

Debbie Beadle

From: Greg Krabbe <gkrabbe@comcast.net>
Sent: Monday, April 15, 2013 12:48 PM
To: Evan Maxim; Debbie Beadle
Subject: ECA - submittal to record
Attachments: 12-05384-000 Krabbe letter 2013 03 19.pdf

Debbie, Evan,

Please find a response from Rob Zisette to Mr Welches Limnological account of the phosphorus loading in Lake Sammamish and enter it into the record.

Thanks.

Greg Krabbe
GFK Consulting Inc
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EXHIBIT NO. CC32.



March 19, 2013

Mr. Greg Krabbe
KKBL Ventures 575 LTD
335 Park Place Center, Suite G111
Kirkland, WA 98033

Subject: Comments on March 12, 2013, Letter from Dr. Gene Welch

Dear Greg:

As you requested, I reviewed the letter dated March 12, 2013, from Dr. Gene Welch to the Sammamish City Council regarding Lake Sammamish quality and the “erosion hazard near sensitive water overlay” (Exhibit CC12). Dr. Welch presented data on average total phosphorus concentrations in Lake Sammamish for seven periods of time since 1964. These data show that average total phosphorus (TP) concentrations in the lake have not changed since 1981 based on annual whole lake TP concentrations (ranging from 17 to 19 µg/L) or summer epilimnion (surface layer) TP concentrations (ranging from 11 to 13 µg/L). However, summer hypolimnion (bottom layer) TP concentrations have decreased 27 percent (from 26 to 19 µg/L) since 1981 (see Dr. Welch’s Figure #2).

Dr. Welch suggests that the observed decrease in summer hypolimnion TP concentration is directly related to a decrease in internal phosphorus loading that may have been equivalent to an increase in external phosphorus loading from development, resulting in no change in the annual whole lake concentration. He supports this explanation by showing a positive correlation ($r^2 = 0.72$) of annual whole lake TP as a function of summer hypolimnion TP concentration (see Dr. Welch’s Figure #3). However, a positive correlation does not exist between these variables for data collected since 1981 because historical inputs of wastewater resulted in high internal phosphorus loading for approximately 20 years after wastewater diversion in 1968, but residual effects of historical wastewater inputs on TP loading are currently likely to be very small to none.

An alternative explanation for the observed decrease in summer hypolimnion TP concentration and no change in the annual whole lake TP concentration is that the decrease in summer hypolimnion TP concentration represents a very small and insignificant decrease in the total TP loading since 1981. Phosphorus loading measurements in 1992 showed that internal loading accounted for only 14 percent of the total loading, while external loading accounted for the remaining 86 percent (see Perkins et al. 1997, cited by Welch). Furthermore, the lake TP simulation model predicted that internal loading would not significantly change from 1992 to



full watershed build-out, and the proportion of total TP loading would decrease from 14 to 12 percent for internal loading and increase from 38 to 57 percent for single family residential development (see Perkins et al. 1997, cited by Dr. Welch). Thus, a significant effect on the annual whole lake TP concentration would not be expected from a small decrease in a minor source of TP loading (i.e., estimated to be an overall 4 percent decrease in the total TP loading since 1981 due to reduced internal TP loading that did not exhibit a measureable effect on the whole lake TP concentration).

Dr. Welch also suggests that reduced inflow to the lake and increased development restrictions may account for the stable annual whole lake TP concentration concurrent with a decreasing summer hypolimnion TP concentration. He presents total annual flows in Issaquah Creek that show a highly variable but overall decreasing trend since 1964 (see Dr. Welch's Figure #4). However, the average total annual stream flow has recently exhibited a 15 percent increase from 1,192 cfs in 1999-2004 to 1,376 cfs in 2005-2011 when development has increased and there has been no change in the annual whole lake TP concentration. Because external loading is the product of inflow volume and TP concentrations and inflow volume has increased in recent years, these results indicate that inflow TP concentrations in watershed runoff have decreased while development has increased, likely due to increased stormwater management requirements for increased flow control, erosion and sediment control, and stormwater treatment requiring at least 50 percent removal of TP from development runoff. This observation supports our previous conclusion that development on shallower slopes within the erosion hazard area would not significantly increase TP loading to Lake Sammamish if stormwater TP removal requirements are met (see letter dated July 27, 2012).

Long term trends in external TP loading to Lake Sammamish should be evaluated using historical TP concentration and flow data collected for watershed streams by King County, USGS, and others. Residuals from regression analyses of TP and hydraulic loading should then be compared to temporal changes in watershed development (using areal land cover analysis) and stormwater management requirements to quantify their effects on TP loading to Lake Sammamish. Herrera has successfully evaluated long term trends in TP loading in other watersheds using this methodology, and would be happy to submit a proposal to conduct this analysis for making informed development and stormwater management decisions by the City of Sammamish and other jurisdictions in the watershed.

Herrera Environmental Consultants, Inc.



Rob Zisette
Water Quality Principal