To: Doug Wise / Portland Water Bureau

From: Matthew Kohlbecker, RG / GSI Water Solutions, Inc.

Date: July 3, 2019

Re: Review of *Annual Performance Report, 1 January 2018 – 31 December 2018; Five Year Remedy Performance Evaluation; East Multnomah County Troutdale Sandstone Aquifer Remedy; ECSI 1479*; dated May 31, 2019

This letter presents a review by GSI Water Solutions, Inc. (GSI) of the *Annual Performance Report, 1 January 2018 – 31 December 2018; Five Year Remedy Performance Evaluation; East Multnomah County Troutdale Sandstone Aquifer Remedy; ECSI 1479* (the report), prepared by Geosyntec Consultants, Inc. (Geosyntec), Landau Associates, Inc. (Landau), and S.S. Papadopulos & Associates, Inc. (SSPA), and dated May 31, 2019.

GSI's comments are organized into the following sections: (1) hydraulic capture assessment, (2) groundwater sampling frequency related to pilot shutdown of EW-1, (3) groundwater sampling frequency at monitoring wells, (4) concentration vs. time trends, (5) monitoring well decommissioning request, and (6) request for partial closure of Zone D.

(1) Hydraulic Capture Assessment

The report concludes that ". . . hydraulic capture continued to be achieved in 2018" (pg. 19) because "Groundwater elevations . . . indicate inward horizontal gradients towards the operating extraction wells" (pg. 11). The report is using a cone of depression to demonstrate hydraulic capture. However, this is not a technically correct method for demonstrating hydraulic capture.

Geosyntec used the same method to demonstrate hydraulic capture for the 2017 Annual Report, and GSI commented on this approach in our May 3, 2018, letter. We repeat those comments here. A cone of depression cannot be used to demonstrate hydraulic capture for two reasons:

- A cone of depression is not the same as a capture zone (see Fetter, 1992). In fact, a capture zone is smaller than a cone of depression.
- The report is using water levels measured in extraction wells to demonstrate capture. Water levels in extraction wells are not representative of water levels in the aquifer due to turbulent well losses.

Hydraulic capture can only be demonstrated by determining groundwater flowpaths, which are delineated from a cone of depression. It is difficult to determine, based on the information presented in the report, whether trichloroethene (TCE) is hydraulically captured at the site. GSI recommends that DEQ require Geosyntec to demonstrate hydraulic capture using a technically correct method. For a review of

the methods that are used to demonstrate hydraulic capture, please see Applied Hydrogeology by C. W. Fetter, 3rd Edition. Technically correct methods may show that TCE is hydraulically captured, which will provide the regulated public and stakeholders with confidence that the municipal groundwater supply is protected.

(2) Groundwater Sampling Frequency Related to Pilot Shutdown of EW-1

DEQ approved pilot shutdown of extraction well EW-1 on August 2, 2018, and Boeing/Cascade shut off EW-1 on August 31, 2018. A condition of the pilot shutdown of EW-1 was to increase monitoring at lower Troutdale Sandstone Aquifer (TSA) wells BOP-13(dg), BOP-31(dg), and D-17(dg) from yearly to quarterly, to monitor for any adverse effects of the shutdown of EW-1. When groundwater is sampled quarterly, samples are collected once each quarter of the year, or every three months. Therefore, if a well enters pilot shutdown in the third quarter of 2018, we would expect quarterly groundwater monitoring to begin in the fourth quarter of 2018. We reviewed the groundwater quality data in Table E-1 and found that, despite the shutdown of EW-1 in the 3rd quarter of 2018, neither BOP-13(dg), BOP-31(dg), nor D-17(dg) were sampled in the fourth quarter of 2018.

Without quarterly groundwater quality data, DEQ and the stakeholders are unable to evaluate whether shutdown of extraction well EW-1 is having adverse effects on groundwater quality. GSI recommends that: (1) Boeing and Cascade confirm that these wells are currently being monitored quarterly and, (2) that during future pilot shutdowns, quarterly sampling commence immediately during the quarter following the shutdown, so that any adverse effects of extraction well shutdown can be identified quickly, and corrective action, if required, can be taken.

(3) Groundwater Sampling Frequency at Monitoring Wells

We also noted that several wells that Boeing/Cascade is supposed to monitor quarterly (based on Table 2-2 of the report) were not sampled quarterly. This is illustrated in the table below.

Well ID	Monitoring Frequency [1]	Monitored Quarterly?			
		1st Q 2018	2nd Q 2018	3rd Q 2018	4th Q 2018
EW-1	Quarterly	Yes	Yes	Yes	Yes
EW-2	Quarterly	Yes	Yes	Yes	Yes
EW-14	Quarterly	Yes	Yes	Yes	Yes
BOP-13(ds)	Quarterly	Yes	Yes	Yes	No
BOP-13(dg)	Quarterly	No	No	Yes	No
BOP-31(ds)	Quarterly	No	No	Yes	No
BOP-31(dg)	Quarterly	No	No	Yes	No
D-17(ds)	Quarterly	Yes	Yes	Yes	Yes
D-17(dg)	Quarterly	Yes	No	Yes	Yes
EW-12	Quarterly	Yes	Yes	Yes	No
CMW-10(dg)	Quarterly	No	No	Yes	No
CMW-17(ds)	Quarterly	Yes	Yes	Yes	Yes
CMW-18(ds)	Quarterly	Yes	Yes	Yes	Yes
CMW-19(ds)	Quarterly	Yes	Yes	Yes	Yes

NOTE:
(1) From Table 2-2

GSI recommends that Boeing/Cascade provide clarification on why the samples in Table 1 were not collected (e.g., was this a DEQ-approved change that was not noted in Table 2-2?). In addition, recognizing that our review only checked that quarterly samples were collected, we recommend that Boeing/Cascade to confirm that all required biennial, annual, and semiannual samples were collected.

(4) Section 5.3, Concentration Time Trends

The text states that "Over the last five years, TCE concentrations have generally decreased except at two wells: D-17(ds) and CMW-18(ds)." GSI would like to point out that TCE concentrations are also increasing at City of Portland monitoring well PWB-1-LTS, which is located downgradient of the site in Zone A (see Figure 1, attached).

(5) Monitoring Well Decommissioning Request

Boeing/Cascade proposes to decommission the wells shown in the table below.

Well	Aquifer	History of Nondetects
BOP-22R(ds)	Upper TSA	ND, 2008 – 2018
BOP-60R(ds)	Upper TSA	ND, 2012 -- ??
CMW-8(dg)	Lower TSA	ND, 2007 – 2017
CMW-10(dg)	Lower TSA	ND, 2013 – 2018

NOTE:
ND = nondetect
TSA = Troutdale Sandstone Aquifer

GSI does not find any technical issues with the decommissioning based on the information presented in the report. Monitoring wells CMW-8(dg) and CMW-10(dg) are upgradient wells that are not necessary for demonstrating hydraulic capture. Monitoring wells BOP-22R(ds) and BOP-60R(ds) are downgradient wells that are helpful for demonstrating hydraulic capture, but other lower TSA wells [e.g., BOP-60(dg)] located closer to the TCE plume can be used to demonstrate capture, and are already being sampled on the same biennial interval as the wells planned for decommissioning.

(6) Partial Closure Request in Zone D [and monitoring well CMW-26(dg)]

The report states that "Restoration has been achieved in the remedy area located east of NE 205th Avenue (Remedy Zone D) and, therefore, we are recommending a partial closure (partial NFA) for this area of the remedy . . . Remedy objectives stated in the ROD have been achieved for the Upper TSA and the Lower TSA in Remedy Zone D."

According to the TSA Record of Decision (ROD), Remedial Action Objective (a) (RAO-a) is (EPA, pg. 6-1, 1996, emphasis added):

> Restore the TSA to protective concentrations in a reasonable time, if feasible. If not feasible, minimize the extent of the TSA containing VOCs above MCLs, or 1 x 10^{-6} excess cancer risk levels, whichever is more stringent, and provide long-term containment of areas where concentrations are above MCLs.

The TCE concentrations in the August 2018 (6.46 ug/L) and February 2019 (6.51 ug/L) groundwater samples from monitoring well CMW-26(dg), which is located in Zone D, exceed the MCL of 5 ug/L. In addition, because Boeing/Cascade shut off nearby extraction well EW-16 in October 2017, the MCL exceedances are not contained. Therefore, the data do not support the report's conclusion that "Remedy objectives stated in the ROD have been achieved." We recommend that no partial NFAs are issued until Boeing/Cascade is able to achieve the remedy objectives stated in the ROD.

The report also requests reducing groundwater quality monitoring at CMW-26(dg) from quarterly to semiannually. The report characterizes TCE concentrations in CMW-26(dg) well as exhibiting a "steady

increase" dating back to August 2017 (pg. 16). Based on the increasing concentrations in this well, we request that Boeing/Cascade continue to monitor the well quarterly.

Thank you for the opportunity to review the report and provide comments. Please do not hesitate to call or email if you have any questions.

Sincerely,

Matthew Kohlbecker, RG
Senior Hydrogeologist