

Concentration Limits for the Protection of Aquatic Receiving Environments

This guidance document establishes concentration limits in and around aquatic receiving environments in British Columbia. Where these concentration limits are satisfied, no further action is required to address risks to aquatic life as long as site conditions do not change.

It is intended for use at contaminated sites where preliminary and detailed site investigations have been completed and soil, sediment, groundwater, and surface water contamination has been satisfactorily characterized and delineated in accordance with regulatory requirements, procedures, and guidance.

Definitions

For the purpose of this document, the following terms are defined as follows:

“aquatic receiving environment” means any surface water, watercourse, wetland, sediment or porewater containing aquatic life.

“constructed ditch” means a regularly maintained man-made trench or furrow dug in the ground for the primary purpose of conveying or draining surface water, storm water or irrigation water, that may or may not, contain water at all times of the year.

“constructed pond” means a regularly maintained man-made pool of still water for the primary purpose of storing surface water, storm

water or irrigation water collected from a constructed ditch, or inter-connected system of constructed ditches, including without limitation; sedimentation ponds, retention ponds, detention ponds, treatment lagoons or artificial wetland treatment systems.

“maintained watercourse” means a constructed ditch or constructed pond that:

- a) conveys irrigation water on agricultural land, or
- b) conveys, drains or stores storm water or surface water on agricultural, residential, commercial, or industrial land;

unless the constructed ditch or constructed pond:

- a) has been designated as critical habitat for scheduled aquatic species at risk, under the *Federal Species at Risk Act*, or
- b) constitutes sensitive habitat for designated endangered or threatened aquatic species, under the *British Columbia Wildlife Act*.

Other terms used in this guidance are defined in Procedure 8: [“Definitions and Acronyms for Contaminated Sites”](#).

Standards, guidelines and criteria for the protection of aquatic life

Water

The [British Columbia \(Approved and Working\) Water Quality Guidelines](#) (WQGs) are substance concentrations considered protective of aquatic

life. The WQGs are largely based on the Canadian Water Quality Guidelines issued by the Canadian Council of Ministers of the Environment, modified to suit site-specific factors in British Columbia.

The Contaminated Sites Regulation (the Regulation) Schedule 6 aquatic life standards (AW standards) are generic numerical water standards for the protection of groundwater and surface water that may discharge into an aquatic receiving environment. The AW standards are, for the majority of substances, 10 times the respective WQGs based on the assumption that 10-fold dilution will occur before discharge.

Sediment

The Regulation’s Schedule 9 Sediment Quality Criteria (SedQC) are generic numerical criteria that have been developed for the protection of aquatic life in sediments of aquatic receiving environments.

SedQC are separated into those for sensitive (SedQC_{SS}) and typical (SedQC_{TS}) sediments based on the level of protection needed to support the designated uses of the ecosystem and ministry sediment management objectives.

In addition to the SedQC, WQGs for ambient sediment quality have been developed for some substances. These WQGs for sediment are not commonly used in the assessment of sediment quality under the Regulation. However, the WQGs for sediment are often considered in establishing ministry authorizations for effluent discharges into uncontaminated areas or areas not impacted by human activity.

Salinity

WQGs, AW standards, and SedQC may be specific to either freshwater (i.e., salinity less than 1.5 grams per litre; Regulation Schedule 6) or marine/estuarine receiving environments. To differentiate freshwater from marine/estuarine

water, the salinity of the water should be determined either by a sampling program, or by reference to a credible scientific authority (e.g., the Fraser River Estuary Management Program, the ministry, Environment Canada, etc.). Alternatively, a proponent may elect not to characterize the salinity *per se* but rather use the more stringent of the freshwater or marine/estuarine standards or guidelines to assess the site.

The ministry considers the Fraser River:

- freshwater, above the Pattullo Bridge;
- marine or estuarine, below the George Massey tunnel on the Main Arm and below the western tip of Mitchell Island on the North Arm.

Concentration limits for water

In this guidance, protection of aquatic receiving environments is achieved by use of concentration limits at two fixed locations along the groundwater to surface water flow pathway as shown in Table 1 and Figure 1.

Table 1. Water concentration limits in aquatic receiving environments

	Assessment Zone	Zone Description	Concentration Limit
1.	Surface water	Water within and below an ARE that is not a maintained watercourse	WQG
2.	Dilution zone	Area between the HWM of an ARE and 10 metres inland	Concentration limits not specified
3.	Groundwater	Beyond ten metres inland from the HWM of an ARE	AW standards

Abbreviations: ARE = aquatic receiving environment; AW standards = Contaminated Sites Regulation Schedule 6 aquatic life standards; HWM = high water mark; WQG = BC water quality guideline.

Where the concentration limits are satisfied at a contaminated site, the aquatic receiving environment is deemed adequately protected.

Concentration limits apply to all depths of investigation. Water samples should be obtained from a depth that intersects the contamination and is representative of worst case concentrations of contaminants. Contamination plumes evaluated using this guidance should be demonstrated to be stable or shrinking, and seasonal and temporal effects should be taken into account.

Surface water

Surface water in aquatic receiving environments other than maintained watercourses should be evaluated against the WQGs.

There may be circumstances where site conditions limit the ability to collect water samples at the high water mark. In these circumstances, investigations of shallow groundwater at the point of discharge to the porewater in the ecologically active zone, or investigation of both porewater and surface water within the aquatic receiving environment, may be acceptable. At sites where shorelines are lined with riprap or other porous materials, the concentration limits may be met one metre inland from the point where the riprap or material meets the land.

Groundwater

The AW standards apply to groundwater at distances greater than or equal to 10 metres from the high water mark of aquatic receiving environments, based on the assumption that groundwater will be diluted at least 10-fold from its initial concentration in the remaining 10 metres before entering the aquatic receiving environment.

AW standards do not apply to groundwater at contaminated sites located at distances greater than 500 metres away from an aquatic receiving environment that is not a maintained watercourse.

Dilution zone

This guidance does not specify concentration limits within the zone located between 10 metres and the high water mark of an aquatic receiving environment (i.e., the dilution zone). Therefore, if the concentration limits at the two fixed locations (i.e., AW standards at 10 metres from the high water mark and WQGs at the high water mark) cannot be met, an alternative risk-based approach is recommended which shows that:

- the 10-fold dilution of substance concentrations in groundwater occurs before the water enters the aquatic receiving environment;
- groundwater quality meets a site-specific risk-based standard with a protection level appropriate for aquatic receiving environments (i.e., EC₂₀); or
- substance concentrations in groundwater do not represent an unacceptable risk to aquatic life as revealed by a detailed ecological risk assessment (See also [Detailed Ecological Risk Assessment in British Columbia Technical Guidance. Science Advisory Board. September, 2008](#)).

Concentration limits for sediment

The SedQC apply to the sediments in aquatic receiving environments below the high water mark as shown in Table 2 and Figure 2.

Table 2. Sediment concentration limits in aquatic receiving environments

	Assessment Zone	Zone Description	Concentration Limit
1.	Sediment in the ecologically active zone	The top one metre of stable sediment of an ARE	SedQCSS or SedQCTS
2.	Sediment below the ecologically active zone	Sediment below the top one metre of stable sediment of an ARE	SedQCTS
3.	Intertidal sediment	Sediment between the HWM and LWM	SedQCSS or SedQCTS (Environmental protection) and Schedule 4, 5, 10 (human health protection)
4.	Soil	Beyond the HWM of an ARE	Schedule 4, 5, 10 (environmental & human health protection)

Abbreviations: ARE = aquatic receiving environment; HWM = high water mark; LWM = low water mark; SedQCSS = Contaminated Sites Regulation sediment quality criteria for sensitive sediments; SedQCTS = Contaminated Sites Regulation sediment quality criteria for typical sediments.

The uppermost 1 metre of stable sediment comprises the ecologically active zone, i.e., that depth of sediment which is important for a variety of ecological and physicochemical processes that support aquatic life. In the ecologically active zone, either the SedQC_{SS} or SedQC_{TS} apply depending on whether the zone supports sensitive habitat and/or whether sensitive sediment management objectives apply. Stable sediment is sediment which is not subject to erosion, dredging or upwards transport of contaminants.

SedQC_{TS} are applicable to any depth at typical sediment sites and to depths greater than 1 metre at sensitive sediment sites.

If the SedQC cannot be met, detailed ecological risk assessment is recommended.

In addition to the SedQC, the Regulation's Schedules 4, 5, and 10 soil standards for the protection of human health apply to sediments in intertidal zones if an operable human health exposure pathway is present at the site.

If an operable human health exposure pathway is identified for sediment containing substance concentrations greater than the applicable standards, detailed human health risk assessment is recommended.

Concentration limits for maintained watercourses

For maintained watercourses, the AW standards apply to surface and groundwater and the Regulation's Schedules 4, 5, and 10 soil standards apply to sediment (see Table 3).

Where possible, it should be demonstrated that WQGs are met at the point where surface water from a maintained watercourse enters an aquatic receiving environment. In the case that a maintained watercourse:

- ceases to be maintained in accordance with a regular maintenance schedule,
- is abandoned, or allowed to ecologically succeed, or
- otherwise ceases to serve as a maintained watercourse, then

the function of the watercourse is considered to revert to an aquatic receiving environment to which the WQGs apply.

For more information, contact the Environmental Management Branch at site@gov.bc.ca

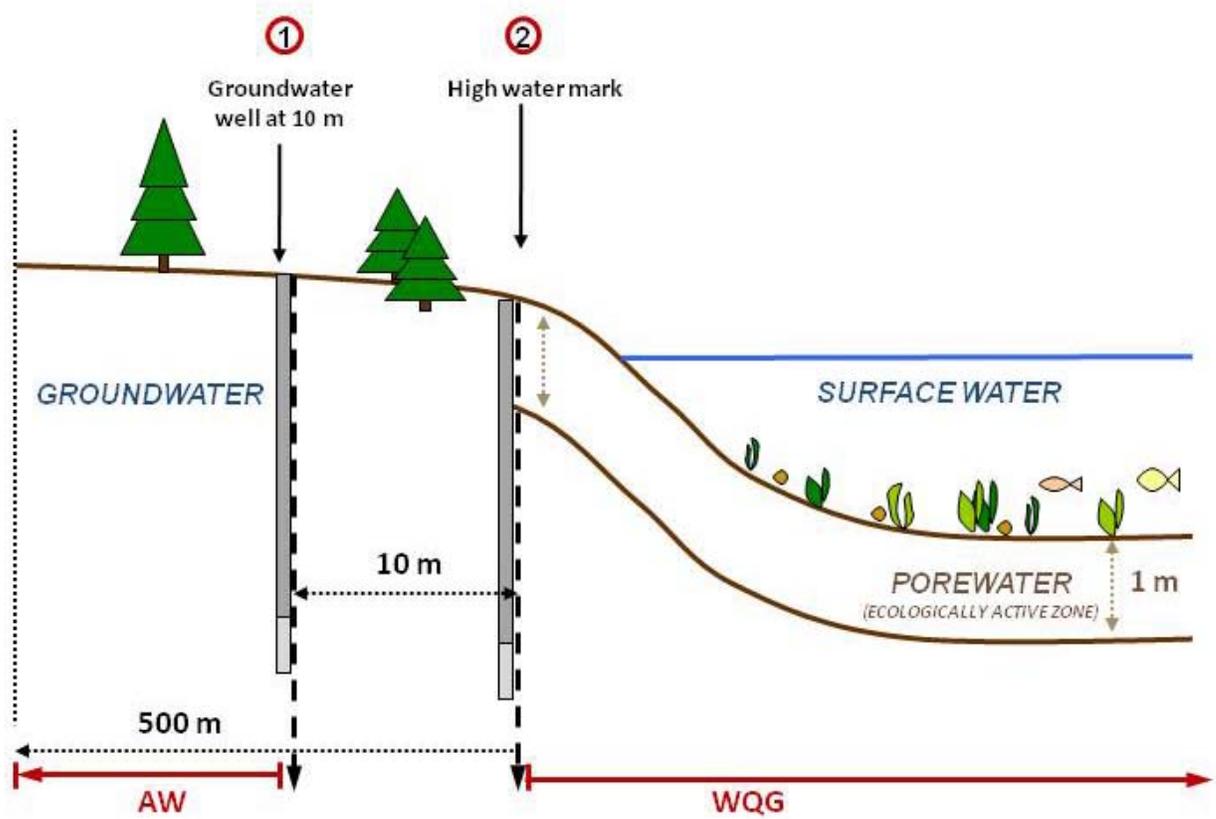


Figure 1. Illustration of the concentration limits for water in an aquatic receiving environment.

Note. Red lettering indicates the applicable standards and guidelines for each water type. Illustration is not drawn to scale.

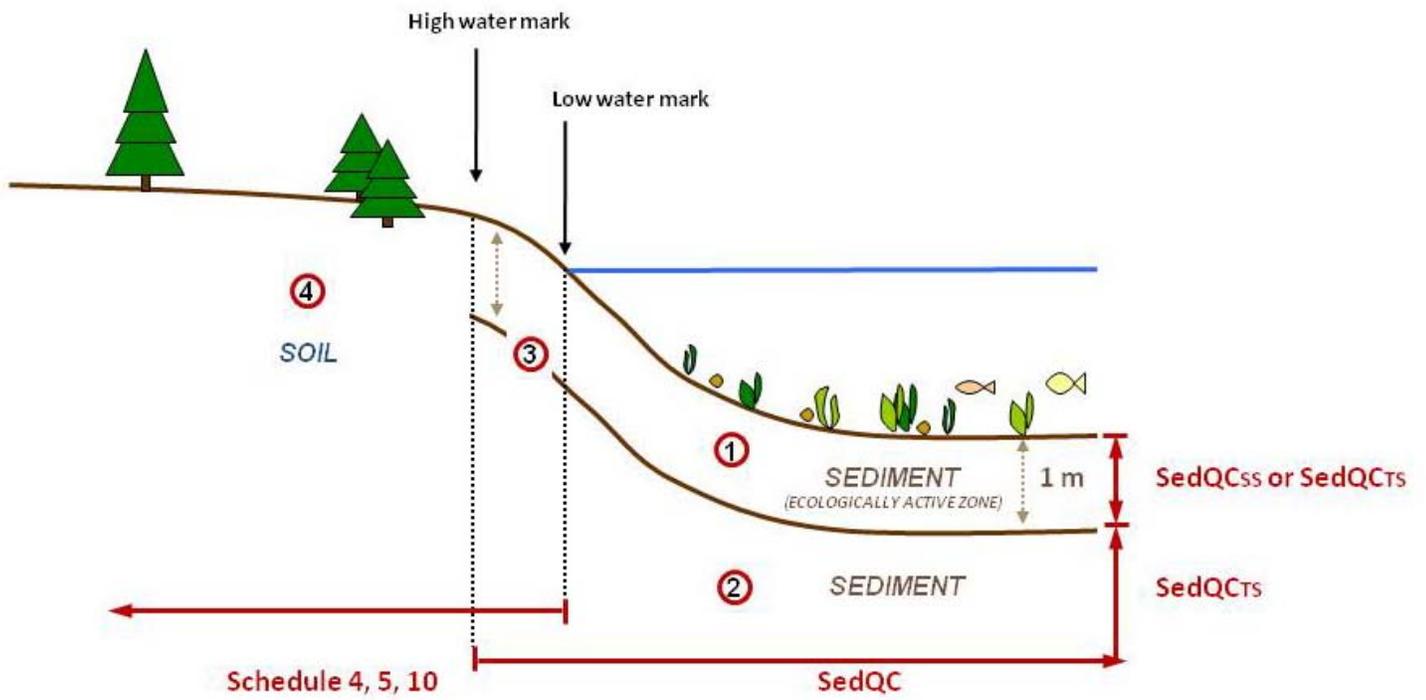


Figure 2. Illustration of the concentration limits for sediment in an aquatic receiving environment.

Note. Red lettering indicates the applicable standards and criteria. Illustration is not drawn to scale.

Table 3. Summary of concentration limits in aquatic receiving environments and maintained watercourses

	Water	Sediment
Aquatic receiving environments that are not maintained watercourses	WQG	Schedule 9
Constructed ponds - Less than 500 metres from an aquatic receiving environment	Schedule 6 AW	Schedule 4, 5, 10
Constructed ponds - More than 500 metres from an aquatic receiving environment	If operational and permitted, standards do not apply. Upon remediation, Schedule 4 and 5 apply.	
Constructed ditches	Schedule 6 AW	Schedule 4, 5, 10

Notes: If hydraulically connected to an aquatic receiving environment, based on the pathway for groundwater flow to surface water containing aquatic life.