

Using Two Mass Flux Methods to Evaluate Areas of TCE Discharge to a Creek

Background

Landau Associates and The Boeing Company have been investigating, monitoring, and performing cleanup actions on groundwater impacted with trichloroethene (TCE) since the mid-2000s:

- TCE impacts groundwater beneath ~3,000-ft of a wooded ravine. Groundwater flows parallel to a creek that shares varying levels of hydraulic connectivity to the adjacent aquifer; localized impacts from TCE discharge to a portion of the creek have been observed and are continually monitored.
- Boeing and the Department of Ecology agreed to an interim action to hydraulically control the TCE-impacted groundwater and minimize discharge to the creek with extraction wells. • An evaluation was performed to determine where extraction wells would be necessary to
- minimize discharge to the creek.
- Boeing implemented a groundwater extraction and treatment system that is containing TCE-impacted groundwater, has minimized TCE migration to the creek, and has reduced concentrations to below risk-based levels; regular system O&M and site monitoring is ongoing.

Characterization of TCE Discharge to Creek Required

- Based on groundwater contours and concentrations of TCE in the creek it appeared that TCE discharge was highest in the "upper area" and at the "lower area" of the site.
- The "mid-area" with a culvert and channelized section of the creek appeared to have negligible inputs of TCE.
- No extraction wells appeared needed in the mid-area, but Department of Ecology required greater certainty.
- A detailed investigation and evaluation of TCE flux into the creek was performed.





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- the creek.



TCE Flux Investigation (Two Methods)

To determine the location and magnitude of TCE discharge to the creek, an investigation was performed to evaluate TCE flux within and into the creek:

1. CREEK FLUX METHOD

• Step 1: Volumetric stream flow measurements and creek water quality data were collected at multiple locations along the creek. Flow and TCE concentrations were multiplied to calculate TCE mass discharge (µg/sec) passing each point within

• Step 2: The difference in mass discharge values between points was used to determine positive or negative flux of TCE to the creek (i.e., net difference between TCE discharge into the creek and volatilization out of the creek).

Comparison of Flux Methods

Boeing installed and continues to operate groundwater extraction wells which effectively minimize TCE discharges to the creek. The creek is monitored regularly and TCE concentrations remain below risk-based levels and continue to decline.







Two distinct TCE flux evaluation methods strongly correlate relative magnitude and location of TCE flux to creek.