Seabold

Potential Seawater Intrusion Investigation

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Executive Summary

In 2006, chloride concentration in the Seabold Water Association drinking water supply well exceeded the city's early warning level for potential seawater intrusion. The city, Kitsap Public Utility District (KPUD), and the Kitsap Public Health District (Health District) conducted a 2-phase investigation to determine if elevated chloride was a regional issue and if the elevated chloride was due to seawater intrusion or a local point source of contamination.

Results indicate that elevated chloride concentration is localized to the Seabold well and not a regional problem.

Seawater intrusion of the Seabold well is unlikely, but it cannot be completely ruled out. Well water chemistry shows evidence of groundwater and saltwater interaction. However, by-products from the treatment of hardness, iron, and manganese are a potential source for chloride contamination in this well and could explain the rapid increase in chloride concentration (7.8 mg/L in 1998 to 1,300 mg/L in 2017) despite so little water use (this well has not been used other than to collect periodic water samples since the water system drilled a deeper well in 2007).

Northwest Water Systems and the city continue to monitor water level and chloride in the Seabold well. If chloride concentrations decline with time, it may be evidence that historic pumping of the well caused seawater intrusion. If chloride concentrations increase with time, a local point source of contamination may be the cause.

There appear to be no impacts to nearby wells.

Phase 1

Phase 1 was a desktop assessment of available water quality data for representative wells on the north end of the island north of Lovgreen Road to determine if water quality was indicative of seawater intrusion (Figure 1). Wells targeted for the assessment were those with a static water level elevation at or near sea level and a well screen interval in the Sea Level Aquifer or a similar shallow aquifer located at a depth of sea level to about 100 feet below sea level.

KPUD staff completed an assessment of data on file with the Health District and its own in-house database (APSFED) to examine records for private and public supply wells, both active and inactive, that met the construction criteria and had chloride analyses. About 230 wells had at least one chloride value in APSFED. Of those, less than 5 met the criteria, and none had unusual chloride values.

The review of water quality data from the Health District and KPUD files was followed up with a review of additional information from the Washington State Department of Health (DOH) water quality database for Group A and B public water systems. The Health District and KPUD requested water quality data from DOH[1] for 75 water systems with source wells that met the screening criteria. 16 systems had 25 chloride samples available for review. All results were well below any level of concern, and all conductivity readings were within normal range.

Phase 2

During Phase 2, city staff measured well water chemistry[1] in eleven representative public and private wells in the local vicinity of the Seabold Water Association well (Figure 1). Though one well (26/2E-29Q) initially exceeded the early warning level, subsequent confirmation sampling did not exceed the early warning level. The city intends to add this well to its routine annual chloride monitoring for future observation.

The city also monitored the Seabold Water Association well. Although this well is no longer in use, chloride concentration in this well remains high and has increased since sampling in 2006 (1,010 mg/L in 2006 to 1,300 mg/L in 2017). However, it is unlikely that seawater intrusion is the source of these results based on the following:

- The chloride concentration in the Seabold well is approximately 165 times the concentration found in a well in the same aquifer located approximately 150 feet to the south.
- The Seabold well is located approximately 500 feet from the shoreline. In order to induce seawater intrusion, pumping would have had to reverse the hydraulic gradient within the source aquifer. This has low probability given that the well was capable of just 5 gallons per minute and was pumped at an average of 2,463 gallons per day based on meter records between 12/4/2005 and 12/4/2007.
- Chloride concentrations increased over time, even though the Seabold well has been inactive since 2008.

An alternative potential source of chloride contamination is the by-products of water treatment. The well water is very hard (bicarbonate = 263 mg/L) and very high in iron and manganese. When the well was in use, the Seabold Water Association used an ion-exchange treatment which included the use of chlorine salt in the treatment process. If salt by-products were disposed of near the well or the brine solution used to backwash and regenerate the water softening process was discharged near the well, it is possible that chloride-enriched water infiltrated into the soils and migrated down to the well sceen. The well report (driller's log) indicates 23 feet of sand at the surface that

[1] Analytes requested and/or analyzed were chloride, conductivity, and major cations and anions.

is conducive to infiltration. Although no longer in use and disconnected from the current system, the original treatment system is still in place, and field staff observed stockpiles of sodium chloride salt in the well house. Treatment by-products as a source for chloride contamination could explain the rapid increase of chloride concentration despite so little water use (7.8 mg/L in 1998 to 1,300 mg/L in 2017).

Although seawater intrusion of the Seabold well is unlikely, it cannot be completely ruled out. Northwest Water Systems and the city continue to monitor water level and chloride in the Seabold Water Association well which may help to determine the source of chloride in time. If chloride concentrations decline with time, it may be evidence that historic pumping of the well caused seawater intrusion. If chloride concentrations continue to increase with time, a local point source of contamination may be the cause of high chloride.

There appear to be no impacts to nearby wells.

Figure 1. Study Area