



April 8, 2022

**Certified Mail No. 7010 1870 0002 9226 6584**

Drew Dittman  
Lake City Engineering  
126 E. Poplar Ave.  
Coeur d'Alene, ID 83814

Dear Mr. Dittman:

The Idaho Department of Environmental Quality (DEQ) received a document completed by Inland Earth Sciences (IES) regarding the Bayshore Estates Development located in Post Falls, Idaho titled "Estimation of Hydraulic Conductivity by Grain-Size Analysis, Nutrient-Pathogen Evaluation level 2, Bayshore Estates Subdivision, Post Falls, Idaho" dated March 14, 2022. The report was reviewed and DEQ has the following comments and questions:

1. There are still outstanding questions and comments related to the May 11<sup>th</sup> and 12<sup>th</sup> 2021 aquifer test results as described in DEQ's letter dated October 4, 2021. Until these questions and comments are addressed the 200 feet/day hydraulic conductivity value derived from the aquifer testing referenced in your March 14<sup>th</sup> letter is not considered a representative value.
2. There are specific input parameters for each of the equations used to estimate the hydraulic conductivity that are estimated and are not measured. Using the HydrogeoSieveXL spreadsheet and the grain size analysis results for Wells A and B as described by IES along with a range of porosity (0.2 to 0.4) and C values (low and high as made available in the spreadsheet) resulted in a wide range of corresponding calculated hydraulic conductivity values. The hydraulic conductivity for Well A ranged between  $4.2 \times 10E^{-3}$  and 7,292 feet per day for the analysis that met the criteria. The hydraulic conductivity for Well B ranged between 1.24 and 2,273 feet per day for the analysis that met the criteria. The large potential range of calculated hydraulic conductivity values require better definition of the input variables for use in any subsequent analysis.
3. The use of grain size analysis to determine hydraulic conductivity for critical analysis as compared to measured values has limitations as described in numerous documents. Additional justification would be required and better definition of the input variables for use in any subsequent analysis.
  - Devlin, J.F., 2015. HydrogeoSieveXL: an excel-based tool to estimate hydraulic conductivity from grain-size analysis.  
*"At the same time, it must be conceded that after more than a century of trying, the goal of obtaining a value of K in the laboratory that is fully representative of K in an aquifer has yet to be achieved (Rosas et al., 2014)"*
  - Vukovic, M., Soro, A. 1992. Determination of hydraulic conductivity of porous media from grain-size composition. Water Resources Publications.  
*"On the basis of the results of this analysis, a significant deviation was obtained for hydraulic conductivity, computed by the empirical formulas, from the representative values; the factor was as high as 50 or more".*

*"The application of these formulas for determination of hydraulic conductivity, from the grain-size composition of materials, results in more than 80% of cases involving deviations with values two times higher or lower than the corresponding real values of this important conductivity characteristics"*

- Rosas, J. et al., 2014. Determination of Hydraulic Conductivity from Grain-Size Distribution for Different Depositional Environments. Groundwater. Vol 52, No. 3.  
*"It was found that most of the hydraulic conductivity values estimated from empirical equations correlated poorly to the measured hydraulic conductivity values with errors ranging to over 500%".*
- Vienken, T., Dietrich, P., 2011. Field evaluation of methods for determining hydraulic conductivity from grain size data. Journal of Hydrology 400.  
*"Based on these results, the applied formulas appear to be suitable for an initial assessment of aquifer K. However, considering the difference in K mean values, results are not sufficiently reliable for high resolution analysis of K variations needed for flow or transport modeling".*

Please let us know if you have any questions or would like to discuss this further. Thank you.

Sincerely



Gary Stevens P.G.  
Waste Management & Remediation Manager  
2110 Ironwood Parkway  
Coeur d'Alene, Idaho 83814  
208-666-4627  
[gary.stevens@deq.idaho.gov](mailto:gary.stevens@deq.idaho.gov)

- c. Seth Oliver, DEQ  
Dan McCracken, DEQ  
Ed Hagan, DEQ  
Kevin Freeman, Inland Earth Sciences, [kfreeman@inlandearth.com](mailto:kfreeman@inlandearth.com)  
David Callahan, Kootenai County, [dcallahan@kcgov.us](mailto:dcallahan@kcgov.us)  
Jesse Goetz Family Ltd Partnership, Property Owner/Applicant, P.O. Box 338, Bayview, ID 83803