ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SPILL PREVENTION AND RESPONSE
CONTAMINATED SITES PROGRAM

Regulatory Approach to Managing Contamination in Hydrologically Connected Groundwater and Surface Water

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PURPOSE

This technical memo clarifies how groundwater cleanup criteria under 18 AAC 75 and water quality standards under 18 AAC 70 apply to the hydrologically connected groundwater and surface water (including the hyporheic zone) during the cleanup of contaminated sites (i.e., as regulated under 18 AAC 75 or 18 AAC 78 regulations). Hazardous substances may impact surface waters through overland flow from contaminated soils, or surface water or sediments from hydrologically connected, contaminated groundwater. The memo also emphasizes the coordination that is necessary between the Contaminated Sites and Water Quality Programs in these instances.

REGULATORY BACKGROUND

Groundwater cleanup criteria under 18 AAC 75 apply to groundwater and are used to derive the migration to groundwater cleanup criteria for soil. However, the Site Cleanup Rules recognize that oil and other hazardous substance cleanups must also meet the water quality standards for contaminated surface water and sediment. Key regulations are excerpted below.

18 AAC 75.345

(f) Groundwater that is closely connected hydrologically to nearby surface water may not cause a violation of the water quality standards in 18 AAC 70 for surface water or sediment. The department will, in consultation with local, state, and federal officials and the public, establish points of compliance with this subsection, taking into account the following factors:
(1) groundwater travel time and distance from sources of hazardous substances to surface water;
(2) the contribution of the groundwater to the chemical and physical quantity and quality of the surface water;
(3) organisms living in or dependent upon the groundwater to surface water ecosystems;

(4) climatic, tidal, or seasonal variations;
(5) feasibility of attaining applicable water quality standards to support the designated uses of the surface water;[1]
(6) presence of sediment contamination;
(7) if conducted for the site, the conclusions of a site-specific risk assessment conducted under the *Risk Assessment Procedures Manual*, adopted by reference in 18 AAC 75.340.
(g) If the groundwater point of compliance is established at or near a property boundary or if groundwater is closely connected hydrologically to a surface waterbody, the department will, if the department determines that sentinel monitoring is necessary to ensure protection of human health, safety, or welfare, or the environment, require a responsible person to develop sentinel monitoring wells that monitor for any hazardous substances likely to migrate to the applicable point of compliance at concentrations that exceed the cleanup levels.

Where groundwater at a site is determined to be hydrologically connected to surface water, it must meet the more stringent or more protective of either the Table C criteria in 18 AAC 75 or the Alaska Water Quality Standards under 18 AAC 70 in order to be protective for use as a drinking water source and to protect potential ecological receptors. In the regulations governing water quality there are two relevant provisions for contaminated sites.

At 18 AAC 70.050, groundwater is protected for Class (1) (A) uses (freshwater water supply):

18 AAC 70.050
CLASSIFICATION OF STATE WATERS.
(a) Except as specified in 18 AAC 70.230 (e), state water is protected for the following use classes:
(1) fresh waters - Classes (1)(A) - (1)(C);
(2) groundwaters - Class (1)(A); and
(3) marine waters - Classes (2)(A) - (2)(D).

However, according to 18 AAC 70.005, the water quality standards (WQS) do not apply to approved groundwater cleanup actions; however they continue to apply to contaminated surface water and sediment.[2]

18 AAC 70.005
NONAPPLICABILITY OF GROUNDWATER PROVISIONS.
(a) Except as provided in (b) of this section, the provisions of this chapter that are applicable to groundwater do not apply to a response, a cleanup, or a corrective action approved by
(1) the department under 18 AAC 60.440, 18 AAC 60.080, 18 AAC 75, or 18 AAC 78, except as this chapter is specifically made applicable by 18 AAC 60, 18 AAC 75, or 18 AAC 78; or
(2) the United States Environmental Protection Agency (EPA) under 42 U.S.C. 9601 - 9675 (Comprehensive Environmental Response, Compensation, and Liability Act of 1980) or 42 U.S.C. 6901 - 6992k (Solid Waste Disposal Act, as amended by the Resource Conservation Recovery

[1] Before a designated use can eliminated (feasibility determination) a use attainability study must be conducted to show the use is not achievable.

[2] Since the regulation is designed to protect the designated use of aquatic life, the standard applies only as deep as aquatic life reside. Salmon eggs and aquatic invertebrates are not generally found deeper than 40 cm.

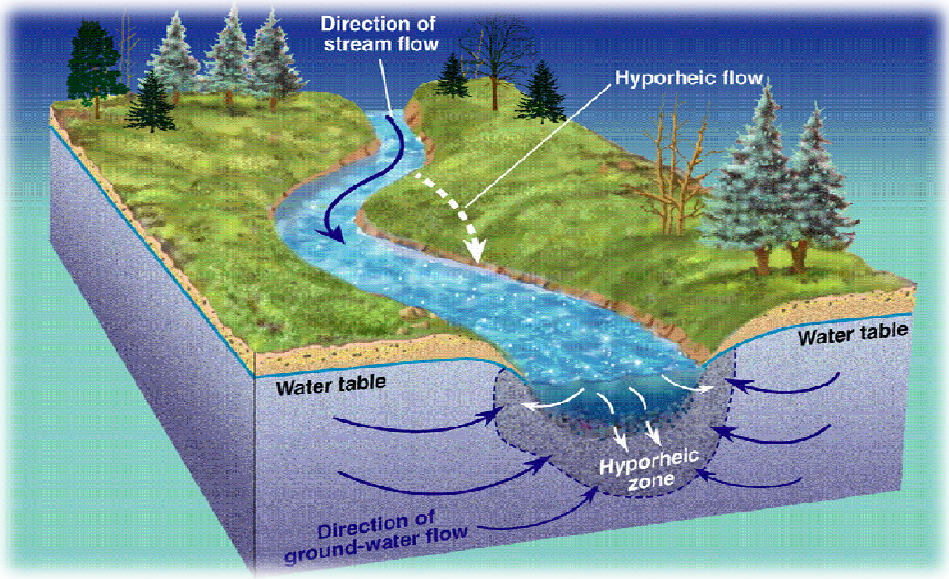
Act), if the response, cleanup, or corrective action meets, at a minimum, the site cleanup rules at18 AAC 75.325 – 18 AAC.75.390.
(b) This section does not affect the application of this chapter to contaminated surface water and sediment.

18 AAC 70.020.11 (c)
WATER QUALITY STANDARDS FOR DESIGNATED USES
There may be no concentrations of toxic substances in water or in **shoreline or bottom sediments** (emphasis added)**,** that, singly or in combination, cause, or reasonably can be expected to cause, adverse effects on aquatic life or produce undesirable or nuisance aquatic life, except as authorized by this chapter.

DETERMINING WHICH STANDARDS APPLY

Given this regulatory setting, choosing the applicable standards may not be clear-cut. At the most basic level, groundwater cleanup levels under 18 AAC 75.345 (Table C) apply to groundwater at a contaminated site that is not in contact with surface water. Whereas, 18 AAC 70 Water Quality Standards apply if the water appears at the surface. The hyporheic zone, however, includes both groundwater and surface water. Therefore, which regulatory criteria apply in this transition area?

Defining the Hyporheic Zone



The hyporheic zone is a region beneath and lateral to a stream bed, lake, wetland, or estuarine area where there is mixing of shallow groundwater and surface flow. Fluctuation may occur daily (e.g. tidal events) to seasonally (e.g. peak surface water discharge or peak groundwater movement). Hyporheic flow paths can also be lateral or vertical moving in a downstream direction and are driven primarily by topographic features and changes in substrate permeability. Fluvial processes also wield a strong control on the hyporheic zone at many levels; e.g. spatial scales, annual, seasonal and storm event timescales.[3]

[3] Barnes, Dave and Horacio Toniolo. June 2006. Literature review of the hyporheic zone: prepared for the Alaska Department of Environmental Conservation. University of Alaska Fairbanks, Department of Civil and Environmental Engineering, Water and Environmental Research Center. 15pp.

The flow dynamics and behavior in the hyporheic zone are important for surface water/groundwater interactions, as well as fish spawning and other processes. The hyporheic zone is an important location for hydrologic, biogeochemical, and biological processes. This biological ecotone provides an ideal habitat for hyporheic fauna and aquatic organisms (hyporheos). The exchange of water in the hyporheic zone also helps regulate stream water temperatures which are important to nutrient cycling and microbial activity, and is important for spawning anadromous fish which utilize the hyporheic zone during egg development.

The hyporheic zone is characterized by the presence of both water and sediment. Pore water, the water filling the spaces between grains of sediment in the hyporheic zone, has two origins: surface water (which some researchers define as anywhere from 10% to 90%), and groundwater. Because both surface water and groundwater are regulated under different authorities, the CSP project manager must be able to distinguish between the applicable regulations and defined collection methods.

Establishing the Physical Point of Compliance

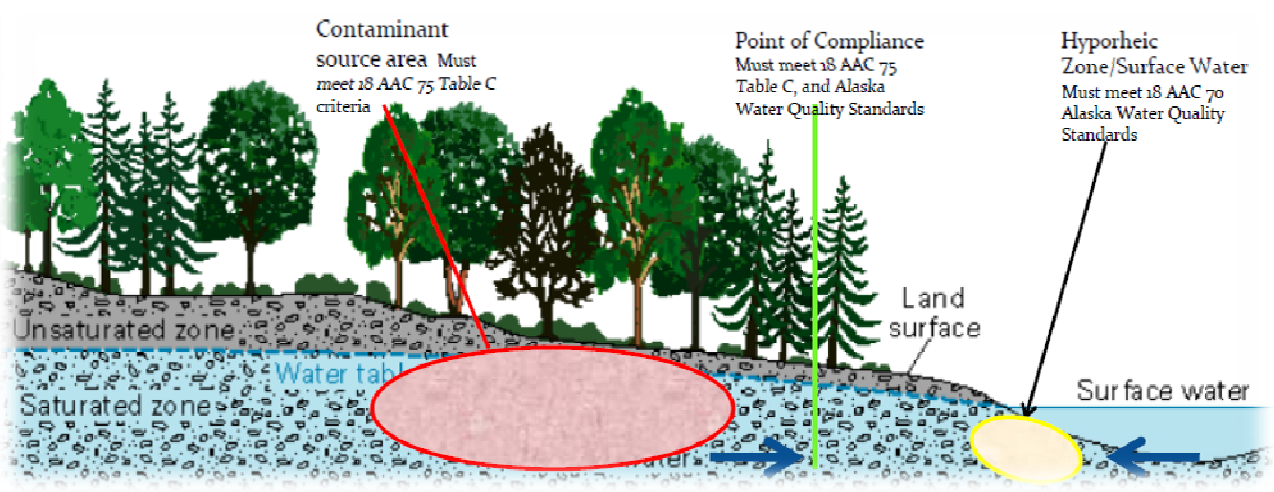
The cleanup level point of compliance is normally placed downgradient of the leading edge of a contaminant plume for the purposes of meeting Table C cleanup levels **and** to ensure the protection of surface water (see 18 AAC 75.345(f) above). In practical terms, the point of compliance should be established at a distance that is protective of a potentially impacted surface water body, where site-specific water quality parameters, or modeling, indicate the presence of a hydrologic groundwater/surface water connection (the hyporheic zone). The selected point of compliance is unlikely to reflect the transition between groundwater and surface water perfectly because the hyporheic zone represents a continuum of conditions that are very difficult to predict or measure with 100 percent confidence. However, the point of compliance must be reasonable and must pass the test of regulatory defensibility. For example, in most cases it would be unreasonable to apply surface water quality standards at a point of compliance located a mile upgradient from a salmon stream because it is unlikely the hyporheic zone reaches that far. Similarly, surface water quality standards should extend beyond the water column in a waterbody to be protective of organisms (macroinvertebrates and fish eggs) living in the stream bed and sediments.

The important consideration when establishing the point of compliance within the lateral constraints of the hyporheic zone is that groundwater **may** be a current or reasonably expected future source of drinking water, **and** the hydrological connection to nearby surface water **may** dictate the need for aquatic life protection. On the other hand, if groundwater is determined not to be a current or potential future drinking water source (i.e. water with high salinity), only surface water quality standards would be applicable.

The point of compliance where overlapping regulatory authorities apply must be reasonable and defensible.

Applying the Applicable Criteria

Once a reasonable and defensible point of compliance has been established, the next challenge for the CSP project manager is to consider both the groundwater cleanup levels and the surface water quality standards to ensure protection of human health and the environment and to achieve a defensible cleanup decision. It is at the point of compliance - the transition between groundwater and surface water – that both sets of numeric criteria need to be scrutinized.



As an example, each individual component of BTEX has a groundwater cleanup level under 18 AAC 75 Table C but are summed for Total Aromatic Hydrocarbons (TAH) under the 18 AAC 70. As a result, there may be cases where the concentration of each BTEX contaminant in pore water is below its groundwater cleanup level but the sum of all the components exceed the Total Aqueous Hydrocarbons (TAH) standard of 10 µg/L established by 18 AAC 70. For example, benzene may be detected in a pore water sample at 8.0 µg/L while concentrations of toluene, ethylbenzene and xylene concentrations in the same sample are non-detect. In this case, the total BTEX is less than the TAH criterion of 10µg/L, but benzene exceeds the Table C criterion of 5.0 µg/L. Thus the Table C value would apply.

The applicable criteria at the point of compliance are the more stringent of either the Table C levels or surface water quality standards.

It is important to note that while surface water quality standards are the starting point, numeric criteria for specific compounds may not be available under 18 AAC 70. The presence of sensitive aquatic receptors, and the type(s) of contaminants present, should be evaluated in these situations to determine if a site-specific ecological cleanup level is appropriate. If not, the Table C groundwater cleanup level may be the appropriate default.

Risk Assessments

A risk assessment may be used to develop cleanup levels where no criteria exist in either 18 AAC 75 or 18 AAC 70, or where certain receptors are present that require a more protective value than what is available. Regardless, a risk assessment cannot be used to develop groundwater or surface water cleanup levels less stringent than either the Table C values under 18 AAC 75 or the WQS under 18 AAC 70. The WQS are the first regulatory action level for surface water and cannot be waived by cleanup project managers.

A risk assessment may also be helpful in prioritizing the level of action and resources applied to clean-up. Also, because water quality regulations do not adopt any specific numeric criteria for sediments[4], an ecological risk assessment may be useful and appropriate for determining cleanup levels for sediments under the WQS.

Site-specific ecological levels and/or an ecological risk assessment may also be appropriate.

CONTAMINATED SITES AND WATER DIVISION COORDINATION

Contaminated Sites staff must involve the Water Quality Program staff in the Nonpoint Source Program at sites where data indicates that surface water or sediments are impacted by contamination. Staff in the Non-Point Source program will use the data to make a determination as to whether the surface water body should be listed as threatened or impaired. Additionally, proposed remedial action to address the contamination will be taken into account as Water Quality staff determine the appropriate category to assign to the waterbody. Water Quality Standards staff should also be consulted if there are questions regarding applicable surface water quality criteria.

Typically, CSP staff will be the lead in these cross-program coordination efforts. Water Quality staff will monitor the response action to ensure sure water quality standards are reached. Water Quality staff may take on a more prominent role if they are actively managing a waterbody - such as permitting, overseeing grant-funded projects, or developing Total Maximum Daily Loads (TMDLs).

[4] For guidance on screening levels and setting criteria for sediment, refer to the Tech Memo, "Sediment Quality Guidelines" dated March 2004, and the companion document, "Sediment Quality Guideline Options for the State of Alaska" (Cormack 2001). Both are available at the CSP internet website under Guidance & Forms.