TD2
engineering
& surveying

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September 11, 2020

Board of Directors
West Shores Homeowners Association
P.O. Box 97
Waterloo, Nebraska 68060-0097

RE: West Shores Lake Bathymetric Change Analysis
TD2 File No. 200-20-115

Dear Board of Directors:

Thank you for the opportunity to be of service. We have had the opportunity to review the hydrographic survey data gathered on July 15-17, 2020. This data was used to create the bathymetric map from Stockwell Engineers dated 8/6/2020. We have compared this hydrographic data relative to the hydrographic survey data generated by these offices on July 13, 2001. We provided the TD2 horizontal survey coordinates used in 2001 to Stockwell prior to their hydrographic survey work. This was done to ensure the hydrographic data was sampled in the same relative locations over time. Stockwell indicates the equipment they use for hydrographic surveys is accurate to 0.50 feet. This is the same margin of error for the equipment TD2 used in 2001. Attached, as Exhibit A, is a copy of sheet 3-6 from EM 1110-2-1003 Hydrographic Surveying from the U.S. Army Corps of Engineers. Contained in it is a table of Depth Accuracy Standards based on performance test results. The table indicates accuracy standards of 0.3 feet repeatability with a 0.8 ft standard deviation on soft sand dredged surfaces.

Also attached as Exhibits B and C, respectively, are tables of the aforementioned hydrographic survey coordinates and the relative change in elevation at each location. We have provided tables of these coordinates in numerical order and in order of magnitude of change. There are seven coordinates labeled with a numeral with no data. These are omitted from the magnitude of change table. A negative elevation change indicates the elevation of the surface of the lake bed at that coordinate has decreased since 2001. A positive number indicates the surface of the lake bed has risen at that coordinate location since 2001. These coordinates are plotted on a map of the lake to allow review of individual locations of interest. This map is attached as Exhibit D.

In addition, we have provided a map of the cross sections used in our calculations (Exhibit E) and the cross sections themselves (Exhibit F). The cross sections indicate areas of increase or decrease in lake bed elevations.

Finally, we have provided a color coded map indicating the changes in elevations (Exhibit G). Each of the 10 colors indicates a range of change. Blue means an increase and red means a decrease in lake bed elevation. Darker shades indicate greater changes.

Using the 881 coordinate cut/fill points surveyed, the average change is -0.086 feet (approximately one inch). The median change is -.0020 feet (approximately ¼ inch). Each of these numbers is within the accuracy tolerances of the equipment used for both hydrographic surveys.

Assuming the measurements are perfectly accurate for both surveys, we arrive at the following calculations:

Total volume of water in lake at the time of the 2020 hydrographic survey was 3,859,856 cubic yards (for reference)

The volume difference indicated by cross sections between the 2001 and 2020 hydrographic surveys:

164,287 cubic yards lost

141,174 cubic yards gained

TOTAL DIFFERENCE is 23,113 cubic yards lost (lost material from bottom of lake) (.006 increase of total lake volume)

In my professional opinion, given the accuracy tolerances of the hydrographic equipment, the data indicates no significant change in the lake volume between 2001 and 2020.

Respectfully submitted by,

THOMPSON, DREESSEN & DORNER, INC.

Douglas S Dreessen, P.E.

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DSD/lad