



## King County

### Water and Land Resources Division

Department of Natural Resources and Parks  
King Street Center  
201 South Jackson Street, Suite 600  
Seattle, WA 98104-3855

**206-477-4800** Fax 206-296-0192

TTY Relay: 711

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## TECHNICAL MEMORANDUM

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December 20, 2016

TO: Wesley Kameda, Stormwater Services Section, Department of Natural Resources and Parks

FM: Eric Ferguson, LHG, Science and Technical Support Section, Water and Land Resources Division, Department of Natural Resources and Parks

RE: Horseshoe Lake Area Groundwater Monitoring – September/October 2016

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### Introduction

In September/October 2016, King County Environmental Lab staff and I re-sampled six monitoring wells that were part of the 2016 Horseshoe Lake Emergency Pumping monitoring effort in February/March 2016. We sampled each of the six monitoring wells one time on September 26, 28, 29 or October 6, 2016. No sample was collected from the seventh monitoring well, MW-13, which was dry (no water).

### *Comparison to Previous Results*

Overall, water quality is similar to the previous sampling event, see attached results. Differences from the previous event may be reflective of seasonal variability; however, additional sampling would be necessary to confirm this range. All sites had lower water levels in September/October compared to February/March levels.

### *Water Quality Summary*

The list of parameters analyzed was the same as the previous event (King County, 2016). Results for dissolved oxygen, conductivity, total suspended solids, turbidity, hardness, alkalinity differed slightly at all or most sites compared to previous sampling. Most sites had lower

dissolved oxygen and higher conductivity values compared to the earlier sampling event. This observation may be a reflection of regional aquifer water versus newly recharged water. Two wells (MW-12 and MW-27) had increases in hardness and alkalinity values compared to the earlier sampling event. Three wells (MW-12, MW-29, and MW-30) had lower turbidity and total suspended solids values during this event compared to earlier. Two wells (MW-10 and MW-27) had increased turbidity and total suspended solids values this event compared to earlier sampling. The increases in turbidity and total suspended solids are likely due to the sampling procedure. In particular, well MW-27 had a change in turbidity values from 2.1 to 27.8 NTU and total suspended solids values went from a non-detection (<1) to 26.3 mg/L. These changes are likely related to having only 5 feet of water in the well at the time of sampling. The sampling dynamics may have caused sediment at the bottom of well to become suspended due to pumping and to cause draw down yielding turbidity and total suspended solids values greater than waters that are flowing into the well.

### ***Groundwater Levels***

All sites had lower water levels at the time of sampling in September/October as compared to the February/March event. The range of change was from -4.6 to -13.2 feet, which the exception of well MW-13, which was dry and yielded a difference of more than 10 feet. Table 1 presents the depth to water data from the two sampling events and the relative difference. This range observed is similar to previously presented data showing the range of groundwater levels (Golder Associates, 2013).

Table 1. Depth to water measurements at the time of sampling. All units are feet.

Site	Feb/Mar 2016 Depth To Water	Sep/Oct 2016 Depth To Water	Difference
MW-10	98.2	107.2	-9.0
MW-12	46.1	58.6	-12.5
MW-13	38.6	Dry*	> -10*
MW-27	43.3	49.8	-6.5
MW-28	28.6	33.2	-4.6
MW-29	51.2	64.4	-13.2
MW-30	49.2	62.1	-12.9

\* = refers difference in depth to water data to bottom of well

### ***Summary of October 2016 Golder Associates Data***

Unrelated to the most recent sampling effort, Golder Associates shared additional groundwater level data related to the 2016 Emergency Pumping in October (Golder Associates, 2016). This information was for wells, MW-27 and MW-28. Because the continuous data logger at MW-28 failed, no data was available for the emergency pumping period. Well MW-27 continuous data

logger data was available. This data is transformed like the other data shared from Golder Associates. Attached are plots of water table elevation data for the emergency pumping period (2/1 – 4/10/2016). The water table shows changing levels that are likely related to recharge events and not the emergency pumping, especially when compared to wells MW-29 and MW-30 that show effects of infiltration.

### ***Summary***

In summary, six of the seven monitoring wells were sampled in September/October, 2016. The water quality results showed slight variability that is likely due to seasonal change and/or is an artifact of sampling during low water level periods. Additional data collection would be necessary to determine the range of variability at these wells.

If you have any questions, please do not hesitate to contact me at (206) 477-4690 or [eric.ferguson@kingcounty.gov](mailto:eric.ferguson@kingcounty.gov).

### References:

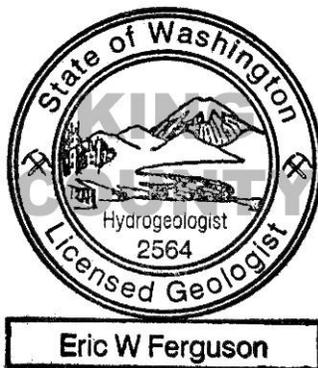
- Golder Associates. 2013. Technical Memorandum – Reserve at Woodlands Hydrogeologic Information, King County, Washington. Date: November 13, 2013. Prepared by James Johnson, Golder Associates, Redmond, Washington.
- Golder Associates. 2016. Personal communication with Michael Klisch – re: groundwater well information and water level data. Email communication – 10/03/2016.
- King County. 2016. 2016 Horseshoe Lake Emergency Pumping Groundwater Monitoring. Prepared by Eric Ferguson, Water and Land Resources Division. Seattle, Washington.

### Attached data files:

King County Environmental Lab Analytical Report (water quality results)  
Groundwater level data for Well MW-27

***RE: Horseshoe Lake area groundwater monitoring – September/October 2016***

The technical materials contained in this report were prepared under the supervision of a licensed hydrogeologist, whose seal appears below.



Eric W. Ferguson, LHG  
King County Department of Natural Resources and Parks

December 20, 2016  
Date