Riparian Areas Regulation*" and "The *Riparian Areas Regulation* Process", below).

30. OHEB's Habitat Management Program was re-structured in 2004/05 through the Expenditure Review Committee Process and the EPMP.[44] The resulting

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[38] Ringtail Document CAN180495 at 22.
[39] Planning Guidance for British Columbia and Yukon, online: Fisheries and Oceans Canada <http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/index-eng.htm> [Planning Guidance for British Columbia and Yukon].
[40] Planning Guidance for British Columbia and Yukon.
[41] Operational Statement Notification Form, online: Fisheries and Oceans Canada <http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/form-formulaire-eng.htm>.
[42] Ringtail Document CAN002923 at 9.
[43] Ringtail Document CAN002916 at 4.
[44] Habitat Management PPR at 24-31.

reorganisation of DFO and the Habitat Management Program resulted in reduced staffing in the Pacific Region and involved changing staff roles and responsibilities for some programs.[45] Although the number of individuals working in the Habitat Management Program was decreased, there was no corresponding decrease in program responsibility. At this time, the Habitat Management Program moved to a much greater reliance on streamlining processes like the application of provincial Best Management Practices ("BMPs") and federal OS for low-risk development activities in order meet the challenges posed by reduced capacity.[46] Habitat Management OS and BMPs are guidance documents covering referrals deemed low risk. National OS were developed in 2005 after which regionalization of these documents began.[47] DFO's streamlining of the referral process under the EPMP and use of OS is described in the commission's Habitat Management PPR.[48]

31. In response to the EPMP and cuts to staffing levels in 2004/05, DFO's BC Interior ("BCI") Area Office also created Habitat Management operating principles.[49] These operating principles are summary documents that describe a standardized approach for BCI's strategy for dealing with various industries.[50] There are habitat management operating principles for, amongst others, flood control activities,[51] lake and large river foreshore activities,[52] highway activities[53] and urban/rural activities.[54] Each operating statement identifies the proponent's activity, BCI OHEB's current and future (according to the Area Transition Strategy) response activities as well as classifying each activity according to

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[45] Ringtail Documents CAN014446 at 1 and 3, CAN012190 at 13, CAN014544 at 1 and CAN393189 at 1.
[46] Ringtail Documents CAN009168 at 49, CAN021555 at 4 and CAN393189 at 1.
[47] Ringtail Documents CAN128582 at 1 and CAN205991 at 2.
[48] Habitat Management PPR at 24-28 and 37-38. It is also mentioned in Cohen Commission Exhibit 35 (CESD Spring 2009 Report) at para. 1.52.
[49] Ringtail Document CAN005941 at 1.
[50] Ringtail Document CAN005941 at 1.
[51] Ringtail Document CAN005949.
[52] Ringtail Document CAN005951.
[53] Ringtail Document CAN005958.
[54] Ringtail Document CAN005979.

priority.[55] Priority 1 activities are mandatory, priority 2 activities are discretionary and priority 3 activities are the lowest priority activities.[56] Consistent with DFO's Risk Management Framework, priority 2 and 3 activities are addressed through guidelines, BMPs, integrated plans and stewardship/outreach strategies.[57]

Transport Canada

32. Port and marina development can affect fish habitat through physical loss of habitat and the deposition of deleterious substances. Transport Canada ("TC") is responsible for ensuring safe, secure, efficient and affordable transportation systems.[58] It oversees marine infrastructure for pleasure craft, small vessels and large commercial vessels as well as the transport of dangerous goods by water and the protection of the marine environment. The *Navigable Waters Protection Act*, R.S.C., 1985, c. N-22 (the "*NWPA*") ensures the public right of navigation by allowing for the removal of obstructions and requiring approvals for planned obstructions.[59] It prohibits the building, placing or maintaining of any work in, on, over, under, through or across any navigable water without the authorisation of the Minister of Transport Canada.[60] The construction of ports, docks and marinas is thus regulated by this Act.

33. As with a number of other federal departments, including DFO and Environment Canada ("EC"), TC may also be a Responsible Authority under the *Canadian Environmental Assessment Act*, S.C. 1992, c. 37 ("*CEAA*") and be responsible for the environmental assessment of proposed development projects.

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[55] Ringtail Document CAN005941 at 1-2.
[56] Ringtail Document CAN005941 at 2.
[57] Ringtail Documents CAN005972 at 1 and CAN005941 at 1-2.
[58] Ringtail Document CAN025064 at 35.
[59] Ringtail Document CAN024597 at 40.
[60] *NWPA*, s. 5; Navigable Waters Protection, online: Transport Canada <http://www.tc.gc.ca/eng/quebec/nwp-menu-1424.htm> [Navigable Waters Protection]. According to TC, "Navigable water" designates any body of water capable, in its natural state, of being navigated by any type of floating vessel for the purpose of transportation, recreation or commerce (Navigable Waters Protection).

Environment Canada

34. Environment Canada is responsible for the administration, including enforcement, of s. 36 of the *Fisheries Act*. As set out in the Habitat Enforcement PPR, s. 36 prohibits the deposit of deleterious substances into water frequented by fish.[61] Further detail on EC's responsibilities with respect to s. 36 and contaminants is set out below (see section, "Regulation of non-point source contaminants that could affect Fraser sockeye"). EC may also be a Responsible Authority under *CEAA*.

Provincial management context

Organisational structure

35. Provincial ministries in charge of environmental issues have been reorganised several time since September 2010. As of May 2011, the relevant ministries for this PPR are the Ministry of Environment ("MOE") and Ministry of Forests, Lands and Natural Resource Operations. This latter ministry consists of the following Divisions:

    a. Major Projects, First Nations and Community Opportunities;
    b. Integrated Resource Operations;
    c. Resource Stewardship;
    d. Timber Operations and Pricing;
    e. Tenures, Competitive and Innovation; and
    f. Corporate Initiatives Unit.

36. The Major Projects, First Nations and Community Opportunities Division, is responsible for major projects, resort development, crown land opportunities and restoration, archaeology, heritage and First Nations consultation functions in an effort to streamline complex decision coordination. The Integrated Resource

[61] Habitat Enforcement PPR at 6-8.

Operations division includes Compliance and Enforcement, Recreation Sites and Trails, Wildfire Management, GeoBC and Range Branch.

Environmental Assessment Act

37. The provincial *Environmental Assessment Act*, S.B.C. 2002, c. 43 ("BC *EAA*") applies to reviewable projects[62] as defined by the Lieutenant Governor in Council[63] as well as projects which the minister is satisfied may have significant adverse environmental, economic, social, heritage or health effects, the designation of which is in the public interest, and which the minister believes, on reasonable grounds, have not substantially been started at the time of designation.[64] Renewable projects include mine, energy, water management (dams, dykes, water diversion projects, groundwater extraction projects and shoreline modification projects), waste disposal, food processing, transportation (public highways, railways, ferry terminals, marine port facilities and airports) and tourist destination resort projects (marine resorts, golf resorts, ski resorts and other resort developments).[65] The criteria for each of these project types is described in a matrix which enables proponents to determine, prior to starting a project, whether the BC *EAA* applies to the development.[66]

Provincial Fish Protection Act

38. The provincial *Fish Protection Act*, S.B.C. 1997, c. 21, states that the Lieutenant Governor in Council may, by regulation, designate sensitive streams when such designation will contribute to protecting a population of fish whose sustainability is at risk due to inadequate water flow within a stream or due to habitat degradation.[67] Designated sensitive streams include the Nathan Creek, Salmon River (near Prince George), Silverdale Creek, West and Whonnock Creeks which

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[62] As defined in the *Renewable Projects Regulation*, BC. Reg. 370/2002 [*Renewable Projects Regulation*].
[63] BC *EAA*, s. 5(1).
[64] BC *EAA*, s. 6(1).
[65] *Renewable Projects Regulation*.
[66] *Renewable Projects Regulation*; Ringtail Document CAN002592 at 46.
[67] *Fish Protection Act*, s. 6(2).

all flow into the Fraser River.[68] For licenses on sensitive streams, the regional water manager or comptroller may consider impacts on fish and fish habitat and specify conditions regarding this when approving or amending licenses.[69] The *Fish Protection Act* also protects the Fraser River from construction of new bank-to-bank dams.[70]

39. Lastly, the *Fish Protection Act* empowers the Lieutenant Governor in Council to establish, by regulation, policy directives regarding the protection and enhancement of riparian areas after consultation with representatives for the Union of British Columbia Municipalities (the "UBCM").[71] Such policy directives may vary across British Columbia depending on local government powers and as established by the directives.[72] If such a policy directive applies to a local government, riparian area protection provisions at least comparable to the policy directives must be established.[73]

Riparian Areas Regulation

40. Enabled by s. 12 of the *Fish Protection Act*, the *Riparian Areas Regulation* came into force on March 31, 2005[74], repealing the *Streamside Protection Regulation*. The *RAR* provides local governments with direction to improve the protection of fish and fish habitat in British Columbia.[75] The purpose of the *RAR* is to "establish directives to protect riparian areas from development so that the areas can provide natural features, functions and conditions that support fish and life processes"[76] and to facilitate cooperation between DFO, MOE and the UBCM.[77]

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[68] *Sensitive Streams Designation and Licensing Regulation*, B.C. Reg. 89/2000.
[69] *Fish Protection Act*, ss. 6(6), 6(7), 6(8) and 6(9).
[70] *Fish Protection Act*, ss. 4(1)(g) and 4(3).
[71] *Fish Protection Act*, *s*s. 12(1) and 12(2).
[72] *Fish Protection Act*, *s*. 12(3).
[73] *Fish Protection Act*, *s.* 12|(4).
[74] Note that some local governments were given a year to comply with the RAR and thus it is often noted that the RAR took effect on March 31, 2006 (see e.g., Ringtail Documents CAN066449 at 3, CAN063111 at 2 and CAN066448 at 2).
[75] Ringtail Document CAN002916 at 4.
[76] *RAR*, s. 2(a); Ringtail Document BCP001507 at 4.

41. On July 16, 2008 DFO, MOE and UBCM entered the Intergovernmental Cooperation Agreement Respecting the Implementation of British Columbia's Riparian Areas Regulation (the "*RAR* Agreement").[78] The purpose of the *RAR* Agreement is to define the roles and responsibilities of DFO, MOE and the UBCM and create a management structure to oversee the implementation and ongoing delivery of the *RAR*.[79] The *RAR* Agreement also established a tripartite Steering Committee ("RARSC").[80]

42. The *RAR* applies to municipalities and regional districts in the Lower Mainland, on much of Vancouver Island, in the Islands Trust area and in parts of the Southern Interior; adoption is voluntary for local governments.[81] To date no local governments have opted to comply with the *RAR* in its entirety. There is no process to bring the *RAR* into force in the rest of Province. Where it applies, the *RAR* covers all streams, rivers, creeks, ditches, ponds, lakes, springs and wetlands that are connected (above-ground) to a water-body that provides fish habitat, but does not apply to estuarine areas.[82]

43. The *RAR* applies only in association with new residential, commercial and industrial development on land under local government jurisdiction, which includes private land and the private use of provincial Crown land.[83] Under the *RAR*, development is defined as being any activities that are, "associated with or resulting from the local government regulation or approval of residential, commercial, or industrial activities or ancillary to the extent that they are subject

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[77] *RAR*, s. 2(b); Ringtail Document BCP001507 at 4.
[78] Ringtail Document BCP000402.
[79] Ringtail Document BCP000402 at 4.
[80] Ringtail Document BCP000402 at 4.
[81] Ringtail Document CAN002916 at 8.
[82] Ringtail Document CAN002916 at 5.
[83] Ringtail Document CAN002916 at 6-7.

to local government powers under Part 26 of the *Local Government Act*."[84] These activities include the following:[85]

a. Removal, alteration, disruption, or destruction of vegetation;

b. Disturbance of soils;

c. Construction or erection of buildings and structures;

d. Creation of non-structural 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; and

j. Subdivision as defined in s. 872 of the *Local Governments Act*.

44. The *RAR* does not apply to development or development variance permits issued to enable reconstruction or repair of permanent structures described in s. 911(8) of the *Local Government Act* if the structure remains on its existing foundation.[86] It also does not apply to farming and mining activities, hydroelectric facilities, forestry, federal and First Nations reserve lands, parks and parkland and institutional developments.[87] Nor does it apply to existing permanent structures, roads and other development within the riparian protection area or developments that were approved before the *RAR* was enabled.[88]

45. Section 12(1) of the *Fish Protection Act* enables the Lieutenant Governor in Council to "establish policy directives regarding the protection and enhancement of riparian areas...subject to residential, commercial or industrial development" by

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[84] *RAR*, s. 1(1); Ringtail Document BCP001507 at 1.
[85] *RAR*, s. 1(1); Ringtail Document BCP001507 at 1-2.
[86] *RAR*, s. 3(2); Ringtail Document BCP001507 at 5.
[87] Ringtail Document CAN002916 at 10-12.
[88] Ringtail Document CAN002916 at 10-11.

regulation. To implement such regulations, s. 12(4) of the *Fish Protection Act* specifies that a local government must do either of the following:

(a) include in its zoning and rural land use bylaws riparian area protection provisions in accordance with the directive, or

(b) ensure that its bylaws and permits under Part 267 of the *Local Government Act* or Part XXVII of the *Vancouver Charter*, as applicable, provide a level of protection that, in the opinion of the local government, is comparable or exceeds that established by the directive.

46. Local governments can implement the *RAR* by adding a requirement to produce a Qualified Environmental Professional ("QEP")'s Assessment Report to existing development permitting and approval processes.[89] Alternatively, a local government can incorporate a level of protection consistent with the *RAR* into their zoning and general bylaws.[90] Regardless of the tool employed by local government, the regulatory process must include a definition of streams and riparian areas consistent with the *RAR*, a means to trigger regulatory action for development activities proposed within riparian assessment areas and a means of requiring a QEP Assessment Report that complies with the *RAR* and the *RAR* assessment methods.[91]

47. The *Riparian Areas Regulation* Implementation Guidebook (the "*RAR* Guidebook") provides guidance to QEPs, local governments, MOE staff, landowners, developers, community organizations and others regarding the *RAR* process and requirements.[92] The *RAR* Guidebook also sets out the roles and responsibilities of governments, QEPs and proponents (landowners and developers) in implementing and complying with the *RAR*.[93] It describes the process for seeking project approval and outlines the implementation tools for

[89] Ringtail Document CAN002916 at 12.
[90] Ringtail Document CAN002916 at 12.
[91] Ringtail Document CAN002916 at 39-40 and 48. For more information on methods of implementation see CAN002916 at 47-51.
[92] Ringtail Document CAN002916 at 4.
[93] Ringtail Document CAN002916 at 4.

local government along with compliance monitoring and enforcement efforts and tools.[94]

48. The *RAR* is an example of a streamlining tool consistent with DFO's Environmental Process Modernization Plan.[95]

The Riparian Areas Regulation process

49. The *RAR* defines a riparian area or Streamside Protection and Enhancement Area ("SPEA") as an area:[96]

> (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.

50. Qualified Environmental Professionals are individuals or groups of applied scientists or technologists that meet the following requirements:[97]

> (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.

51. QEPs complete Assessment Reports in accordance with assessment methods defined in the schedule to the *RAR*.[98] A proponent who proposes to develop

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[94] Ringtail Document CAN002916.
[95] Ringtail Document CAN037329 at 17-19.
[96] *RAR*, s. 1(1).
[97] *RAR*, s. 1(1).
[98] *RAR*, s. 1(1).

within the riparian assessment area must have a QEP Assessment Report completed before development may be approved or allowed by local governments.[99] The process for seeking approval for a development is described in Figure 1. Completed Assessment Reports must be submitted electronically to MOE who maintains a notification system for the *RAR* and notifies both DFO and local governments of the report.[100] A local government may approve a development upon being notified by MOE that both MOE and DFO have been notified of the development proposal, have been provided with copies of the Assessment Report that certifies that the QEP is qualified to carry out the assessment and that the assessment methods were followed and if the QEP is of the opinion that:[101]

(a) 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

(b) 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.

52. If implementing a development proposal would result in a HADD in the riparian assessment area, a local government may nonetheless allow or approve the development if the Minister of Fisheries and Oceans or a regulation under the *Fisheries Act* authorizes that HADD.[102] Under the *RAR* process, DFO may grant approvals, which are referred to as variances, to SPEAs in situations where the property owner faces hardship or special circumstances.[103] The *RAR* Variance

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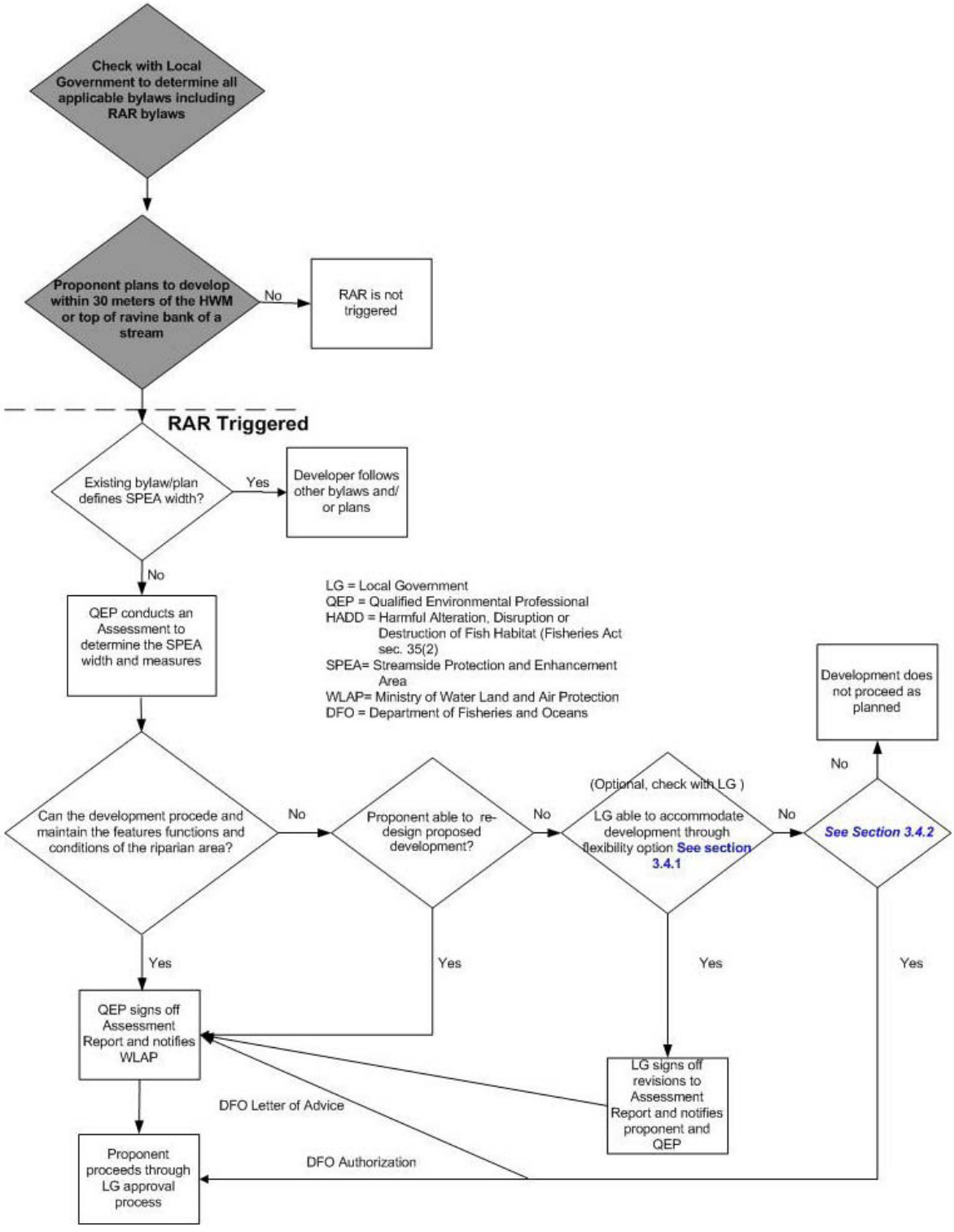
[99] *RAR*, s.4(2)(b); Ringtail Document CAN002916 at 23.
[100] Ringtail Documents CAN002916 at 8 and BCP000402 at 11.
[101] *RAR*, s. 4(2).
[102] RAR s. 4(3).
[103] Protocol for Management of *Riparian Area Regulation* Variances Between the Department of Fisheries & Oceans and the Ministry of Environment, Draft 7C at 1 [*RAR* Variance Protocol] (not yet available in Ringtail at the publication date of this Policy and Practice Report, but the commission has requested production by the Department of Justice through Ringtail).

Protocol contains standards and methodology to determine whether there is an undue hardship.[104] Variances will only be granted when a property would be made sterile (i.e., where no private development remains available to the landowner).[105]

[104] *RAR* Variance Protocol.
[105] *RAR* Variance Protocol at 1-2.

Figure 1: Process for Seeking Project Approval under the *Riparian Areas Regulation*.[106]



[106] Ringtail Document CAN002916 at 29.

Environmental Review Committees

53. Local governments and DFO can set up Environmental Review Committees ("ERC") to review project proposals. These committees allow DFO the opportunity to discuss projects with municipalities and proponents.[107] Since the *RAR* was enacted, the ERC process is no longer necessary, except with respect to making variance decisions. Municipalities can still do this type of planning with DFO if they chose to[108], but use of the ERC has been substantially curbed since *RAR* was implemented.

Implementation of the Riparian Areas Regulation

54. To implement the *RAR*, MOE has developed a *RAR Implementation* Workplan, which includes eight major components:[109]

    a. Intergovernmental Cooperation Agreement (see section "*Riparian Areas Regulation*", above);

    b. Effectiveness monitoring and directed research;

    c. Compliance monitoring;

    d. Ongoing *RAR* implementation;

    e. Training;

    f. Professional associations;

    g. Communications; and

    h. Improvements to materials.

Effectiveness monitoring and directed research

[107] Ringtail Document CAN223922 at 1-2.
[108] Ringtail Documents CAN267363 at 3 and CAN223922.
[109] 2008/2009 Annual Report at 2-3.

55. The Province intends the management of the *RAR* to rely on an adaptive management approach, which the RARSC is responsible for implementing.[110] Adaptive management is an approach characterised by a continual learning process[111] in which the RARSC will consider information collected on the implementation and effectiveness of *RAR* in order to recommend revisions be made to the *RAR* or supporting materials to increase its effectiveness and function. [112] Such recommended changes would be submitted through the provincial government's Order in Council procedure for decision.[113] MOE has completed one directed research study which it recently submitted for publication. Based on data collected on large woody debris in the Lower Mainland for the past three years, the paper concludes that the *RAR* setbacks are appropriate in their current form and do not need to be changed.

56. Experimental designs to determine whether the *RAR* is effective are likely to be complex.[114] MOE has engaged a consultant to help develop Effectiveness Monitoring Plans for its overall monitoring strategy and are trying to fit the *RAR* under this results-based monitoring activities umbrella. This plan, which has been in development for less than a year, has not been completed.

Compliance monitoring

57. The RARSC is responsible for ensuring that compliance, complaints, enforcement and effectiveness monitoring are undertaken and that the results are incorporated into annual monitoring plans and reported to the RARSC.[115] Under the *RAR* Agreement, the RARSC is also obliged to submit annual reports on the implementation of the *RAR* Agreement and specific activities related to *RAR* administration, implementation and monitoring to the signatories of the *RAR*

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[110] Ringtail Document BCP000402 at 7-8.
[111] See e.g. Walters, C. *Adaptive Management of Renewable Resources* (New York: Macmillan Publishing Company, 1986).
[112] Ringtail Document BCP000402 at 7-8.
[113] Ringtail Document BCP000402 at 7-8.
[114] 2008/2009 Annual Report at 16.
[115] Ringtail Document BCP000402 at 7 (s. 8, Annex 1 of the *RAR* Agreement).

Agreement.[116] These reports are supposed to include a summary of compliance monitoring results, effectiveness monitoring results, directed research, status of implementation, numbers of notifications and any recommendations for revisions to the *RAR* and supporting materials.[117]

58. MOE compliance monitoring is broken into three components: QEP, developer and local government compliance. DFO and MOE agreed on a *RAR* compliance target or benchmark of achieving 90% compliance with 90% confidence.[118] Although the intention is to produce annual compliance reports, to date, MOE has only produced one draft compliance report (for 2007), although the annual reports submitted by the RARSC to DFO, MOE and UBCM also contain information about compliance monitoring.[119]

59. MOE determines QEP compliance with the *RAR* reporting requirements by reviewing every report submitted by a QEP in each year.[120] This review determines whether the QEP adhered to the *RAR* methodology.[121] From 2006 – 2009/10, the MOE reviewed all QEP Assessment Reports, but the results have not been published.[122] The MOE reviews have now moved to more of an audit function where every fifth report is audited unless there are particular concerns with specific QEPs that warrant further monitoring of their reports. According to MOE, QEP Assessment Report compliance has increased significantly since 2006, but a random sample of 100 QEP Assessment Reports in 2009 resulted in

[116] Ringtail Document BCP000402 at 7 (s. 5, Annex 1 of the *RAR* Agreement).
[117] Ringtail Document BCP000402 at 7 (s. 7, Annex 1 of the *RAR* Agreement).
[118] Compliance with the Riparian Areas Regulation (RAR) – Report on Monitoring Activities for Assessments Submitted in 2007 (April 2009 Draft) [2007 Compliance Report] at 4 (not yet available in Ringtail at the publication date of this Policy and Practice Report, but the commission has requested production by the Province through Ringtail).
[119] 2007 Compliance Report; 2008/2009 Annual Report at 13-15.
[120] 2008/2009 Annual Report at 13.
[121] 2008/2009 Annual Report at 13.
[122] 2008/2009 Annual Report at 13.

MOE returning 28 reports to the QEPs due to errors; five of the reports contained substantive errors.[123]

60. One hundred and eight development sites were monitored in 2007 to determine compliance with the RAR.[124] Of the 45 sites monitored in the lower mainland, 60% were compliant with the *RAR* with non-compliance due to developer non-compliance or errors by the QEP.[125] Developer compliance assesses regulatory compliance of land developers with the *RAR*.[126] For sites monitored on Vancouver Island, developer compliance was found to be 38%.[127] On the BC Mainland, developers were responsible for 52% of the sites that were not in compliance.[128] However, the 2008/09 Annual Report on implementation of the *RAR* notes that there were many reports of development occurring without the benefit of a *RAR* assessment and QEPs have reported that in some areas sites are regularly cleared of vegetation before the QEP is called in to perform an assessment.[129]

61. In its 2008/09 Annual Report, MOE states that sixty percent of local governments were compliant with the *RAR* because they had a regulatory mechanism to trigger the regulation in appropriate contexts.[130] The report also notes that even within compliant municipalities there are variations in the way that the *RAR* is adopted that can result in non-compliance.[131] For example, vegetation removal or soil disturbance may not be captured by municipal bylaws or may not trigger the need for a development permit.[132]

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[123] 2008/2009 Annual Report at 13-14.
[124] 2007 Compliance Report at 6-7; 2008/2009 Annual Report at 14.
[125] 2007 Compliance Report at 6-7; 2008/2009 Annual Report at 14.
[126] 2008/2009 Annual Report at 15.
[127] 2008/2009 Annual Report at 15.
[128] 2008/2009 Annual Report at 15.
[129] 2008/2009 Annual Report at 15.
[130] 2008/2009 Annual Report at 15.
[131] 2008/2009 Annual Report at 15.
[132] 2008/2009 Annual Report at 15.

62. Since the 2008/2009 Annual Report and 2007 Compliance Report were completed in May 2009, no further analysis of compliance data has been completed. To date, no changes to *RAR* have been made on the basis of compliance reporting results.

Qualified Environmental Professionals

63. The use of a professional reliance model, which requires a QEP (usually hired by the developer[133]) to conduct assessments and determine riparian setbacks, is intended to reduce DFO involvement.[134]

64. The RARSC considers, directs, reviews and audits the training course for QEPs.[135] The committee may recommend changes to the training course to ensure its quality and completeness and can liaise with associations representing QEPs to discuss feedback, report on compliance of QEPs, assess training needs and discuss the results of the associations' disciplinary procedures.[136] As of May 2011, two MOE employees had audited the training course to determine whether it was reasonable, but there has been no formal review of the course.

65. If MOE has an issue with a QEP's performance it can raise its concerns with the QEP's professional association. MOE does not have the authority to refuse a report completed by a QEP, but it does review the Assessment Reports as set out above.

Lakeshore/riverfront development

66. Dramatic changes to the pattern of flooding on a floodplain and the most serious losses of floodplain fish habitats are due to urban development.[137]

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[133] Ringtail Documents CAN002916 at 27 and 2007 Compliance Report at 2.
[134] Ringtail Documents CAN285478 at 1 and CAN037329 at 19.
[135] Ringtail Document BCP000402 at 8.
[136] Ringtail Document BCP000402 at 8.
[137] Ringtail Document CAN022148 at 87.

67. Lakeshore/riverfront/riverine areas are sensitive and productive fish habitat and play a crucial role in ensuring healthy fish populations.[138] The impacts of urbanization can be thought of as falling into two closely related categories– stream channel alteration work done to prevent flooding and development within the SPEA.

68. Stream channel alteration in the floodplain ecosystem is often undertaken in areas where flooding threatens human activities.[139] Over half of the BC population resides within the 2.8% of the province that makes up the Fraser River floodplain.[140] Alteration to stream channels associated with river instability, seasonal floods and the migration of channels includes dyking, dredging, ditching and land filling.[141] By 2004, the lower Fraser River was surrounded by some 620 kilometres of dykes and an estimated 70% of wetland habitats had been isolated from the river.[142] However, the effects of hydro-modification are not limited to the lower Fraser River. The Thompson River Basin, tributaries of the Fraser River below Hope, the Nicola River Valley, the east coast of Vancouver Island, and most BC towns and cities bordering a water course face similar problems.[143] Stream channel alteration in rural areas may be limited to channelization and the use of rip-rap to reduce erosion and prevent flooding.[144]

69. Emergency flood projects requiring formal authorization from DFO do not require *CEAA* screening because of the emergency nature of the work.[145] Emergency projects proceed even if habitat compensation is required, and DFO is flexible on details and timing of such compensation to ensure timely completion of the primary work.[146] Under emergency deadlines, DFO may not be able to assess

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[138] Ringtail Documents CAN005950 at 1; CAN002592 at 10 and CAN175326 at 1.
[139] Ringtail Document CAN022148 at 87.
[140] Ringtail Document CAN022148 at 87.
[141] Ringtail Document CAN022148 at 87.
[142] Ringtail Document CAN022148 at 87.
[143] Ringtail Document CAN022148 at 89.
[144] Ringtail Document CAN022148 at 89.
[145] *CEAA* s. 7(1)(b) and (c); Ringtail Document CAN295016 at 1.
[146] Ringtail Document CAN295016 at 1.

impacts of an activity or to identify suitable compensation habitat. In such cases impacts can be assessed and suitable compensation habitat identified based on photos and surveys after the work has been initiated. Dykes constructed in emergency situations often become permanent structures. DFO is not involved in granting approvals for flood projects under the Provincial Emergency Program; although it can ask questions, it defers to the Province's assessment. Canada has matched funding from the Province for flood protection works, including dyking and gravel removal, but provincial funding does not cover environmental protection or mitigation.[147]

70. An emergency exclusion from *CEAA* does not change *Fisheries Act*, s. 35 requirements for habitat compensation. Requirements for habitat compensation may be written into an authorization, for example, that the proponent will compensate to DFO's satisfaction within a specific time frame. DFO expects that habitat compensation will be completed within a year if it is feasible to do so.

71. Lakeshore and riverine development often affects shoreline stability, putting it at risk for erosion. Lakeshore stabilisation practices also include work to protect bank shores from erosion; while each such improvement may have minimal impacts, the cumulative effect may be significant as protecting or armouring stream banks in one area increases the potential for erosion problems elsewhere along a stream.[148] Shoreline development works can also have other significant impacts such as the removal of riparian, bank and foreshore vegetation in addition to stabilising structures acting as barriers limiting the use of the foreshore for fish.[149]

72. Protection of fish and fish habitat depends on stream and lakeside vegetation, which protects root systems stabilising shorelines and maintaining natural bank geometry, sustains food supplies from insects and leaf-drop, maintains shade

[147] Ringtail Document CAN0295016 at 1.
[148] Ringtail Documents CAN066454 at 67 and CAN005950 at 1.
[149] Ringtail Document CAN005950 at 1.

and hiding spots for predator avoidance and temperature moderation and reduces sedimentation and run-off of non-point source pollution into lakes.[150]

73. The provincial *Water Act*, R.S.B.C. 1996, c. 483, vests in the provincial government the right to use and regulate flow of all stream water except where private rights have been established.[151] Changes made in or about a stream by a person, minister or municipality must be approved under s. 9 of the *Water Act* or according to regulations or a license under it.[152] Work in or about a stream is defined to include all work proposed in or about a stream, ravine or active floodplain of a stream or its riparian or streamside area.[153] The *Water Regulation* sets out works that may be permitted under the *Water Act*'s notification process.[154] Such work includes restoration and maintenance of fish habitat, repair and maintenance of existing dykes and flood protection work in emergencies.[155] If a planned work does not fall within the listed activities under s. 44 of the *Water Regulation*, formal approval through the *Water Act* approval process must be sought.[156]

74. To ensure the ability to enforce the *Water Act*, MOE regional staff, local government, the Integrated Land Management Bureau and DFO undertook a project on Lakeshore Development Compliance.[157] This three year program began collecting base-line foreshore habitat data for an inventory to assess compliance with the *Water Act*.[158] The program determined that compliance was

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[150] Ringtail Document CAN005950 at 1.
[151] *Water Act*, s. 2.
[152] *Water Act*, s. 9(2) and *Water Regulation*, B.C. Reg. 204/88 ss.36-44.
[153] Ringtail Document CAN005950 at 2.
[154] *Water Regulation*, s. 44.
[155] *Water Regulation*, s. 44(1).
[156] Ringtail Document CAN005950 at 2.
[157] Lakeshore Development Compliance Project: Defining the Issue across BC 2008/09 Phase 1 [Lakeshore Development Compliance Project] (not yet available in Ringtail at the publication date of this Policy and Practice Report, but the commission has requested production by the Province through Ringtail); Ringtail Document CAN192925.
[158] Lakeshore Development Compliance Project at 6; Ringtail Document CAN192925 at 3-4.

extremely low, with the majority of beach creation and docks work not authorized.[159]

75. Lands adjacent to water courses may be privately owned, but the land between the low- and high-water marks in lakes, rivers and streams is owned by the Province.[160] The Province has interpreted "in and around streams" as only applying to activities at or below the natural boundary (the annual high-water mark) and the Water Management Branch (MOE) thus maintains that no approvals are required for such work above the annual high water mark. As a result, there may be an operational gap in relation to approvals required for works between the high water mark and the top of the bank.

76. Work extending into the water course, such as private moorage, is guided by the provincial Land Use Operational Policy which applies to moorage facilities in inland and coastal aquatic crown lands.[161] This policy does not apply to mooring buoys used for private moorage. For private moorage facilities the policy prohibits dredging the foreshore, using fill below the present natural boundary and using crib foundations or solid core structures of cement or steel sheeting (which can cause water blockages, erosion and impact habitat).[162] Further, pressure treated wood must not be used for private moorage facilities.[163] General permissions are granted to docks smaller than 20 m^2 in surface area that follow the policy document, while larger docks must go through a special permission application process.[164]

77. For more information on stream channel alteration and foreshore development see the following:

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[159] Lakeshore Development Compliance Project at 9-11.
[160] Ringtail Document CAN027909 at 21.
[161] Ringtail Document BCP001389.
[162] Ringtail Document BCP001389 at 18-19.
[163] Ringtail Document BCP001389 at 20.
[164] Ringtail Document BCP001389 at 7-8.

a. BC, A User's Guide to Working In and Around Water, Ministry of Environment, May 18, 2005;[165]

b. BC, Best Management Practices for Lakeshore Stabilization, Ministry of Water, Land and Air Protection, February 24, 2005 (Ringtail Document CAN005950);

c. BC, Dike Design and Construction Guide: Best Management Practices for British Columbia, Ministry of Water, July 2003;[166]

d. BC, Dike Operation and Maintenance Manual: TEMPLATE, Ministry of Environment, Lands & Parks, January 2001;[167]

e. BC, Environmental Guidelines for Vegetation Management on Flood Protection Works to Protect Public Safety and the Environment;[168]

f. BC, Standards and Best Practices for Instream Works, Ministry of Water, Land and Air Protection, March 2004 (Ringtail Document CAN066454);

g. BC, Wetland Ways – Interim Guidelines for Wetland Protection and Conservation in BC;[169]

h. DFO, Addendum to the BC Ministry of Water, Land and Air Protection Best Management Practices for Lakeshore Stabilization (Ringtail Document CAN005973);

i. DFO, Habitat Management Operating Principles for Foreshore Activities (Ringtail Document CAN022849);

j. Dike and Channel Maintenance and Habitat Subcommittee, Comprehensive Management for Flood Protection Works, October 2001 (Ringtail Document CAN182040); and

k. Streambank Protection with Rip-rap: An Evaluation of the Effects on Fish and Fish Habitat, 2004. Quigley, J.T. and Harper, D.J. (eds), Canadian Manuscript Report of Fisheries and Aquatic Sciences 2701 (Ringtail Document CAN024181).

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[165] Available online at: http://www.env.gov.bc.ca/wsd/water_rights/cabinet/working_around_water.pdf.
[166] Available online at: http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/2010_dike_des_cons_guide.pdf.
[167] Available online at: http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/dike_op_main_man.pdf.
[168] Available online at: http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/env_gd_veg_man.pdf.
[169] Online: Ministry of Environment <http://www.env.gov.bc.ca/wld/documents/bmp/wetlandways2009/wetlandways_docintro.html>.

78. See also the commission's Technical Reports 3 (Exhibit 562) and 12 (Exhibit 735).

SLIPP

79. In the Shuswap, fourteen government agencies share jurisdiction over the management of fish habitat (and damage caused thereto), water quality (and its degradation) and conflicts between recreational users.[170] These agencies have separate mandates, priorities and financial pressures creating a complicated regulatory environment.[171] The *RAR* applies to some of these areas, but not all. The Shuswap Lake Integrated Planning Process ("SLIPP") launched in 2007 was designed to foster a joint planning process by multiple government agencies, politicians, First Nations and the public.[172] SLIPP was initiated by the Province in order to gain control over the type and rate of development and increase government effectiveness in coordinating and filling regulatory gaps in the lake environment. The SLIPP Strategic Plan contains a joint vision for Shuswap and Mara lakes in terms of foreshore development, water quality and waste management and recreational use.[173] Implementation of the strategies designed to meet these goals requires collaboration amongst the various contributors.[174] Through this project relevant agencies from all four levels of government address complex issues.[175] An Inter-agency Technical Committee reviews development applications in order to improve decision-making and ensure efficiency in the development process.[176]

80. Depending on agency jurisdiction and expertise, staff are assigned to one of three workstreams: 1) Foreshore Development; 2) Water Quality and Waste

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[170] Ringtail Document BCP000532 at 1.
[171] Ringtail Document BCP000532 at 1; Shuswap Lake Integrated Planning Process Strategic Plan, available online at: http://www.thinksalmon.com/reports/SLIPP_Strategic_Plan_Final.pdf at 3 [SLIPP Strategic Plan].
[172] Ringtail Document BCP000532 at 1-2.
[173] Ringtail Document BCP000532 at 1.
[174] Ringtail Document BCP000532 at 1.
[175] Ringtail Document BCP000532 at 3.
[176] Ringtail Document BCP000532 at 3.

Management; and 3) Recreational Management.[177] Each workstream is guided by a Steering Committee comprised of locally elected officials and First Nations and by the public though a series of open meetings.[178]

81. DFO participates in the compliance and enforcement working group established in 2008 under the Water Quality and Waste Management workstream.[179] Fisheries officers, provincial conservation officers, local government and building inspectors are supposed to coordinate to promote and compel compliance with boating, wastewater management and habitat protection regulations. Habitat Management staff in the BCI Area Office plan to dedicate 0.5 full-time equivalents ("FTE") to this compliance work, however, the individual in this role has been reassigned and the position has not been re-staffed. Similarly, for SLIPP-related habitat work DFO probably contributes in the order of 0.5 FTE.

Linear development

82. Linear developments in the Fraser River Basin include road networks, rail networks, electrical transmission lines and seismic lines used in the oil and gas industry.[180]

83. Regulators of linear development include Transport Canada, the National Energy Board and the BC Utilities Commission. Also, fish and fish habitat are protected through the federal *Fisheries Act*, ss. 35 and 36. Linear development projects are assessed by DFO like other development projects through Operational Statements and the Stream Crossing Guidebook.[181]

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[177] SLIPP Strategic Plan at 3.
[178] SLIPP Strategic Plan at 3.
[179] SLIPP Strategic Plan at 20.
[180] Cohen Commission Exhibit 826 (Cohen Commission Technical Report 2) at 40.
[181] Ringtail Document CAN005959 at 1. The Fish-Stream Crossing Guidebook is not cited in provincial regulation, but was intended to help forest and other resource managers implement sound forest practices while complying with the *Fisheries Act* and former *Forest Practices Code*, R.S.B.C. 1996 c.159 [*Forests Practices Code*] (Ringtail Document CAN002912 at 1 and 7).

Roads and highways

84. Due to new road development, the number of stream crossings within BC is continually increasing.[182] The crossings impede fish passage and may thus be an important factor affecting fish habitat.[183] While the loss of habitat may be small on a case-by-case base, the cumulative effect might be significant.[184]

85. Transport Canada is often a Responsible Authority under *CEAA* for major road and highway construction projects.

86. The DFO project review process for transportation projects relies on the proponent to determine whether DFO needs to review a project.[185] Also, the BC *Water Act* may apply to road-building depending on the circumstances of the development.

87. Highway construction can impact local stream habitat and biota, but some impacts will also be felt downstream.[186] Such impacts may be temporary in nature, which does not preclude the possibility that the water-ways can subsequently recover.[187] The main threat is fine sediment pollution which can cause direct mortality, reduce reproductive success and reduce food availability for fish.[188] Other threats include encroachment of development onto floodplains and riparian areas, loss of critical riparian vegetation and modifications of the stream channel, which can alter flow characteristics causing further impacts downstream.[189]

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[182] Ringtail Document BCP001345 at 7.
[183] Ringtail Document BCP001345 at 6-7.
[184] Ringtail Document BCP001345 at 19.
[185] Ringtail Document CAN005959 at 1.
[186] Ringtail Document CAN034908 at 3.
[187] Ringtail Document CAN034908 at 3.
[188] Ringtail Document CAN034908 at 4.
[189] Ringtail Document CAN034908 at 4.

88. In some areas of the province DFO is concerned about the combination of forest harvesting and linear development activities.[190] When the *Forest Practices Code* was in place, DFO considered the protection it afforded sufficient and opted to participate in planning meetings rather than being involved in reviewing road permits in connection with forestry practices.[191] Now the regulatory regime is governed by the *Forest and Range Practices Act*, S.B.C. 2002, c. 69. For further information on fish passage issues as it relates to the forestry sector, see the commission's forthcoming PPR on forestry.

89. With respect to the review of highway projects under DFO's habitat referral process, in 2005, BCI OHEB staff decided that they would reduce DFO involvement in these reviews.[192] This involved a shift to reliance on BMPs and Regional OS rather than conducting project reviews.[193] There would also be reliance on annual highway maintenance plans.[194] At this time, BCI developed a habitat management operating principle for highway activities, which notes that staff would selectively continue to attend initial conceptual meetings and provide comments on Corridor Management plans.[195]

90. For routine maintenance works not requiring Water Act notification, a provincial BMP describes guidelines to ensure work is completed in compliance with performance standards and environmental legislation.[196]

Bridges

91. The construction of bridges may only minimally impact banks, but channelization and poor construction practices may destabilise channels.[197] Culverts are often used as alternatives to spanning structures on streams and these can destabilise

[190] Ringtail Document CAN020325 at 1.
[191] Ringtail Document CAN020325 at 1.
[192] Ringtail Document CAN005957 at 2.
[193] Ringtail Document CAN005957 at 2.
[194] Ringtail Document CAN005957 at 2.
[195] Ringtail Document CAN005958 at 1.
[196] Ringtail Document CAN066286 at 3.
[197] Ringtail Document CAN034908 at 6.

stream channels by disrupting the flow of woody debris, sediment and water.[198] Culverts also tend to cause the stream channel to widen above the constriction, reducing current velocities and trapping sediment.[199] Due to the proximity to water, bridges are more prone to contaminating water with road run-off, especially de-icing salt, as well as leaks resulting from vehicle accidents.[200]

92. Construction of bridges must comply with the *Fisheries Act* and with the *Water Act* and *Water Regulation*.[201] DFO has put together an Bridge Maintenance OS where work is needed to extend the life of existing bridges while ensuring public safety.[202] According to this OS, DFO review is not required when the work does not involve new dredging, placement of fill or excavation of the bed or bank of a water course and the measures to protect fish and fish habitat described in the OS are incorporated.[203] All in-stream work involving rock armouring of bridge structures should be referred to the local DFO Area Office.[204] A separate OS exists for clear-span bridges (small-scale bridge structures no larger than two lanes wide that completely span a watercourse) that do not alter the stream bed or bank.[205] For more information on DFO's use of OS see the Habitat Management PPR.

Railways

93. Relevant legislation regarding railway construction may include the *CEAA, Fisheries Act*, BC *EAA* and the *Water Act*. With respect to maintenance of right-of-way areas devoted to providing transportation corridors such as railways, an

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[198] Ringtail Document CAN034908 at 6.
[199] Ringtail Document CAN034908 at 6.
[200] Ringtail Document CAN034908 at 8.
[201] Bridge Maintenance Operational Statement, available online at: http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/pdfs/bridge_maintenance_e.pdf [Bridge Maintenance OS] at 1.
[202] Ringtail Document CAN020670 at 1; Bridge Maintenance OS at 1.
[203] Ringtail Document CAN020670 at 1; Bridge Maintenance OS at 1.
[204] Bridge Maintenance OS at 1.
[205] Clear-Span Bridges Operational Statement, available online at: http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/pdfs/clear_span_bridge_e.pdf.

OS describes when DFO does not need to review maintenance measures.[206] The BCI OHEB staff have also created operating principles (see section "Management Context – DFO", above) for railway activities.[207]

Transmission lines

94. Transmission line corridors are another type of linear development that can affect Fraser sockeye habitat.

95. BC Hydro, the provincial government and DFO developed a process for managing vegetation, called "Approved Work Practice for Riparian Habitation".[208]

96. DFO developed a Rights-of-Way OS to guide maintenance of riparian vegetation in transportation corridors and for transmission lines that would allow for management of riparian vegetation in a right-of way.[209] The Rights-of-Way OS describes conditions where right-of-way maintenance projects can proceed without DFO review. Prior to creation of the Rights-of-Way OS, BC Hydro had a more detailed management strategy (which, for example, would specify the species of willow that had to be left in place to provide habitat but that would not grow too high to interfere with power lines).[210] BC Hydro has not suggested that

[206] Maintenance of Riparian Vegetation in Existing Rights-of-Way, available online at: http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/pdfs/riparian_veg_maint_e.pdf [Rights-of-Way OS] at 1.
[207] Ringtail Document CAN005972.
[208] Appendix A of the Protocol Agreement for Maintenance Work In and Around Water, available online at: BC Hydro http://www.bchydro.com/etc/medialib/internet/documents/bctc_documents/work_practices_riparian.Par.0001.File.managing_riparian_vegetation.pdf [BC Hydro Approved Work Practices for Managing Riparian Vegetation]. The Protocol Agreement itself is available online at: http://www.bchydro.com/etc/medialib/internet/documents/bctc_documents/work_practices_in.Par.0001.File.Workinaroundwater_protocol2009.pdf [BC Hydro Protocol Agreement]. See also the Memorandum of Understanding for Work in and Around Water (Ringtail Document CAN020409).
[209] Ringtail Document CAN020684; Rights-of-Way OS at 1.
[210] BC Hydro Approved Work Practices for Managing Riparian Vegetation at 17 and 23-27; BC Hydro Protocol Agreement at 3.

it will move away from using its field guide[211], but DFO cannot require BC Hydro to stick to its guideline rather than the Rights-of-Way OS.[212]

Port development

97. Large scale developments such as ports are assessed independently by the federal and provincial Responsible Authorities under *CEAA* and the BC *EAA*.[213] The commission's Habitat Management PPR provides a summary of the *CEAA* process. When large projects like port development are finalized under *CEAA* and the BC *EAA*, follow-up and monitoring programs are implemented.[214] Two prominent projects have dominated the public's attention in the last few years, the Deltaport Third Berth and the Vancouver Terminal 2 projects.

98. See also the commission's Technical Report 12 (Exhibit 735).

Deltaport Third Berth Project

99. The Deltaport Third Berth Project added a third berth and twenty hectares of container storage facilities to the Deltaport container terminal, expanding container operations to be able to handle more containers.[215] Although the project was opposed by some members of the public due to concerns over environmental impacts,[216] the third berth at the Deltaport container terminal was officially opened in January 2010 after provincial and federal environmental

[211] See e.g., Ringtail Documents CAN186041 at 18 (Regional Habitat Regulatory Decision Framework, 2010) and CAN067214 at 1 (2010 DFO Authorization for BC Hydro to install new distribution lines specifying that the right-of-way will be managed as per the BC Hydro Protocol Agreement).
[212] BC Hydro Protocol Agreement at para. 15 (page 4).
[213] Ringtail Document CAN095832 at 75.
[214] Ringtail Document CAN095832 at 75.
[215] Deltaport Third Berth Project, online: Port Metro Vancouver <http://www.portmetrovancouver.com/en/projects/ongoing_projects/deltaport_third_berth_project.aspx> [DP3].
[216] See e.g. Ringtail Documents CAN095832 and CAN142149.

assessments determined that it was not likely to result in significant adverse environmental effects.[217]

Vancouver Terminal 2 Project

100. The Robert's Bank Terminal 2 Project is a proposal to expand the Robert's Bank container capacity.[218] As a part of the on-going review, there is a working group developing a coordinated inter-departmental strategy between the Canadian Environmental Assessment Agency, DFO, TC and EC.[219] A proposal for the project has not yet been put forward by Port Metro Vancouver.

Agriculture

101. The dyking of Lulu Island over 100 years ago represented the first significant impact of agriculture on Fraser salmon habitat.[220] Agriculture affects fish habitat through run-off, water extraction, cattle grazing, fish passage and loss of riparian habitat.[221] The impacts of agricultural run-off and its regulation are discussed below (see section "Agricultural run-off", below). Water extraction will be the subject of hearings and an intended PPR on hydroelectric power and water flow and temperature.

102. The fish passage work that the BC Ministry of Forests does is focused on structures and roads and is not specific to the activity that caused them to be built. The source of these structures and roads is mostly forestry-related, but there may be some agricultural-related crossings.

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[217] Ringtail Documents CAN095832 at 75-76 and CAN142149; and Deltaport Third Berth Project – Environment, online: Port Metro Vancouver <http://www.portmetrovancouver.com/en/projects/ongoing_projects/Deltaport_Third_Berth_Project/Environment.aspx>.
[218] Roberts Bank Terminal 2, online: Port of Metro Vancouver <http://www.portmetrovancouver.com/en/Roberts_Bank_Terminal_2.aspx>.
[219] Ringtail Document CAN158109 at 1.
[220] Ringtail Document CAN002582 at 42.
[221] Ringtail Document CAN000642 at 6.

103. As with any other private or commercial activity, if work is done on agricultural land that results a HADD, then s. 35 the *Fisheries Act* applies. The Canada – British Columbia Environmental Farm Plan Program (the "EFP") is a partnership between Agriculture and Agri-Food Canada, the BC Ministry of Agriculture and the BC Agriculture Research and Development Corporation.[222] Under the EFP, a number of resources educate farmers and encourage best practices with respect to environmental stewardship.[223] Although these practices are voluntary, there is joint provincial-federal funding to help farmers address specific environmental risks, including riparian protection, grazing strategies, integrated pest management, run-off control and product and waste management.[224]

104. Some municipalities also have polices and initiatives to address agricultural issues.[225]

105. See also the commission's Technical Reports 3 (Exhibit 562) and 12 (Exhibit 735).

Impacts on water quality: Non-point source contaminants

106. A "contaminant" is a substance that can be detected and a "pollutant" is a contaminant that has been shown to have an adverse biological effect on the

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[222] Environmental Farm Planning, online: BC Ministry of Agriculture <http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/index.htm> and Growing Forward: The Canada-British Columbia Environmental Farm Plan Program, 2009-2013, available online at: http://www.ardcorp.ca/userfiles/file/efp/EFP_BMP%20Program.pdf [Growing Forward].

[223] See for example: Reference Guide: The Canada – British Columbia Environmental Farm Plan Program, available online at: http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/EFP_Refguide/Refguide_toc.htm [EFP Reference Guide]; Drainage Management Guide, available online at: http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/EFP_Drainage_Mgmt_Guide/Drainage_Mgmt_Guide_toc.htm; Grazing Management Guide, available online at: http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/EFP_Grazing_Mgmt_Guide/Grazing_Mgmt_Guide_toc.htm; and Riparian Management Field Workbook (not available online, but see the "Riparian Factsheet" on this published by the BC Ministry of Agriculture, available online at: http://www.agf.gov.bc.ca/resmgmt/publist/800Series/810210-0_Riparian_Mgmt_Field_Workbook_intro_factsheet.pdf).

[224] Growing Forward.

[225] See for example: Agriculture, online: Metro Vancouver <http://www.metrovancouver.org/PLANNING/DEVELOPMENT/AGRICULTURE/Pages/default.aspx>.

environment. All pollutants are contaminants, but not all contaminants are pollutants.

Contaminants generally

107. Contaminants in the Fraser River originate from both natural and anthropogenic sources, the latter of which is the focus of this PPR. Natural sources include weathering and erosion of terrestrial soils, bacterial decomposition of vegetation and animal matter and long-range transport of substances from natural combustion sources including wildfires.

108. Anthropogenic non-point source contaminants enter the environment through a number of sources including greywater, run-off from development, run-off from residential areas (e.g., lawn pesticides, fertilisers, petroleum products, biocides, fecal coliform bacteria, heavy metals, sediment, salts and organic detritus), run-off from agricultural operations (e.g., pesticides and fertilisers), run-off from forestry, run-off from railways, leachate from landfills, leachate from wood waste and stored logs and emissions from vehicles and industry. The latter includes the long-range transport of atmospheric chemicals. Most contaminants enter Fraser River sockeye habitat as a result of land-based activities whether through deliberate discharge, run-off or eventual atmospheric deposition.[226]

109. Run-off from roads and highways can have substantial effects on streams, especially in rural areas where the relative increase in magnitude and frequency of stream flooding due to run-off associated with the impervious surfaces is greater than in less developed areas.[227] In addition, road run-off contains a variety of contaminants from vehicle traffic which is transported to waterways.[228] This run-off is not well studied, but includes iron, zinc, lead, cadmium, nickel, copper, chromium, petroleum and de-icing salt (which may be contaminated by

[226] Ringtail Document CAN024648 at 9; Ringtail Document BCP000233 at 177.
[227] Ringtail Document CAN034908 at 5.
[228] Ringtail Document CAN034908 at 7.

metals and nutrients such as phosphorous, lead and zinc).[229] It also includes hydrocarbons.[230] The volume of contaminants in stream sediment may be positively correlated to traffic volume.[231] These contaminants may also be absorbed by neighbouring soils[232] and percolate into streams through groundwater.

110. Further, physical alterations to the natural landscape are often associated with the proliferation of impervious areas that result in decreases in the natural percolation and storage capacity of the watershed, which in turn can cause increased levels of contaminants and sediments to enter the Fraser River.[233] Both point-source and non-point source contaminants have synergetic effects on water quality.[234] However, changes in water quality are difficult to assess and to control due to the sheer size of the watershed, scope of the activities within and gaps in monitoring.[235]

111. There are two general classes of contaminants: Those that are persistent, bio-accumulating and toxic ("PBTs") and those that tend to be soluble and less persistent, but are still toxic.[236]

Persistent, bioaccumulative and toxic contaminants

112. Persistent bioaccumulative and toxic contaminants include many well-known chemicals such as dioxins, furans, polychlorinated biphenyls ("PCBs"), polybrominated diphenyl ethers ("PBDEs"), polycyclic aromatic hydrocarbons ("PAHs") and dichlorodiphenyltrichloroethane ("DDT").[237] These chemicals are fat-soluble meaning that they accumulate in fatty tissues and so readily

[229] Ringtail Document CAN034908 at 7.
[230] Cohen Commission Exhibit 833 at 37.
[231] Ringtail Document CAN034908 at 7.
[232] Ringtail Document CAN034908 at 7.
[233] Ringtail Document BCP000233 at 176-177.
[234] Ringtail Document BCP0000428 at 14.
[235] Ringtail Document BCP000233 at 176; Cohen Commission Exhibit 826 (Commission Technical Report 2).
[236] Ringtail Document CAN270107 at 1; Cohen Commission Exhibit 73 at 75.
[237] Ringtail Document BCP000221 at 126.

accumulate in aquatic food chains and can reach relatively high concentrations in fish.[238] Fish, including sockeye, do not easily metabolise PBTs and so they can "carry the risk" of these contaminants with them through their entire life cycle, but as sockeye migrate home from the sea they use their fat reserves so these chemicals can then be transferred to their reproductive tissues.[239] PBTs are subject to transport around the globe through the oceans and atmosphere and can be found in soil, vegetation and water.[240] Despite regulations at the national and international level and the fact that peak use of these chemicals occurred in the 1960s – 1970s, PBTs continue to cycle today because they resist chemical decomposition.[241]

Non-persistent contaminants

113. These kinds of contaminants are less persistent, less fat-soluble or do not move readily through the environment.[242] Thus, sockeye exposure to these contaminants may be fairly localised with usage or discharge and can affect fish at different developmental stages, but tend not to persist in the tissues of the fish.[243]

114. For more information on both point and non-point source contaminants, please see the commission's Technical Report 2 (Exhibit 826).

Contaminants and Fraser River sockeye

115. Contaminant effects can be lethal (i.e., result in an immediate fish kill), but more commonly the effects are sub-lethal and may cause sockeye to be more susceptible to disease, parasites and or predators.[244] Both lethal and non-lethal

[238] Cohen Commission Exhibit 73 at 75-76.
[239] Cohen Commission Exhibit 73 at 75.
[240] Ringtail Document CAN270107 at 1.
[241] Ringtail Documents CAN270107 at 1 and BCP000221 at 126; Cohen Commission Transcripts, May 10, 2011 at 39-40.
[242] Cohen Commission Exhibit 73 at 76.
[243] Cohen Commission Exhibit 73 at 76.
[244] Cohen Commission Exhibit 573 at 30; Cohen Commission Transcripts, May 10, 2011 at 60.

effects can be enhanced when fish are challenged by other environmental factors such as high temperatures, disease or nutritional stress.[245]

116. DFO has acknowledged that contaminants such as pesticides and other pollutants may potentially impact Fraser salmon.[246] There are many contaminants entering sockeye habitats[247] and exposure to contaminants can occur at any stage of the sockeye life cycle via digestion, gills, skin absorption or sensory exposure.[248] There are two types of impacts due to exposure to two general classes of contaminants:[249]

    a. Deferred "carry the risk" effects where sockeye are exposed either as eggs in their spawning habitat, smolts in freshwater, estuarine or coastal habitats or juveniles in coastal or oceanic habitat; and

    b. More immediate "gauntlet" effects, where sockeye are exposed as they transit from lake to ocean and back to lake.

117. With respect to sockeye, there are a number of recognised sub-lethal effects that could result in behavioural change which in turn could impact survival:[250]

    a. Neurotoxicity: Can involve temporary or permanent alteration of nerve or brain function. Migration is a genetically programmed form of behaviour involving the brain and nervous system and therefore nerve or brain function changes may affect migration behaviour.

    b. Olfactory effects: There is evidence that some contaminants impair salmonid olfaction.[251] Chemical imprinting may attract fish to spawning streams suggesting that olfaction is connected to migratory behaviour. Thus,

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[245] Cohen Commission Exhibit 73 at 75 and 77; Cohen Commission Transcripts, May 10, 2011 at 32 (ll. 8-22) and 59-60s.
[246] Ringtail Document CAN134842 at 2.
[247] Cohen Commission Exhibit 73 at 76.
[248] Cohen Commission Exhibit 833 at 16.
[249] Cohen Commission Exhibit 573 at 30.
[250] Cohen Commission Exhibit 833 at 14-16; Ringtail Document CAN247346 at 7-9.
[251] Tierney, K.B., Taylor, A.L., Ross, P.S. and Kennedy,C.J. 2006. The alarm reaction of coho salmon parr is impaired by the carbamate fungicide IPBC. Aquat. Toxicol. 79: 149-157; Tierney, K.B., Singh, C.R., Ross, P.S. and Kennedy, C.J. 2007. Relating olfactory neurotoxicity to altered olfactory-mediated behaviours in rainbow trout exposed to three currently-used pesticides. Aquat. Toxicol. 81:55-64, Tierney, K.B., Ross, P.S. and Kennedy, C.J. 2007. Linuron and carbaryl differentially impair baseline amino acid and bile salt olfactory responses in three salmonids. Toxicology 231: 175-187 and Tierney, K.B., Sampson, J.L., Ross, P.S., Sekela, M.A. and Kennedy, C.J. 2008. Salmon olfaction is impaired by an environmentally realistic pesticide mixture. Environmental Science & Technology 42: 4996-5001.

contaminants might cause behavioural changes in sockeye such as erroneous homing behaviour.[252]

c. Endocrine disruption: The endocrine system is involved in the coordination of a wide variety of physiological functions including development, growth, reproduction, chemical balance (in particular, osmoregulation) and chemical messaging. Disruptions to this system can thus affect behaviour and the timing and extent of changes in the body. Also of concern is the disruption of sexual development, feminization and masculinisation of fish. For example:

   i. Dioxins, furans and PCBs have been shown to lead to feminization of lake trout in Ontario;[253]

   ii. An aminocarb (4-nonylphenol adjuvant) has been shown to impair smoltification and osmoregulation in Atlantic salmon;[254] and

   iii. decaBDE (or "BDE-209) has been reported to result in some physiological or morphological effects.[255]

d. Immunosuppression: Exposure to toxic contaminants can reduce the effectiveness of an organism's immune system and thus salmon may become more susceptible to disease and parasites.[256]

e. Developmental effects: Aquatic organisms may be more susceptible to some of the aforementioned effects in their early life stages. Persistent and bio-accumulative contaminants may be passed from mother to egg and the resulting developmental impairments may result in present or future behavioural anomalies.

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[252] Scholz, N.L., Truelove, N.K., French, B.L., Berejikian, B.A., Quinn, T.P., Casillas, E. and Collier, T.K. 2000. Diazinon disrupts antipredator and homing behaviors in Chinook salmon (*Oncorhyncus tshawytscha*). Can. J. Fish. Aquat. Sci. 57: 1911-1918.

[253] Cook, P.M., Robbins, J., Endicott, D.D., Lodge, K.B., Guiney, P.D., Walker, M.K., Zabel, E.W. and Peterson, R. 2003. Effects of aryl hydrocarbon receptor-mediated early life stage toxicity on lake trout populations in Lake Ontario during the 20th century. Environ. Sci. Technol. 37: 3864-3877.

[254] Arsenault, J.T.M., Fairchild, W.L., MacLatchy, D.L., Burridge, L., Haya, K. and Brown, S.B. 2004. Effects of water-borne 4 nonylphenol and 17~-estradiol exposures during parr-smolt transformation on growth and plasma IGF-I of Atlantic salmon (*Salmo salar L*.). Aquat. Toxicol. 66:255-265 (available online at: http://www.gulfofmaine.org/kb/files/8930/ArsenaultEtAl04.pdf); and Fairchild, W.L., Swansburg, E.O., Arsenault, J.T. and Brown, S.B. 1999. Does an association between pesticide use and subsequent declines in catch of Atlantic salmon (Salmo salar) represent a case of endocrine disruption? Environ. Health Perspect.107: 349-358 (available online at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1566411/pdf/envhper00510-0059.pdf).

[255] Ringtail Document CAN010704 at 7.

[256] Arkoosh, M.R., Casillas, E., Clemons, E., Kagley, A.N., Olson, R., Reno, P. and Stein, J.E. 1998. Effect of pollution on fish diseases: potential impacts on salmonid populations. J. Aquat. Anim. Health 10: 182-190 and Collier, T., Arkoosh, E., Casillas, E., Myers, M., Stehr, C., Meador, J. and Stein, J. 2000. Impaired health of juvenile Pacific salmon migrating through contaminated estuaries. Mar. Environ. Res. 50: 468 (available online at: http://oregonstate.edu/dept/microbiology/publications/Arkoosh%20et%20al%5B1%5D.pdf).

118. Studies have shown that the transport of PBTs through anadromous fish may be more important than the transfer through the atmosphere.[257] Contaminant research also shows that Pacific salmon accumulating persistent pollutants in their ocean life-stage transport these contaminants into spawning and lake environments.[258]

119. Metals such as arsenic, chromium, copper, aluminum have been shown to cause mortalities or sub-lethal effects in salmonids.[259] For a more extensive of metals that may impact Fraser sockeye, see the commission's Technical Report 2.[260]

120. At the Pacific Salmon Commission (the "PSC")'s workshop on the Decline of Fraser River Sockeye Salmon in June 2010 (the "PSC Workshop"), the expert advisory panel concluded that the relative likelihood of contaminants in the Fraser River causing the 2009 decline was possible, but unlikely or very unlikely.[261] In terms of the long term trend in declining productivity, the expert advisory panel considered Fraser River contaminants and habitat conditions an unlikely or very unlikely contributor to the decline.[262] However, limited site-specific data on contaminants and the often complex nature of environmental toxicological processes means that any conclusion about the role of contaminants is highly uncertain.[263] The DFO Science contaminant researchers who participated in the PSC Workshop concluded that it was plausible that contaminants were a secondary contributor to reduced productivity of Fraser sockeye, but that direct evidence is lacking and further, that the monitoring or assessment studies to assess any impacts are lacking.[264] However, these

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[257] Ringtail Document CAN024695 at 1.
[258] Ringtail Document CAN024922 at 102.
[259] Ringtail Document CAN261042.
[260] Cohen Commission Exhibit 826 at 71-72.
[261] Cohen Commission Exhibit 73 at 9.
[262] Cohen Commission Exhibit 73 at 9.
[263] Cohen Commission Exhibit 73 at 77. See also Cohen Commission Exhibit 826 (Commission Technical Report 2).
[264] Cohen Commission Exhibit 73 at 77. See also Cohen Commission Transcripts, May 10, 2011 at 36-37 and 70 (ll. 17-26).

researchers noted that chemicals are likely to fall into the category of sockeye stressors that we can actually control.[265]

Regulation of non-point source contaminants that could affect Fraser sockeye

Legislation

121. Section 36 of the Fisheries Act prohibits the deposition of deleterious substances in waters frequented by fish or where deleterious substances may enter such water. The commission's Habitat Enforcement PPR describes DFO's responsibilities with respect to enforcing ss. 35 and 36 of the Fisheries Act. It also provides a summary of the delegation of the administrative responsibility for s. 36 to EC, through a 1978 prime ministerial directive (the "1978 Directive"), a 1985 EC-DFO Memorandum of Understanding (the "1985 MOU")[266] and a 1987 Regional Working Agreement (the "RWA").[267]

122. The Canadian Environmental Protection Act, 1999, S.C. 1999, c. 33 ("*CEPA*"), s. 44(1) directs the Minister of EC in part to:

> (a) establish, operate and maintain a system for monitoring environmental quality;
>
> (b) conduct research and studies relating to pollution prevention, the nature, transportation, dispersion, effects, control and abatement of pollution and the effects of pollution on environmental quality, and provide advisory and technical services and information related to that research and those studies;
>
> (c) conduct research and studies relating to
>
> (i) environmental contamination arising from disturbances of ecosystems by human activity,
>
> (ii) changes in the normal geochemical cycling of toxic substances that are naturally present in the environment, and
>
> (iii) detection and damage to ecosystems;

[265] Cohen Commission Exhibit 73 at 76.
[266] Cohen Commission Exhibit 689.
[267] Cohen Commission Exhibit 690. See also Ringtail Document CAN394661.

123. Environment Canada also regulates the use of contaminants in Canada pursuant to *CEPA*. Part 5 of *CEPA* requires the Minister of the Environment and the Minister of Health to conduct assessments of substances that meet the categorisation criteria set out in *CEPA* and its regulations to determine whether substances present or may present a risk to the environment or human health. Based on the results of a screening assessment, the Ministers can propose to take no further action, add the substance to the Priority Substance List for further assessment or recommend that it be added to Schedule 1 of *CEPA* as a Toxic Substance.[268] A substance may also be designated as a Schedule 1 Toxic Substance through a Priority Substance List assessment[269] or if, on the recommendation of the Ministers of Environment and Health, the Governor in Council is satisfied that a substance is toxic.[270] Once designated as toxic, the Governor in Council may, on the recommendations of the Ministers, make regulations regarding a substance.[271] Further, anthropogenic substances determined to be toxic, persistent and bioaccumulative shall be proposed by the Ministers for implementation of virtual elimination under s. 65(3).[272]

124. Applicable provincial regulation of activities that may result in non-point source contaminants entering the Fraser watershed are discussed under the various sections below.

DFO's responsibilities

125. According to DFO, based on s. 36, the 1978 Directive, the 1985 MOU and s. 44 of *CEPA*, EC has the mandate for all point and non-point source contaminant-related monitoring, research, regulation and enforcement[273] and DFO is

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[268] *CEPA*, s. 77(2).
[269] *CEPA*, s. 77(2).
[270] *CEPA*, s. 90(1).
[271] *CEPA*, s. 93(1).
[272] *CEPA*, ss. 65(3) and 77(4).
[273] Ringtail Documents CAN014253, CAN394661 and CAN394670; Memo from Mitch Bloom to Claire Dansereau, Administration and Enforcement of the Pollution Prevention Provisions of the *Fisheries Act* (Section 36), dated

otherwise responsible for the management and protection of the fisheries resource and its habitat.[274] DFO does not do environmental water quality or effects monitoring.[275] In 2004 DFO disbanded its Water Quality Unit, which used to provide advice to EC on fish presence, fish habitat and receiving water quality of fish habitat (e.g. what is the water quality required to support fish life cycles).[276] As a result, since 2004/05, DFO has only provided advice to EC on fish presence and physical habitat. Although the intention on DFO's part appears to be that EC would take up the water quality work no longer being done by DFO, EC's response in 2004 was that EC did not have the capacity to fully absorb the water quality work previously done by DFO.[277]

126. In terms of environmental science, in 2004, DFO Science had 70-80 people across Canada working on toxic chemical issues such as the impacts of contaminants on fish and fish habitat.[278] As part of the 2003/04 Departmental Assessment and Alignment Project and Treasury Board's 2005 Expenditure Review Committee direction to the Department to cut its budget, DFO Science carried out a review of its toxic chemicals research and reduced the scope of its work on toxic chemicals by 25 FTEs.[279] The effect was to dissolve the Toxic Chemicals Program, refocus the remaining toxic chemicals research on biological impacts on fish and fish habitat (i.e., toxicology), create Labs of Expertise (national labs, each with a specific focus), cease research on identifying contaminant transport pathways, cease any environmental monitoring and cancel the Environmental Science Strategic Research Fund ("ESSRF") that was dedicated to funding DFO environmental science research. Instead, ESSRF

December 23, 2010 (not yet available in Ringtail at the publication date of this Policy and Practice Report, but the commission has requested production by the Department of Justice through Ringtail).

[274] Ringtail Document CAN157797 at 6.

[275] Ringtail Document CAN394661 at 4.

[276] Ringtail Documents CAN394647, CAN157796, CAN353797 and CAN014253 at 5.

[277] Ringtail Documents CAN394647 and CAN353797.

[278] Ringtail Document CAN014253 at 6.

[279] Ringtail Documents CAN014253 at 6, CAN194774, CAN245139, CAN394664 and CAN394637; Draft Briefing Note, Background on Contaminant Research at DFO, no date [Draft Contaminant Research BN] at 2 (not yet available in Ringtail at the publication date of this Policy and Practice Report, but the commission has requested production by the Department of Justice through Ringtail).

monies were rolled in with funding for all Science sector research. Under this new regime for contaminants research, DFO toxic chemicals researchers are supposed to fund their work from other DFO sectors, other government departments and non-government sources. Although there is no longer a dedicated funding envelope for environmental science, the Regions can fund priority toxic work. It should also be noted that there is a significant amount of DFO Science research funding allocated to Pacific salmon, which remains a potential source of funding for contaminant research relevant to Fraser sockeye.

127. Despite the above, under the RWA, DFO is responsible for providing various forms of technical advice to EC such as providing fisheries resource and fish habitat experience, recommending receiving water quality criteria (which was prior to 2004, done through DFO's Water Quality Unit), developing and recommending criteria to protect fish habitat, conducting scientific research on fish toxicology and the effects of pollutants on specific biological processes, organisms, populations and communities, conducting resource-oriented monitoring and surveillance programs and conducting investigative programs related to the impacts of effluents or pollutants on fish and fish habitat.[280] Section 2.5 of the RWA also states that DFO will conduct fishery resource-oriented monitoring and surveillance programs when EC is unable to do this work.

128. Under DFO's 1986 Habitat Policy, a number of water quality roles and responsibilities are assigned to DFO:[281]

    a. Cooperate with EC in the establishment of federal priorities for the protection of fish and their habitats from deleterious substances (s. 2.1);

    b. Cooperate with EC in the use of powers to control the release of deleterious substances into fish habitats (s. 2.2);

[280] Cohen Commission Exhibit 690, s. 2.1; Ringtail Documents CAN157797 at 8 and CAN014253 at 3-4.
[281] Ringtail Documents CAN021794 and CAN014253 at 4.

c. Cooperate with other government departments in the control of ocean pollution and the chemical contamination of fish and fish habitat; provide criteria for fisheries protection (s. 2.2);

d. Collaborate with EC and others to provide advice and specific requirements to control adverse effects, including those from liquid effluent discharges and non-point sources of chemical pollutants such as pesticides, and other environmental contaminants (s. 4.1);

e. Work closely with EC to control effluent discharges and maintain receiving water quality for the fisheries resource, and in collaboration, identify fisheries protection requirements (s 4.1);

f. Investigate fish kills, frequently in collaboration with EC, and ensure action is taken to initiate mitigative measures and eliminate the source of the problem; prosecute alleged violators (section 4.1);

g. Coordinate on enforcement of s 36(3) violations (s 4.1);

h. Direct intervention where there is an immediate threat to fisheries and no other agency has initiated action; use prohibition powers to stop discharges and arrange for clean up; lay charges if the evidence warrants (s. 4.1);

i. Assess effects of human-induced chemical, physical and biological changes on fisheries resources and the habitats that support them (s. 4.3);

j. Cooperate on habitat-related research programs, including those on chemical or biological contamination problems (s. 4.3);

k. Conduct studies to detect chemical hazard problems and to determine baseline conditions and trends (s. 4.8);

l. Deal with chemical contamination of fish habitat and fisheries resources (s. 4.8);

m. Consult with EC on that agency's s. 36 compliance monitoring plans (s. 4.8);

n. In assessing developments, examine implications including assessment of information on physico-chemical properties of suspect chemicals and by-products, toxicity, pathology to fish, and routes and rates of entry into the natural environment; and

o. For major projects, assess proponents' information on chemical compounds involved, and fish habitat likely to be affected, and if necessary, carry out site visits and studies to complete assessments (s. 5.2).

EC's responsibilities

129. EC has primary responsibility for pollution prevention and control of point-source discharges related to s. 36. This includes development of regulations, policies, programs and plans such as enforcement and compliance policies and environmental effects monitoring ("EEM") required for certain industries under the *Fisheries Act* (e.g., pulp and paper and metal mining).[282] It also embraces enforcement of s. 36 and its regulations and emergency response.[283] EC does do water quality assessment, but it is very case specific (for example in relation to an environmental assessment under *CEAA* or EEM). EC also works with the Province on the provincial freshwater Water Quality Monitoring Network (which measures basic parameters such as temperature, flow, suspended solids and some contaminants). EC does not do any marine water quality monitoring and it has not taken over the freshwater and marine work previously done by DFO's Water Quality Unit.

130. Further, around 2006/07, there was a change in EC's governance structure to focus on delivery of *CEPA*, which resulted in non-enforcement s. 36 activities such as compliance promotion and scientific advice to support related activities no longer having any annual budget outside of a few specific programs like the Federal Contaminated Sites Action Plan.

Water Quality Objectives

131. The Province publishes Water Quality Objectives, which are physical, chemical or biological characteristics of water, biota or sediment that are intended to protect the most sensitive designated water uses.[284] These objectives are not legally required to be met by industry or government.[285]

Gaps in federal government responsibilities/mandates

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[282] Ringtail Document CAN394661 at 5.
[283] Ringtail Document CAN394661 at 5.
[284] See e.g.: Ringtail Documents BCP001396 and BCP001374. See also: Water Quality, online: Environmental Protection Division <http://www.env.gov.bc.ca/wat/wq/BCguidelines/principles.html> [Water Quality Objectives].
[285] Water Quality Objectives.

132. Despite its interpretation by both departments, the 1985 MOU does not identify the roles and responsibilities of each department to do research and scientific studies and develop policies, programs and regulations in relation to s. 36. As noted by one DFO consultant and the Commissioner for the Environment and Sustainable Development, this has resulted in a lack of accountability and transparency around some aspects of the administration of s. 36.[286]

133. Additionally, according to some of its Science staff, DFO's change in mandate regarding its toxic chemicals research work appears to have left a gap (or "grey zone") in terms of monitoring, research and science advice on water quality and non-point source contaminants, including complex mixtures, particularly in the marine environment.[287] Moreover, DFO's disbanding of its Water Quality Unit has left EC without advice on receiving water quality levels for fish such as Pacific salmon.

134. DFO staff have also voiced concerns about whether EC should be solely responsible for the regulation of, and research to support, regulation of point-source contaminants because of a perceived lack of marine expertise and capacity at EC to handle all point-source discharges.[288]

135. Finally, non-enforcement s. 36-work such as compliance monitoring appears to have been reduced since the ~2006/07 EC organisational change.

Provision of DFO Science advice/expertise on non-point source contaminants to government regulators

136. The 1985 MOU directs EC and DFO in their Regions to hold their senior managers responsible for communicating on matters of substance and concern to each other related to s. 36, including requirements for scientific criteria on

[286] Ringtail Document CAN394661 at 14 and Cohen Commission Exhibit 35 (CESD Spring 2009 Report).
[287] Ringtail Documents CAN124913 at 1 and CAN134834 at 1; Draft Contaminants Research BN at 2.
[288] Ringtail Document CAN136962 at 2.

which protection action and regulations may be based.[289] Similarly, under the RWA, DFO and EC are supposed to meet to discuss proposed field and laboratory research studies, monitoring and surveillance proposals, investigative or assessment projects and other programs.[290] DFO is also supposed to provide advice to EC on pollution control strategies.[291]

137. However, senior DFO and EC managers have noted the lack of a formal mechanism through which DFO Science can provide advice to EC regulators and have said that it would be beneficial to have such a process.[292] There is the Canadian Science Advisory Secretariat process, but in at least one case where DFO contaminant researchers tried to provide advice to EC regulators regarding scientific concerns about the emergence of a new persistent organic pollutant and the risk to fish and marine mammals, the CSAS process appeared to be ineffective.[293] Moreover, the CSAS process may not be the most efficient way of providing timely science advice to EC regulators as this process generally requires a request originating from managers to DFO Science before work is initiated.

138. DFO Science has an agreement and funding to work with Health Canada's Pest Management Regulatory Agency ("PMRA") to provide scientific research and advice to support PMRA's regulation of pesticides.[294] DFO and PMRA meet annually to identify priorities for research.[295] DFO Scientists may also

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[289] Cohen Commission Exhibit 689, s. 2.
[290] Cohen Commission Exhibit 690, s. 1.5.
[291] Cohen Commission Exhibit 690, s. 2.1.
[292] Ringtail Document CAN322482.
[293] Ringtail Document CAN322469 at 2.
[294] Ringtail Document CAN124913 at 1; Draft Contaminant Research BN at 2; Memorandum of Understanding on Research and Scientific Advice Between Fisheries and Oceans Canada and the Pest Management Regulatory Agency, Health Canada, March 26, 2001 (available online at: http://www.hc-sc.gc.ca/cps-spc/alt_formats/pacrb-dgapcr/pdf/legislation/acts-lois/pest/mou-dfo-mpo-entente-eng.pdf).
[295] 2010-11 DFO Pesticide Planning Workshop minutes, March 16, 2010 (not yet available in Ringtail at the publication date of this Policy and Practice Report, but the commission has requested production by the Department of Justice through Ringtail).

sometimes be asked for *ad hoc* advice on PMRA assessments of certain pesticides.[296]

139. There is no working relationship whereby DFO Science can provide science and research advice to the Integrated Pest Management Unit in the provincial Ministry of Environment.

Pesticides[297]

140. The broad application of pesticides to crops, lawns and forests results in mostly non-point source pollution in the form of run-off. Pesticides can also get into surface waters from over-spraying, erosion of contaminated soils and from contaminated groundwater.[298] Typically, pesticide exposures are sub-lethal to wild salmon.[299] As little as four days of exposure to organophosphate and carbamate classes of insecticides, which are widely detected in aquatic environments, may reduce the growth of and size at ocean entry for Chinook salmon.[300]

141. Active ingredients in a pesticide are the ingredients that have the pesticidal properties. However, inert ingredients (also called adjuvants) are chemicals added to an active ingredient to enhance the product, for example, by improving

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[296] Ringtail Document CAN124937; Answers to Questions posed by Cohen Commission Counsel Prepared by the Pest Management Advisory Agency, May 6, 2011 (not yet available in Ringtail at the publication date of this Policy and Practice Report, but the commission has requested production by the Department of Justice through Ringtail).
[297] According to the *Pest Control Management Act*, S.C. 2002, c. 28, s. 2, a pest control product (i.e. pesticide) means: (a) a product, an organism or a substance, including a product, an organism or a substance derived through biotechnology, that consists of its active ingredient, formulants and contaminants, and that is manufactured, represented, distributed or used as a means for directly or indirectly controlling, destroying, attracting or repelling a pest or for mitigating or preventing its injurious, noxious or troublesome effects; (b) an active ingredient that is used to manufacture anything described in paragraph (a); or (c) any other thing that is prescribed to be a pest control product.
[298] Cohen Commission Exhibit 833 at 49.
[299] Baldwin, D.H, Spromberg, J.A., Collier, T.K. and Scholz, N.L.. 2009. A Fish of Many Scales: Extrapolating Sublethal Pesticide Exposures to the Productivity of Wild Salmon Populations. *Ecological Applications*, 19(8): 2004-2015 at 2004 [Baldwin] (available online at: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/exhibits/sfwc/spprt_docs/sfwc_exh3_baldwin.pdf).
[300] Baldwin at 1.

the performance, helping the application, improving the solubility, allowing the pesticide to spread over a surface or stick to leaves and soil, improve the absorbability of the pesticide by the target species or increase the product's shelf life.[301] Inert ingredients are considered part of the trade secret formulation of a pesticide and so do not have to be reported even if they are highly toxic.[302] For example, emulsions used to mix with pesticides are known to disrupt endocrine systems and may in fact be more toxic than the pesticides themselves.[303]

142. In the last five years, there have been a number of studies by DFO scientists that have looked at pesticides and their effect on Pacific salmon. For a non-exhaustive list of these studies see:

a. DFO, E-mail, November 19, 2008, Re: Issues Management – Effect of Pesticide Spraying on Pacific Salmon (Ringtail Document CAN124913); and

b. Peter Ross c*urriculum vitae* (Ringtail Document CAN305096).

143. All pesticides imported into, sold or used in Canada are regulated federally under the *Pest Control Products Act*, S.C. 2002, c. 28 (the "*PCPA*") and regulations, which is administered by Health Canada's PMRA. PMRA is responsible for administering the *PCPA*, registering pest control products, re-evaluating registered products and setting maximum residue limits under the *Food and Drugs Act*, R.S.C. 1985, c. F-27.[304] According to PMRA:[305]

> Companies that wish to have the right to sell a pest control product in Canada must submit detailed information and data to be evaluated by the PMRA. Companies must provide all the scientific studies necessary for determining that the product is acceptable in terms of safety, merit and value. Depending on the complexity of the submission, a complete evaluation can take anywhere from a number of weeks, to a year or more. The evaluation results either in

[301] Cohen Commission Exhibit 833 at 59.
[302] Cohen Commission Exhibit 833 at 59.
[303] Ringtail Document CAN265358 at 3; Cohen Commission Exhibit 833 at 59.
[304] The Regulation of Pesticides in Canada, online: Health Canada < http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_fact-fiche/reg-pesticide/index-eng.php> [The Regulation of Pesticides].
[305] The Regulation of Pesticides.

the product being granted registration and allowed for sale and use in Canada, or in the product being refused registration.

144. The Province regulates the transportation, sale, use, storage and disposal of pesticides as well as the certification and licensing of applicators and vendors.[306] BC is also responsible for ensuring compliance with PMRA labelling. The provincial Ministry of the Environment's Environmental Protection program implements the Integrated Pest Management program and administers the *Integrated Pest Management Act*, S.B.C. 2003, c. 58 (the "*IPMA*") and regulations. The main function of the Integrated Pest Management program is to protect the quality of BC's water, land, air, living/working spaces and human health in a way that contributes to the sustainability of the Province's resources and economy.[307]

145. Depending on the use and the user, there are three types of pesticide authorisations: Licenses, confirmations and permits. Any person or entity applying pesticides on a fee-for-service basis (e.g., a pest control company) is required to have a pesticide license. In addition, the use of certain restricted pesticide products requires the licensee to have a certificate. Pesticide vendors are required to have a license.[308] Pesticide use on private property by the owner or someone who is not acting on a fee-for-service basis (e.g., an employee or volunteer) does not require a license.[309] The applicator may need a certificate if using a restricted product, however.

146. Pesticide confirmations are required by any person or entity who applies pesticides to areas over certain threshold sizes.[310] Pesticide use permits are

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[306] See the BC *Integrated Pest Management Act*, S.B.C. 2003, c. 58.
[307] Draft Position Description, Section Head, Integrated Pest Management, Environmental Protection, Regional Operations, Ministry of Environment (not yet available in Ringtail at the publication date of this Policy and Practice Report, but the commission has requested production by the Province through Ringtail).
[308] *IPMA*, s. 4.
[309] *IPMA*, s. 4 and *Integrated Pest Management Regulation*, B.C. Reg. 604/2004 [*IPMR*], ss. 5-6.
[310] *IPMA*, s. 7 and *IPMR*, Division 5, in particular s. 24.

authorisations for pesticide use for which there are no regulatory standards.[311] These permits are relatively rare, typically numbering around 3-5 per year for the entire Province.

147. The effect of the *IPMA* is that pesticide application to residential properties and in the agricultural sector is generally not regulated by the Province (unless the use falls into a permit or confirmation-requiring category).

148. Some municipalities have bylaws relating to municipal and private/residential use of pesticides.[312]

149. Comprehensive information on the quantities and types of pesticides used in different areas of BC is not kept by the Province. Information regarding pesticide application to residential properties and the agricultural sector is not collected, nor is it required to be kept by the applicator. Annual summaries of the amount of pesticide used by license, confirmation and permit holders are collected, but do not necessarily have site-specific pesticide information.[313] Proponents keep more detailed records that must be produced to an Integrated Pest Management Inspector upon request.[314] Also, pesticide vendors in BC have to keep a record of their sales.[315]

Atmospheric pollution

150. Atmospheric pollution is mostly from vehicle, agricultural and industrial emissions and long-range transport from distant sources.[316] Vehicular emissions include metals and a number of contaminants such as PAHs.[317] Agricultural emissions include chemicals from fertilizers, such as ammonia, as well as pesticides which

[311] For example, municipal or regional district Gypsy Moth spraying programs require pesticide use permits. *IPMA*, s. 6 and *IPMR*, Division 4, in particular s. 18.
[312] The Regulation of Pesticides.
[313] *IPMR*, s. 39.
[314] *IPMA*, s. 17 and *IPMR*, ss. 35-37.
[315] *IPMR*, s. 34.
[316] Cohen Commission Exhibit 833 at 39.
[317] Cohen Commission Exhibit 833 at 39.

can be removed from the air by precipitation, which then make their way into the Fraser River.[318]

151. Long Range Transport pollutants are fine particles that are blown through the atmosphere, carried by ocean currents or by organisms moving through the oceans.[319] A large number of chemicals can be transported atmospherically across the globe in a fairly short time and the prevailing winds across the Pacific Ocean have been found to bring contaminants from Asia to North America within a matter of days.[320] Long-range transport of atmospheric pollutants causes chemicals such as POPs and PCBs to continue to be deposited in BC, even though they are banned in North America.[321]

152. In 1979, Canada signed the Long Range Transport of Air Pollutants Treaty, which motivated research and subsequent agreements to reduce toxic emissions including PCBs.[322] In 2001, Canada ratified the Stockholm Convention on Persistent Organic Pollutants.[323] The objective of this international agreement is to protect human health and the environment from persistent organic pollutants by restricting and ultimately eliminating their production, use, trade, release and storage.[324] These persistent organic pollutants include PCBs, dioxins and DDT.[325]

Greywater

[318] Cohen Commission Exhibit 833 at 39; Ringtail Document CAN024922 at 100-101.
[319] Ringtail Document CAN024922 at 100.
[320] Cohen Commission Exhibit 833 at 39.
[321] Cohen Commission Exhibit 833 at 39; Ringtail Document BCP000221 at 164.
[322] Ringtail Document CAN216306 at 7.
[323] Ringtail Document BCP000221 at 164.
[324] Stockholm Convention Factsheet at 1, available online at: http://chm.pops.int/Convention/Media/Factsheets/tabid/527/language/en-US/Default.aspx.
[325] Ringtail Document BCP000221 at 164.

153. Greywater is wastewater originating from showers, baths, bathroom sinks, kitchen sinks, pools, spas and laundry.[326] Greywater gets into the environment through municipal wastewater systems, septic systems and through discharge from vessels. It can contain nutrients, bacteria, viruses and a variety of chemicals, including endocrine disruptors associated with detergents and personal care products.[327] According to the Province, the cumulative effects of multiple vessels discharging greywater may result in the long-term disruption of natural nutrient levels and subsequent impacts on the natural ecology of a water body like Shuswap Lake.[328]

154. Federally, greywater is not considered to be garbage or sewage and is not covered by the *Canada Shipping Act*, *2001*, S.C. 2001, c. 26, *Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals*, SOR/2007-86 (the "*Shipping Pollution Regulations*") as long as it does not contain a pollutant prescribed in the *Shipping Pollution Regulations*.[329] However, in some circumstances the general prohibition on discharges of deleterious substances set out in s. 36 of the *Fisheries Act* could apply.

155. The provincial Ministry of the Environment regulates greywater discharges under the authority of the *Environmental Management Act*, S.B.C. 2003, c. 53 (the "*EMA*"). Section 13 prohibits a person from discharging "domestic sewage" or waste from trailers, campers, transportable housing units, boats or house boats onto land or into any reservoir, lake, pond, stream or other natural water body

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[326] Shuswap/Mara Lakes Greywater Discharge Q & A, available online at: http://www.env.gov.bc.ca/wat/wq/shuswap/greywaterqa.pdf [Greywater Q & A] at 1 and Transport Canada, *Canada Shipping Act, 2001* (CSA 2001) Regulatory Reform Project: Public Consultation, Spring 2008, available online at: http://www.tc.gc.ca/media/documents/quebec-eng/regulatory%20reform%20project%20csa%202001.pdf at 5.

[327] Greywater Q & A at 1.

[328] Greywater Q & A at 1.

[329] *Canada Shipping Act, 2001*, ss. 187 and 190(1) and *Shipping Pollution Regulations*, s. 4 and Schedule 1. Note: According to the Province, Transport Canada recently advised BC that it is working on a regulatory approach for greywater discharge from small vessels that would be similar to sewage discharge and the provincial Ministry of the Environment is working with Transport Canada to meet the goal of developing a draft regulation by sometime in 2011-2012 (Greywater Q & A at 2).

except in compliance with a permit, approval, order, waste management plan or *EMA* regulation or if disposal facilities are provided. Domestic sewage in the *EMA*'s *Municipal Sewage Regulation*, B.C. Reg. 129/99 ("*MSR*") includes greywater.[330]

156. In the Shuswap, the increase in rental boats has increased the amount of greywater entering the lake.[331] Shuswap Lake has the highest houseboat numbers on an inland water body in BC and most greywater from these boats is discharged directly into Shuswap Lake.[332] In 2007, MOE committed to a three-year compliance strategy focused on greywater discharges from boats on Shuswap Lake, but acknowledges that it has deferred full enforcement of greywater discharges in the area.[333] As of July 28, 2010, no authorisation, compliance and or enforcement action in relation to the discharge of greywater from watercraft in the Shuswap Lakes had been undertaken by the Province using the *EMA*.[334]

157. In an attempt to address the greywater issue for Shuswap and Mara Lakes, the Shuswap Lake Integrated Planning Process has the elimination of boat discharge on the lakes as one of its strategies.[335] SLIPP also recommended eliminating all private and commercial watercraft discharge on the Shuswap lakes by 2010.[336] To support and facilitate agency decisions on greywater management, SLIPP funded a review of the potential for on-board treatment of greywater to protect water quality in Shuswap Lake. This report was released in July 2010.[337] According to the Province, the Columbia Shuswap Regional District (the "CSRD") has made a commitment to provide access to greywater treatment facilities and

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[330] *MSR*, s. 1.
[331] Ringtail Document CAN002581 at 69.
[332] Ringtail Document BCP008260 at 2.
[333] Greywater Q & A at 3.
[334] Ringtail Document BCP008260 at 42.
[335] Ringtail Documents BCP000532 at 2 and BCP8260 at 13-14.
[336] Ringtail Document BCP008260 at 14.
[337] Ringtail Document BCP008260 at 15.

the CSRD and SLIPP are working with the houseboat industry, the public and other levels of government to find solutions to the greywater discharge issue.[338]

158. Discharges from municipal wastewater systems in relation to Fraser River sockeye are intended to be addressed during hearings on municipal wastewater and will be the subject of another commission PPR.

Agricultural run-off

159. Fifty-two percent of all fertilisers used in the Fraser Basin in 1986 were applied in the Lower Fraser Basin.[339] Use of fertilisers is compounded by increased livestock densities which increase natural fertiliser nitrate and phosphate loading.[340] Run-off from this natural fertiliser can also be laced with chemicals and hormones deriving from animal feed made to augment growth and development.[341] Fertiliser run-off can cause the loss of aquatic plants, lowered oxygen levels, changes in local phytoplankton community structure and increased biochemical oxygen demand in sediments.[342] Biosolids are also used in the Fraser River Basin as fertiliser and run-off from these application sites is a potential source of municipal wastewater chemicals in the Fraser watershed.[343]

160. The potential impacts and regulation of pesticides, which includes pesticides arising from agricultural run-off or spraying are discussed above (see "Pesticides" section, above). In 1986, 90% of all insecticides and 56% of all herbicides used for agriculture in BC were applied in the Lower Fraser sub-basin.[344]

161. As with any other private or commercial activity, if work is done on agricultural land that results in the harmful alteration, disruption or destruction of fish habitat

[338] Greywater Q & A at 5.
[339] Cohen Commission Exhibit 833 at 38.
[340] Cohen Commission Exhibit 833 at 38.
[341] Cohen Commission Exhibit 833 at 38.
[342] Ringtail Document CAN024919 at 15.
[343] Cohen Commission Exhibit 826 (Commission Technical Report 2) at 106-107; Cohen Commission Exhibit 833 at 27-28.
[344] Cohen Commission Exhibit 833 at 38.

or there is a deposit of a deleterious substance into water frequented by fish, then the general prohibitions set out in ss. 35 and 36 of the *Fisheries Act* apply. However, agricultural run-off that could affect Fraser sockeye habitat is primarily regulated by the provincial *EMA* and its *Agricultural Waste Control Regulation*, B.C. Reg. 131/92 and the attached *Code of Agricultural Practice for Waste Management* (the "*Code*"). Section 6 of the *EMA* prohibits a person from introducing or causing or allowing waste to be introduced into the environment in the course of conducting a prescribed industry, trade or business.[345] There is also a prohibition on introducing (or causing or allowing) waste from a prescribed activity or operation to be introduced into the environment.[346] Further, a person must not introduce waste into the environment in such a manner or quantity as to cause pollution.[347] Agriculture is a prescribed industry under the *EMA*. The *EMA* allows the disposition of waste, however, in compliance with the act and a valid permit, approval or order, regulation or waste management plan.[348] Sections 3, 14 and 30 of the *Code* in particular have requirements for the prevention of run-off.

162. The Canada – British Columbia Environmental Farm Plan Program has a number of resources to educate farmers and encourage best practices with respect to environmental stewardship.[349] Although these practices are voluntary, there is provincial-federal funding to help farmers address specific run-off risks, including integrated pest management, run-off control and product and waste management.[350]

163. For more, although somewhat dated, information on agricultural run-off in BC as it relates to salmon-rearing habitats, please see: Brown, T.G., Floodplains,

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[345] *EMA*, s. 6(2).
[346] *EMA*, s. 6(3).
[347] *EMA*, s. 6(4).
[348] *EMA*, s. 6(5).
[349] See for example: EFP Reference Guide, Drainage Management Guide and Riparian Management Field Workbook.
[350] Growing Forward.

flooding, and salmon rearing habitats in British Columbia: A review, PSARC Working Paper H2002-11 (Ringtail Document CAN022148).

164. For a review of agriculture as a non-point source of pollution see: Schreier, H. Hall, K.J., Brown, S.J., Wernick, B., Berka, C., Belzer, W. and Petit, K. 1998, Chapter 4.7, Agriculture: An Important Non-Point Source of Pollution, In: Health of the Fraser River Aquatic Ecosystem: A Synthesis of Research Conducted under the Fraser River Action Plan, 98-11.[351]

Fire and flame retardants

165. PBDEs are flame retardants that have been used in textiles, furniture upholstery, plastics and electronics.[352] All forms of PBDEs are persistent, bioaccumulative and toxic and they are readily transported through atmospheric processes to remote locations.[353] PBDEs are endocrine-disrupting contaminants.[354] Three commercial formulations were removed from the North American market in 2004 because of concerns about health risks in humans and wildlife and EC banned the one form of PBDE (deca) remaining on the market in 2009 based in part on the advice from DFO Pacific Region contaminant scientists.[355] Although PBDEs are now banned in Canada, because they are PBTs, they may remain in the environment as legacy PBTs similar to what has been documented for PCBs.

166. Forest fires in BC are fought with a variety of complex mixtures including short-term fire suppressants like foam and long-term retardants like chemical salts.[356] Fire suppressants and retardants may be toxic depending on their ingredients. For example, one brand of fire retardant has a corrosion inhibitor that when exposed to sunlight produces cyanide which can make even dilute solutions of

[351] Available online at: http://research.rem.sfu.ca/frap/S_47.pdf.
[352] Ringtail Document CAN010704 at 5.
[353] Ringtail Document CAN010704 at 5.
[354] Ringtail Document CAN010704 at 6.
[355] See e.g. Ringtail Documents CAN098982 and CAN010704.
[356] Cohen Commission Exhibit 833 at 69.

this ingredient highly toxic to fish.[357] One fire retardant commonly used to suppress forest fires in BC is toxic to juvenile Chinook salmon at certain levels.[358]

Wood preservatives

167. Chemical preservation is designed to make wood toxic to organisms that would otherwise use it as food.[359] Non-point source contaminants originating from wood preservatives can enter salmon-bearing streams and lakes in the Fraser River watershed through leaching from railroad ties, docks, stored wood and wood waste. In 1988, 90% of the wood waste sites located in the Fraser Valley were adjacent to the Fraser River.[360] The use of wood preservatives in Canada is regulated by the federal government as described above (see section "Regulation of non-point source contaminants that could affect Fraser sockeye", above).

Creosote

168. Creosote is a complex pesticide predominantly made up of PAHs which are a type of PBT. The 1993 Priority Substances List Assessment Report by Canada concluded that there was insufficient data to determine if creosote is a problem for the environment, but the report noted that railway ties and disposal of railway ties are a major source of creosote to the environment.[361] Creosote may leach into soils or become part of run-off through precipitation.[362] Dock pilings are another source of creosote to aquatic environments.

Other wood preservatives

169. Other wood preservatives used in BC include pentachlorophenol, chromate copper arsenate, ammoniacal copper arsenate and ammoniacal copper zinc

[357] Cohen Commission Exhibit 833 at 69.
[358] Ringtail Document CAN022148 at 75.
[359] Ringtail Document CAN022857 at 1.
[360] Ringtail Document CAN0022148 at 95.
[361] Cohen Commission Exhibit 833 at 61.
[362] Ringtail Document CAN018141 at 1.

arsenate.[363] A 1999 survey of pesticide use in BC shows that the use of the first compound decreased by about 74% between 1991 and 1999.[364] The last three compounds contain heavy metals, such as chromium, copper and arsenic which are all toxic to fish; copper has been linked to sub-lethal effects such as olfactory damage and behavioural change.[365]

Urban development

170. In addition to the effect on the hydrological regime, urban lands can contribute considerable run-off, effluents and industrial pollutants to stream systems as rainwater and contaminants are funnelled into storm sewers and directly enter watercourses.[366] Elevated levels of PAHs produced from fuel combustion and PCBs used in electrical equipment have been found in fish and sediments in the lower Fraser River and the Thompson River near Kamloops.[367]

171. Discharges from municipal wastewater systems, including sewage, run-off and storm water, in relation to Fraser River sockeye are intended to be addressed during hearings on municipal wastewater and will be the subject of another commission PPR.

Linear development

172. Releases of non-point source contaminants to aquatic ecosystems can occur during the construction, maintenance, or decommissioning of linear developments.[368] Spills of hazardous substances during transport can also result in contamination of receiving water systems.[369] According to the

[363] Cohen Commission Exhibit 833 at 61.
[364] Cohen Commission Exhibit 833 at 61; Ringtail Document BCP002405.
[365] Cohen Commission Exhibit 833 at 62-63.
[366] Ringtail Document CAN022184 at 93.
[367] Ringtail Document CAN022184 at 93.
[368] Cohen Commission Exhibit 826 (Commission Technical Report 2) at 40.
[369] Cohen Commission Exhibit 826 (Commission Technical Report 2) at 40.

commission's Technical Report 2 (Exhibit 826), the substances of greatest concern relative to linear developments and Fraser sockeye include:[370]

a. Conventional variables (total suspended solids, turbidity and pH);

b. Major ions (e.g., chloride, as a result of road salt applications);

c. Nutrients (e.g., nitrates, nitrite, and ammonia, which are associated with blasting);

d. Metals (arsenic, cadmium, copper, chromium, lead, mercury, nickel, zinc, which may be released during combustion of fossil fuels);

e. PAHs;

f. Petroleum hydrocarbons (e.g., oil and grease, diesel-range organics, alkanes); and

g. In-use herbicides (which may be used to maintain rights-of-way).

Physical and water quality impacts: Sedimentation

173. Sediment released into water has the potential to impact fish and fish habitat through immediate health effects caused by suspended sediments and through immediate and long-term impacts on physical habitat.[371] Salmon require clean gravel for spawning and sedimentation can suffocate eggs and alevins.[372]

174. A number of activities in the Fraser watershed can result in increased sedimentation in Fraser sockeye habitat:

a. Land development, including the construction of transportation corridors;[373]

b. Agriculture;[374]

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[370] Cohen Commission Exhibit 826 (Commission Technical Report 2) at 40.
[371] Ringtail Document CAN024681; Bash, J., Berman, C. and Bolton, S., 2001. Effects of Turbidity and Suspended Solids on Salmonids, Centre for Streamside Studies, University of Washington (attached to Public Submission 0404-Buecker).
[372] Ringtail Documents CAN000127 at 3 and CAN002593 at 15.
[373] Ringtail Document CAN000127 at 3.

c. Mining;[375] and

d. Dams.[376]

175. A Public Submission to the commission has also suggested that ash from forest fires may result in increased sedimentation to salmon habitat.[377]

176. Sedimentation is regulated by several federal Acts and regulations including the *Fisheries Act* (ss. 35 and 36), the *Navigable Waters Protection Act* (in particular, s. 5) and *CEAA* screening. It is also regulated provincially through the *Water Act* and *Water Regulation* (see Part 7, Changes in and About a Stream) and the *Dike Maintenance Act*, R.S.B.C. 1996, c. 96 (in particular, s. 2(4)).

177. The management of gravel removal and its effects on Fraser sockeye are intended to be the focus of a subsequent PPR on this topic.

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[374] Ringtail Document CAN022148 at 97 and EFP Reference Guide at 9-3.
[375] Ringtail Document CAN002593 at 6.
[376] Ringtail Document CAN002593 at 7.
[377] Public Submission 0404-Buecker.

Appendix 1: List of documents and websites cited by this Policy and Practice Report

Ringtail documents

Count	Doc ID	Main Date	Title
1	BCP000221	1-Jan-2006	Alive and Inseparable, British Columbia's Coastal Environment: 2006
2	BCP000233	1-Sep-1978	Coquitlam River Water Management Study
3	BCP000402	4-Sep-2008	Intergovernmental Cooperation Agreement Respecting the Implementation of British Columbia's Riparian Areas Regulation Between Fisheries and Oceans Canada (DFO) and The Ministry of Environment (MOE) and The Union of British Columbia Municipalities (UBCM)
4	BCP000532		Premier's Awards: Promoting Innovation and Excellence Partnership Application Attachment
5	BCP001345	1-Jan-2009	Fish Passage at Stream Crossing, Special Investigation
6	BCP001374	1-Oct-1998	Water Quality Assessment and Objectives for the Fraser River from Hope to Sturgeon and Roberts Bands
7	BCP001389	29-Oct-2005	Land Use Operational Policy, Private Moorage
8	BCP001507	27-Jul-2004	Riparian Areas Regulation B.C. Reg 4/2010
9	BCP002164	1-May-2002	Stormwater Planning: A Guidebook for British Colulmbia
10	BCP002405	1-Apr-2001	Survey of Pesticide Use in British Columbia: 1999
11	BCP008260	28-Jul-2010	Review of Greywater Management Strategies to Improvie Public Health and Water Quality in Shuswap Lake
12	EV.CAN.0001.000000.CAN000127		Chapter 6 - Development of the Initial Phase o f the Salmon Vessel Licence Control Program
13	EV.CAN.0001.000000.CAN000377	1-Jan-2003	Pacific Fisheries Resource Conservation Council - Annual Report 2002-2003
14	EV.CAN.0001.000000.CAN000642	23-Apr-1998	1998 Coho Action Plan - A Draft Working Paper
15	EV.CAN.0001.002000.CAN002581	30-Jun-2007	2006 Annual Report
16	EV.CAN.0001.002000.CAN002582	31-May-2008	2007 Annual Report
17	EV.CAN.0001.002000.CAN002592	30-Jun-1999	Freshwater Habitat
18	EV.CAN.0001.002000.CAN002593	31-May-2000	Sand and Gravel Management and Fish Habitat Protection in British Columbia Salmon and Steelhead Steams
19	EV.CAN.0001.002000.	30-Nov-2007	Saving the Heart of the Fraser - Addressing

	CAN002600		Human Impacts to the Aquatic Ecosystem of the Fraser River, Hope to Mission, British Columbia
20	EV.CAN.0003.000000.CAN002912	1-Mar-2002	Fish-stream Crossing Guidebook
21	EV.CAN.0003.000000.CAN002916	1-Jan-2006	Riparian Areas Regulation Implementation Guidebook
22	EV.CAN.0003.000000.CAN002923	4-Sep-2008	Intergovernmental cooperation agreement respecting the implementation of British Columbia's Riparian areas Regulations
23	EV.CAN.0005.000000.CAN005941	20-May-2005	Subject: Roll-out of BCI Area Operating Principles for Habitat
24	EV.CAN.0005.000000.CAN005949	13-Mar-2006	Habitat Management Operating Principles for Flood Control Activities March 13 06
25	EV.CAN.0005.000000.CAN005950	24-Feb-2005	Best Management Practices for Lakeshore Stabilization
26	EV.CAN.0005.000000.CAN005951	5-Jul-2005	Habitat Management Operating Principles for Lake and Large River Foreshore Activities Version July 5/05
27	EV.CAN.0005.000000.CAN005957		Operating Principles - Highways Activities
28	EV.CAN.0005.000000.CAN005958	5-Jul-2005	Habitat Management Operating Principles for Highways Activities Version July 5/05
29	EV.CAN.0005.000000.CAN005959		Recommended MOT Project Review Process
30	EV.CAN.0005.000000.CAN005972	15-Feb-2006	Habitat Management Operating Principles for Railway Activities Version February 15 06
31	EV.CAN.0005.000000.CAN005973	1-Dec-2004	Fisheries and Oceans Canada - Salmon Arm Field Area - Addendum to the BC Ministry of Water Land and Air Protection Best Management Practices for Lakeshore Stabilization
32	EV.CAN.0005.000000.CAN005979	14-Feb-2006	Habitat Management Operating Principles for Urban/Rural Activities February 14 2006
33	EV.CAN.0006.001000.CAN009168	31-Mar-2007	Fisheries and Oceans Canada - Departmental Performance Report - For the Period Ending March 31 2007
34	EV.CAN.0007.000000.CAN010704	1-Jan-2008	Polybrominated Diphenylethers (PBDEs) in the Canadian Marine Environment: an Emerging Health Risk for Fish Marine Mammals and Their Habitat
35	EV.CAN.0008.000000.CAN012190		Fisheries Act Renewal - Questions and Answers
36	EV.CAN.0008.002000.CAN014253	1-Jan-2004	Fisheries and Oceans Canada and Environment Canada Administration of Section 36 of the Fisheries Act
37	EV.CAN.0008.002000.CAN014446	20-Jun-2005	Budget/ERC 2005 - Media Lines and QS & AS - Habitat Compliance Modernization
38	EV.CAN.0008.002000.		Implementing Habitat Compliance Modernization

	CAN014544		for the HMP
39	EV.CAN.0009.003000.CAN018141	24-Jul-1998	Subject: Inspector's Direction - Removal of Creosote Railway Ties Adjacent Nekliptum Creek
40	EV.CAN.0009.005000.CAN020325	7-Jan-1999	
41	EV.CAN.0009.005000.CAN020409	10-Jun-1999	Memorandum of Understanding for Work in and around Water - Between BC Hydro's Transmission and Distribution Business Unit (BCHT&D) Ministry of Environment Lands and Parks (MELP) and the Department of Fisheries and Oceans (DFO) ie the 'Parties'
42	EV.CAN.0009.006000.CAN020670		Operational Statement - Bridge Maintenance
43	EV.CAN.0009.006000.CAN020684		Operational Statement - Maintenance of Riparian Vegetation in Right-of-Ways
44	EV.CAN.0010.000000.CAN021555	1-Jan-2007	Mid Year Review - Status of 2007-2010 Plans
45	EV.CAN.0010.000000.CAN021794	9-Jan-2001	The Department of Fisheries and Oceans - Policy for the Management of Fish Habitat
46	EV.CAN.0010.000000.CAN022148	1-Jan-2002	PSARC Working Paper H2002-11 - Floodplains Flooding and Salmon Rearing Habitats in British Columbia: A Review
47	EV.CAN.0010.000000.CAN022184	1-Mar-2005	CEDP Review Questionnaire
48	EV.CAN.0010.001000.CAN022849		Habitat Management Operating Principles for Foreshore Activities
49	EV.CAN.0010.001000.CAN022857		Guidelines to Protect Fish and Fish Habitat When Preserved Wood is Proposed for Use in or Near Water
50	EV.CAN.0010.002000.CAN024181	1-Jan-2004	Streambank Protection with Rip-rap: An Evaluation of the Effects on Fish and Fish Habitat
51	EV.CAN.0010.003000.CAN024597	26-Feb-2004	The Role of the Federal Government in the Oceans Sector
52	EV.CAN.0010.003000.CAN024648	1-Jan-1998	State of the Environment Reporting - Tracking Marine Ecosystem Health in Canada: A Possibility in the Next Century?
53	EV.CAN.0010.003000.CAN024681		Sedimentation
54	EV.CAN.0010.003000.CAN024695	1-Jan-2002	Letter of Intent (2001/02) - ESSRF - Title: Assessment of the Biotransport of Persistent Organic Pollutants by Anadromous Fish to Nursery Lakes in British Columbia and Alaska
55	EV.CAN.0010.003000.CAN024919		Threats to and Impacts on Ecosystem Properties and Components of the PNCIMA
56	EV.CAN.0010.003000.CAN024922		Chapter 13: Impacting Activities and Stressors
57	EV.CAN.0010.003000.	30-Mar-2008	Federal Roles Document - Draft Version

	CAN025064		
58	EV.CAN.0010.006000.CAN027763	1-Jan-2005	Annual Report April 1, 2003 to March 31, 2004 - Annual Report to Parliament on the Administration and Enforcement of the Fish Habitat Protection and Pollution Prevention Provisions of the Fisheries Act
59	EV.CAN.0010.006000.CAN027909	9-Jul-2008	Coastal Management Scoping Paper - Draft #1c
60	EV.CAN.0010.013000.CAN034908		Impacts of New Highways and Subsequent Landscape Urbanization on Stream Habitat and Biota
61	EV.CAN.0011.001000.CAN037329	1-Jan-2006	Toward a More Effective Predictable and Timely Habitat Management Program - The Environmental Process Modernization Plan - Fall 2006 Consultation Sessions
62	EV.CAN.0014.000000.CAN063111	25-Jan-2006	Re: Transition Strategy for Review and Comment by DFO Habitat Management Staff on Land Development Proposals Located Adjacent to Waters Containing Fish or Fish Habitat
63	EV.CAN.0014.003000.CAN066286	1-Jul-2004	Best Management Practices for Highway Maintenance Activities
64	EV.CAN.0014.003000.CAN066448	27-Jul-2006	Best Management Practices for Installation and Maintenance of Water Line Intakes
65	EV.CAN.0014.003000.CAN066449	27-Jul-2006	Best Management Practices for Lakeshore Stabilization
66	EV.CAN.0014.003000.CAN066454	1-Mar-2004	Standards and Best Practices for Instream Works
67	EV.CAN.0014.004000.CAN067214	15-Feb-2010	Authorization for Works or Undertakings Affecting Fish Habitat - 09-HPAC-PA2-00032
68	EV.CAN.0017.018000.CAN095832	28-Apr-2009	
69	EV.CAN.0018.001000.CAN098982	31-Mar-2009	RE: Environment Canada ban on DecaPBDE
70	EV.CAN.0020.007000.CAN124913	19-Nov-2008	RE: Issues Management- Effect of Pesticide Spraying on Pacific Salmon
71	EV.CAN.0020.007000.CAN124937	30-May-2007	The Atrazine story
72	EV.CAN.0020.010000.CAN128582	25-Feb-2005	FW: Launch of National Operational Statements on the Habitat Management Program's National Intranet Site - Publication des Ã©noncÃ©s opÃ©rationnels nationaux dans l'intranet national du Programme de gestion de l'habitat
73	EV.CAN.0021.003000.CAN134834	10-Jun-2010	RE: question re: impacts of copper on salmon
74	EV.CAN.0021.003000.CAN134842	4-May-2010	RE: Messages for Canadian Press - urgent approval required
75	EV.CAN.0021.005000.	8-Jul-2007	RE: Robertson II

	CAN136962		
76	EV.CAN.0022.003000.CAN142149	31-Aug-2006	
77	EV.CAN.0022.019000.CAN157796		Subject: Habitat Management's Role in Section 36 of the Fisheries Act
78	EV.CAN.0022.019000.CAN157797	28-Apr-2004	Fisheries Act - Section 36 DFO Pacific Region - Habitat Management Role in Section 36 - Past Present and Future
79	EV.CAN.0022.019000.CAN158109		Terminal 2 Working Group - Terms of Reference
80	EV.CAN.0023.011000.CAN175326	2-Apr-2007	Subject: Proposed Lakeside Marina Residential Re-Development Cultus Lake B.C.
81	EV.CAN.0023.017000.CAN180495	1-Jan-2008	Annual Report to Parliament: On the Administration and Enforcement of the Fish Habitat Protection and Pollution Prevention Provisions of the Fisheries Act: April 1, 2007 to March 31, 2008
82	EV.CAN.0023.018000.CAN182040	1-Oct-2001	Comprehensive Management for Flood Protection Works
83	EV.CAN.0024.000000.CAN186041	1-Jul-2010	Regional Habitat Regulatory Decision Framework
84	EV.CAN.0025.006000.CAN192925	1-Sep-2007	Lakefront Development Compliance - Draft - Project Charter
85	EV.CAN.0025.008000.CAN194774	1-Dec-2005	DFO Toxics Program and National Lab Operation
86	EV.CAN.0026.009000.CAN205991		Protocol to Implement and Update the Operational Statements
87	EV.CAN.0028.000000.CAN216306		Proposed Communications Approach: 2004 Report of the Commissioner of the Environment and Sustainable Development (CESD)
88	EV.CAN.0028.007000.CAN223922	23-May-2006	
89	EV.CAN.0031.001000.CAN245139	1-Dec-2005	DFO Toxics Program and National Lab Operation
90	EV.CAN.0031.003000.CAN247346	31-Jan-2002	Notes from 3rd Late-Run Sockeye Salmon Workshop - January 30-31 2002
91	EV.CAN.0032.007000.CAN261042		5 Quantitative Toxicity Data for Cations in Fish and Invertebrates
92	EV.CAN.0033.001000.CAN265358	22-Dec-2005	
93	EV.CAN.0033.003000.CAN267363	29-Mar-2005	Phase-in of Riparian Areas Regulation DFO Pacific Region - March 29 2005
94	EV.CAN.0033.006000.CAN270107	10-Jun-2010	Salmon and Contaminants
95	EV.CAN.0034.010000.CAN284881		Evaluation of Spawning and Incubation Environment for Stuart Sockeye Salmon
96	EV.CAN.0036.000000.		Update on the Provincial Streamside Protection

	CAN285478		Regulation
97	EV.CAN.0037.001000.CAN295016	13-Apr-2007	FW: Spring 2007 BC Provincial Emergency Program Flood Mitigation Works
98	EV.CAN.0039.001000.CAN305096	1-Jan-2011	Peter Ross
99	EV.CAN.0040.008000.CAN322469	13-Jan-2009	FW: PBDEs
100	EV.CAN.0040.008000.CAN322482	8-Aug-2008	FW: PBDE Letter to EC (George Enei - A/ Director General) from DFO (Sylvain)
101	EV.CAN.0042.001000.CAN353797	3-Aug-2004	
102	EV.CAN.0046.000000.CAN393189	18-Jan-2006	Regional Management Committee Information Paper - Title: Environmental Process Modernization Plan and ERC Reductions
103	EV.CAN.0046.002000.CAN394637	9-Jun-2003	Strategic Review of Toxic Chemicals Research in the Environmental Science Program and the Arctic Science Proggram, Science Sector, Fisheries and Oceans Canada
104	EV.CAN.0046.002000.CAN394647	9-Jul-2004	Habitat Management's Role in Section 36 of the Fisheries Act
105	EV.CAN.0046.002000.CAN394661	1-Mar-2001	Options for Administering s. 36 of the Fisheries Act and its Regulations: A Discussion Paper
106	EV.CAN.0046.002000.CAN394664	13-Jun-2005	Toxic Chemical Research Re-Alignment
107	EV.CAN.0046.002000.CAN394670	1-Mar-2005	DFO Toxic Chemical Review Follow-Up

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1. Cohen Commission Exhibit 14
2. Cohen Commission Exhibit 33-27
3. Cohen Commission Exhibit 33-28
4. Cohen Commission Exhibit 35
5. Cohen Commission Exhibit 73
6. Cohen Commission Exhibit 77
7. Cohen Commission Exhibit 562

8. Cohen Commission Exhibit 573
9. Cohen Commission Exhibit 689
10. Cohen Commission Exhibit 690
11. Cohen Commission Exhibit 735
12. Cohen Commission Exhibit 826
13. Cohen Commission Exhibit 833
14. Cohen Commission Exhibit PP3
15. Cohen Commission Exhibit PPR8
16. Cohen Commission Exhibit PPR9
17. Cohen Commission Exhibit PPR11

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13. BC, Lakeshore Development Compliance Project: Defining the Issue across BC 2008/09 Phase 1

14. BC, Riparian Management Field Workbook (not available online, but see the "Riparian Factsheet" on this published by the BC Ministry of Agriculture, available online at: http://www.agf.gov.bc.ca/resmgmt/publist/800Series/810210-0_Riparian_Mgmt_Field_Workbook_intro_factsheet.pdf)

15. BC, Shuswap/Mara Lakes Greywater Discharge Q & A (available online at: http://www.env.gov.bc.ca/wat/wq/shuswap/greywaterqa.pdf)

16. BC, Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia (available online at: http://www.env.gov.bc.ca/wld/documents/bmp/wetlandways2009/wetlandways_docintro.html)

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Appendix 2: List of selected freshwater urbanization recommendations from previous reports

The recommendations set out below are a selection of recommendations from previous reports that relate to freshwater urbanization as delineated by the commission's hearings on this theme (and as delineated by this PPR). This is not a comprehensive list of all recommendations that may have been made in this area, but the recommendations are from the reports canvassed in Cohen Commission Exhibits 14 and 35.

Report of the Fraser River Sockeye Public Review Board, Fraser River Sockeye, 1994: Problems and Discrepancies, 1995[378]

1. Recommendation 29 (in part): We recommend that federal, provincial and local governments join forces to develop effective policies and plans in the Fraser River basin designed to: Regulate urban development in the Fraser River watershed so as to be compatible with environmental priorities. (pp. 70-71)

Pacific Policy Roundtable, Report to the Minister of Fisheries and Oceans on the Renewal of the Commercial Pacific Salmon Fishery, December 1995

1. Recommendation 15: There must be much better co-ordination and integration of the requirements of the Fisheries Act, the Canadian Environmental Assessment Act and closely related provincial legislation. Canada and BC must agree that the requirements of the federal and provincial legislation covering fisheries, forestry, water, waste disposal, mining, agriculture and the operations of municipalities have common purposes which must be reflected in the approvals and permits issued by the various levels of government, and in project assessments and reviews. Governments should aim at providing "one-stop shopping" for habitat approvals. (p. 28)

[378] Cohen Exhibit 77.

Commissioner of the Environment and Sustainable Development, Chapter 5: Fisheries and Oceans Canada – Salmon Stocks, Habitat, and Aquaculture, October 2004 Report

1. Paragraph 5.66: DFO should co-ordinate efforts with the Province of British Columbia, using a risk-based approach that would both complement the provincial approach and satisfy its own mandate to manage and protect fish habitat. (p.13)

Commissioner of the Environment and Sustainable Development, Chapter 1: Protecting Fish Habitat, Spring 2009 Report

1. Paragraph 1.33: In order to make consistent decisions on project referrals, in accordance with departmental expectations, DFO should ensure that an appropriate risk-based quality assurance system is in place for the review of these decisions. (paras. 1.19–1.32)

2. Paragraph 1.80: DFO should determine what actions are required to fully implement the 1985 Habitat Policy and confirm whether it intends to implement all aspects of the Policy. (paras. 1.75-1.79)

3. Paragraph 1.112: EC should develop a risk-based approach to the Fisheries Act pollution prevention provisions to identify, assess, and address significant risks associated with non-compliance with the Act. As part of this approach, EC should determine whether there are significant risks to fish habitat associated with non-compliance with the Fisheries Act that are not being addressed by the combination of its own administration and enforcement of the Act, and the administration of other federal and provincial legislation. (paras. 1.94–1.111)

4. Paragraph 1.134: DFO, with the support of EC, should clearly establish the expectations for EC's administration of the pollution prevention provisions, including the expected interactions between the two departments to support the delivery of the 1986 Habitat Policy. (paras. 1.127–1.133)

Appendix 3: List of abbreviations

BC *EAA* – BC *Environmental Assessment Act*

BCI – DFO BC Interior Area Office

BMP – Best Management Practice

CEAA – *Canadian Environmental Assessment Act*

CEPA – *Canadian Environmental Protection Act*

CSRD – Columbia-Shuswap Regional District

DDT – dichlorodiphenyltrichloroethane

DFO – Fisheries and Oceans Canada

EC – Environment Canada

EEM – Environmental effects monitoring

EFP – Environmental Farm Plan Program

EMA – BC *Environmental Management Act*

EMP – Environmental Management Plan

EPMP – Environmental Process Modernization Plan

ERC – Environmental Review Process

ESSRF – Environmental Science Strategic Research Fund

HADD – harmful alternation, disruption or destruction of fish habitat (*Fisheries Act*, s. 35)

IPMA – BC *Integrated Pest Management Act*

IPMR – BC *Integrated Pest Management Regulations*

MOE – Ministry of Environment (BC)

MOU – Memorandum of understanding

MSR – BC *Municipal Sewage Regulation*

NWPA – *Navigable Waters Protection Act*

OHEB – Oceans, Habitat and Enhancement Branch (DFO)

OS – Operational Statements

PAH – polycyclic aromatic hydrocarbon

PBT – persistent, bioaccumulative and toxic

PBDE – polybrominated diphenyl ether

PCB – polychlorinated biphenyl

PCPA – *Pest Control Products Act*

PMRA – Pest Management Regulatory Agency (Health Canada)

PPR – Policy and Practice Report

PSC – Pacific Salmon Commission

QEP – Qualified Environmental Professional

RAR – BC *Riparian Areas Regulation*

RARSC – *Riparian Areas Regulation* Steering Committee

RWA – 1987 Regional Working Agreement (EC-DFO)

SLIPP – Shuswap Lake Integrated Planning Process

SPEA – Streamside Protection and Enhancement Area

TC – Transport Canada

UBCM – Union of BC Municipalities