Best Available Science

Critical Aquifer Recharge Areas – Review of Publicly Proposed Amendments to the ECA Regulations

Prepared for the City of Sammamish

by AMEC Environment & Infrastructure, Inc.

Introduction

AMEC provided a Best Available Science (BAS) review that describes information relative to protecting Critical Aquifer Recharge Areas (CARAs) as a critical area within the City of Sammamish (City). The review included an overview of CARA regulations, new science relative to CARAs, issues throughout the Puget Sound region, conditions unique to the City, relevance of federal and state policy changes to the existing City regulations, and a list of recommended actions for the City's Environmentally Critical Areas (ECA) code.

In response to the BAS review provided by AMEC and to the existing ECA code, the public has proposed several amendments to the ECA Code. The City has requested that AMEC review the requested amendments with respect to their consistency with BAS.

Below are listed the recommended ECA code amendments made by members of the public (in bold font) with a response framed in terms of Best Available Science following the comment. In some cases, the proposal can be said to be consistent or not consistent with Best Available Science. However, in cases where there is no known science to review the proposed amendment against, no recommendation is made.

Best Available Science Summary

Regulations Regarding Underground Injection Wells

Injection wells are regulated under state and federal rules, policies, and guidance. The primary regulation is the State of Washington Underground Injection Control (UIC) program (Ch. 173-218 WAC). Five classes of UIC wells are discussed in this rule. Three of the five classes, Classes I, III, and IV, are prohibited in the State of Washington. Class II injection wells, which are associated with petroleum or natural gas production, storage, or wastewater disposal are allowed in the state but are unlikely to be present within the city limits of Sammamish. The city of Sammamish is not known to be a petroleum or natural gas-producing area and it is unlikely that Class II wells would ever be needed and the city could consider a ban on Class II UIC

wells. Class V UIC wells, which do include geothermal/heat exchange wells and stormwater/ surface water wells, are allowed in the State of Washington and are likely to exist in the city of Sammamish. Both types of wells are becoming more prevalent nationally since sustainable building practices have been more widely used in the past few years. Now is a good time for the city to address this issue and establish a policy before the requests accelerate for Class V UIC wells.

Class V injection wells, as defined in WAC 173-218-040 (5), allow for injection of fluids into unsaturated soils, including fluids resulting from stormwater runoff (WAC 173-218-040 (5)(a)(i)), heating and cooling systems (WAC 173-218-040 (5)(a)(ii)), geothermal production (WAC 173-218-040 (5)(a)(vii)), and septic systems (WAC 173-218-040 (5)(a)(v)). UIC wells must meet non-endangerment standards under WAC 173-218-080 and WAC 173-218-090. A brief discussion of the technical issues associated with the two well types follows:

Geothermal/Heat Exchange Wells

Under 173-218-100 (1)(c) WAC, closed-loop heating and cooling water return flow wells that have not added any chemicals or product to the water automatically meet the non-endangerment standard and are considered to be rule authorized after the well is registered with the State Department of Ecology. For these wells, the owner or operator must complete a survey form to verify that current site practices are protective of groundwater quality.

In contrast to the closed loop/no-added chemical type, closed-loop wells with added chemicals, and open-loop wells, are subject to the non-endangerment standard.

Under 173-218-090(3) new UIC wells that are not used for stormwater management and that fall into the categories of heat pump or cooling water return flow and geothermal energy use are able to discharge directly into an aquifer. They must also meet additional groundwater protection requirements if located in a groundwater protection area, and CARAs are included in the definition of groundwater protection area.

Stormwater Injection Wells

Stormwater injection wells are allowed under WAC 173-218-040(5)(b)(v)(B) if the stormwater meets the non-endangerment standard by applying BMPs and requirements in WAC 173-218-090 or if the discharge of stormwater is authorized under a permit.

Owners of stormwater UIC wells must comply with WAC 173-218-070 (1)(b)(i) and (ii), and WAC 173-218-080, which prevents the injection of fluid that contains any contaminant that would cause a violation of Ch. 173-200 WAC (Water Quality Standards). Furthermore, the wells must be constructed, operated, maintained and decommissioned in a manner that protects groundwater quality as described in 40 CFR 144.12 (a) and Ch. 173-160 WAC.

Under WAC 173-218-090 (2)(c)(i), existing Class V UIC wells do not have to meet new stormwater requirements, although they must be registered with the Department of Ecology and do a complete well assessment. The regulation outlines the timeline for registration of existing wells from the time of the adoption date of the rule, which occurred in June 2008. Registration of an existing well requires a well assessment and corrective actions if the well assessment reveals issues of non-compliance. Timelines in the regulation call for a deadline of 3 years (2011) to be registered, and 5 years (2013) to have a well assessment completed. Assuming well owners have complied with the timelines in the regulation, most of the wells within the City of Sammamish should have been registered and completed a well assessment by now (2012).

Ch 173-218-090 (1) and (2) describes specific requirements for new and existing stormwater Class V wells to meet the non-endangerment standard. In the case of new stormwater Class V wells, the regulations have a number of requirements that should lower risk associated with stormwater injection. However, one area of risk is the presumptive remedy approach to compliance, and the presumptive performance of stormwater treatment practices. A UIC well is presumed to meet the non-endangerment standard if Ecology (2006) guidelines are followed, which included: (1) application of source control measures to control pollutants that are difficult to remove from stormwater, (2) application of pre-treatment best management practice (BMP) to stormwater before discharging into the UIC well, and (3) availability of appropriate vadose zone treatment to remove the solid phase of pollutants. The basis of the presumptive approach is that these source control and treatment processes will achieve a minimum level of effectiveness for removing pollutants. In practice there may be sites and situations where source controls or pre-treatment BMPs are not properly implemented or maintained, posing risks that stormwater contaminants may reach the vadose zone. Pre-treatment BMPs as defined by Ecology (2006) constitute "Basic Treatment" as defined in the Stormwater Management Manual for Western Washington (2005), for which the intended (and presumed) performance is to achieve 80 percent removal of total suspended solids on an annual basis. Depending on site uses, various pollutants may be transported by stormwater, and systems designed to meet the standards for the presumptive approach could deliver 20 percent of the annual total suspended solids, along with attached and dissolved pollutants, to the vadose zone. Discharges to the vadose zone can infiltrate into an aquifer at rates that are dependent on the vertical separation between the discharge elevation in the vadose zone and the top of the aquifer, and the permeability of the vadose zone. In cases where a treatment BMP may have been improperly designed or constructed, or inadequately maintained, additional pollutants may be discharged to the UIC.

Proposed Amendments, and Responses Framed in Best Available Science

Issue #1 (Public Comments #56 and 57)

<u>Northeast Sammamish Sewer & Water District (NESSWD) and Sammamish Plateau Water & Sewer District (SPWSD) comment letters.</u> Both districts are concerned that geothermal wells / heat exchanges within the mapped Critical Aquifer Recharge Areas will contaminate the aquifer for municipal water supply wells. Possible contamination could occur either through:

- **Geothermal well / heat exchange failures (i.e. leaks) resulting from poor maintenance; or,**
- **Ground water contamination from surface water contamination down the edge of the well.**

Recommendation Regarding Issue #1

The City should prohibit in CARAs new geothermal/heat exchange wells of the types that are open loop or closed loop with non-potable fluids, and determine whether any of these wells exist in CARAs now. Existing and new closed loop geothermal/heat exchange wells with potable circulating water must meet well protection requirements, and circulating water should be periodically tested to demonstrate compliance with drinking water quality criteria. Because of the potential risk to the aquifer of surface water contamination infiltrating down a poorly constructed or damaged well, the state regulations, Chapter 173-160 WAC, provide a minimum standard for construction and maintenance of wells. The City should inventory existing wells in CARAs and determine whether it should provide a policy regarding additional requirements beyond Ch. 173-160 WAC.

Issue #2 (Public Comment # 57)

<u>Sammamish Plateau Water & Sewer District (SPWSD) comment letter (#57).</u> The SPWSD is interested in ensuring that the ground water injection systems do not degrade groundwater near their municipal water supply wellheads, and has suggested that a ban within mapped Class 1 and 2 CARAs will reduce the chances of such contamination.

Response to Comment #56

Comment #56 was from Steve Nelson of RH2 on behalf of NESSWD. Mr. Nelson requested the City to consider restrictions on the construction of geothermal/heat exchange well within the city limits. Specifically, he suggested that open-loop geothermal wells and closed-loop wells that circulate fluids other than potable water be prohibited in Classes 1, 2, and 3 Wellhead Protection Zones. He further suggested that closed-loop geothermal wells that circulate only potable water be prohibited in Class 1 and 2 Zones, but allowed in the Class 3 Zone.

Although the regulations require geothermal/heat exchange wells to meet groundwater protection requirements in CARAs for new wells, existing wells have a low threshold for compliance with the owner or operator simply filling out a form. The City should research the numbers and locations of existing geothermal/heat exchange wells, classify the types and locations relative to CARA classes, review the survey forms, and decide whether the risk to groundwater from existing wells has too high a potential cost and consider decommissioning. AMEC recommends that new open loop wells in the City should not be allowed to discharge to the aquifer, must meet well protection requirements based on potable groundwater quality criteria, and require periodic (City-specified) demonstration.

Despite the controls and requirements discussed above, any type of well can deteriorate with time or be subject to failure. Wells can be damaged due to manmade (e.g., vehicle collisions, illegal discharges) or natural causes (e.g., earthquakes, differential settlement), which make maintenance and protection of wells a paramount priority. Well construction can vary with the skill of the driller, and poor well construction leads to cross-contamination of aquifers. Because well construction and protection can never be perfect, the City should study the effect of prohibiting open wells and closed-loop non-potable circulating wells in Classes 1, 2, and 3 wellhead protection zones. Closed-loop potable wells should be researched as a separate category to determine how many wells would be currently affected by a prohibition. If no wells exist in the City that are closed-loop potable, then the City should consider a policy to prohibit closed-loop potable in Class 1 and 2 wellhead protection zones, unless protection of water quality can be appropriately demonstrated.

Response to Comment #57

Comment #57 was from Jay Regenstreif, a planning engineer at the SPWSD. Mr. Regenstreif expressed concerns to the City regarding injection wells used for stormwater and geothermal water, particularly in Class 1 and Class 2 Wellhead Protection Zones. He requested that the City consider prohibiting these types of injection wells in Class 1 and 2 Zones.

AMEC's position on Mr. Regenstreif's comments on geothermal wells was covered in Comment #56. Mr. Regenstreif's comment regarding stormwater injection is another issue that should be studied when researching existing UIC wells in the City. Although requirements for stormwater injection appear to be sufficient, as discussed previously, a demonstrative standard should be considered, rather than a presumptive standard. Then, if the stormwater treatment technology cannot meet potable groundwater cleanup levels, as per WAC 173-340 and WAC 173-200, additional treatment would be required prior to discharge.

There is also risk to an aquifer by assuming that permit-compliant NPDES holders meet the potability requirements for discharge to aquifers as allowed under WAC 173-218-090(2)(c)(i). There are numerous differences between stormwater and potable groundwater quality criteria in

the numbers of analytes and allowable concentrations. Generally, stormwater quality criteria are less rigorous than potable groundwater criteria. Consequently, compliance with stormwater quality criteria may not be protective of groundwater quality for potable uses.

Recommendation Regarding Issue #2

The City should prohibit in CARAs new stormwater injection wells, and determine whether any of these wells exist in CARAs now. Existing and new stormwater injection wells in CARAs should be tested for compliance with drinking water standards, and if not in compliance, the water should be additionally treated to meet drinking water standards prior to injection.

References

Washington Department of Ecology, 2005. Stormwater Management Manual for Western Washington.

Washington Department of Ecology, 2006. Guidance for UIC Wells that Manage Stormwater, Publication 05-10-067, December 2006.