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November 20, 2019

Kevin Nordquist
Jackson County Auditor-Treasurer
405 4th Street
Jackson County, MN 56143

RE: Supplemental Information to the Final Engineer's Report
Judicial Ditch No. 24 Improvement
BMI Project No.:S12.107995

Dear Mr. Nordquist:

The intent of this letter is to provide supplemental information to the Final Engineer's Report for the proposed Judicial Ditch No. 24 Improvement project in Jackson County. At the continuation of the Final Hearing on September 23, 2019, additional information was requested from the Drainage Authority regarding the Adequacy of the Outlet portion of the Final Engineer's Report.

In the Final Engineer's Report, the Adequacy of the Outlet analysis assumed that the peak design event flow rates for the improved tiles coincided with the peak flow rate in the JD 24 open ditch. The analysis used the difference between the Manning's equation capacity of the existing and proposed tiles for Branches Q, S, T, and U. Because Branch B is designed with a WASCOB / storage basin at the outlet, a HydroCAD model was used to determine the change in the peak flow rate at Branch B for the design event. The methodology used in the FER determined that the Improvement will result in a net increase of 6 cfs to the peak flow rate of the JD 24 open ditch.

The Drainage Authority directed us to revisit the analysis and develop a model of the system to consider the impact of timing of the existing peak flows and the timing of the proposed peak flows on the JD 24 open ditch. The watersheds within the improvement areas were modeled in detail to include the existing tiles, roadway culverts, and existing low areas within the fields. The contributing watershed to the JD 24 Main open ditch upstream of Branch T and Branch U is approximately 14,500 acres. The contributing watershed to the JD 24 Main open ditch downstream of 330th Avenue, excluding the Branch B watershed, is approximately 4,190 acres. The existing conditions model was calibrated by estimating the time of concentration for these two large watersheds to generate the existing peak flow rates obtained by the US Geological Survey "StreamStats" program for the 10-Year event. The 14,500-acre watershed time of concentration was calibrated to obtain the existing 10-Year event peak flow rate of approximately 527 cfs at 330th Avenue. The 4,190-acre watershed time of concentration was calibrated to obtain the existing 10-Year event peak flow rate of approximately 611 cfs at the JD 24 Main open ditch at Branch B.

Figure 1 below shows the existing conditions hydrograph at 330th Avenue for the 10-Year event. The initial peak on the graph is from the JD 24 watershed upstream of 330th Avenue. The second peak on the graph is from the 14,500 acre watershed that is upstream of JD 24. As can be seen on the graph, the majority of the water and peak flow is from the 14,500 acre watershed upstream of JD 24.

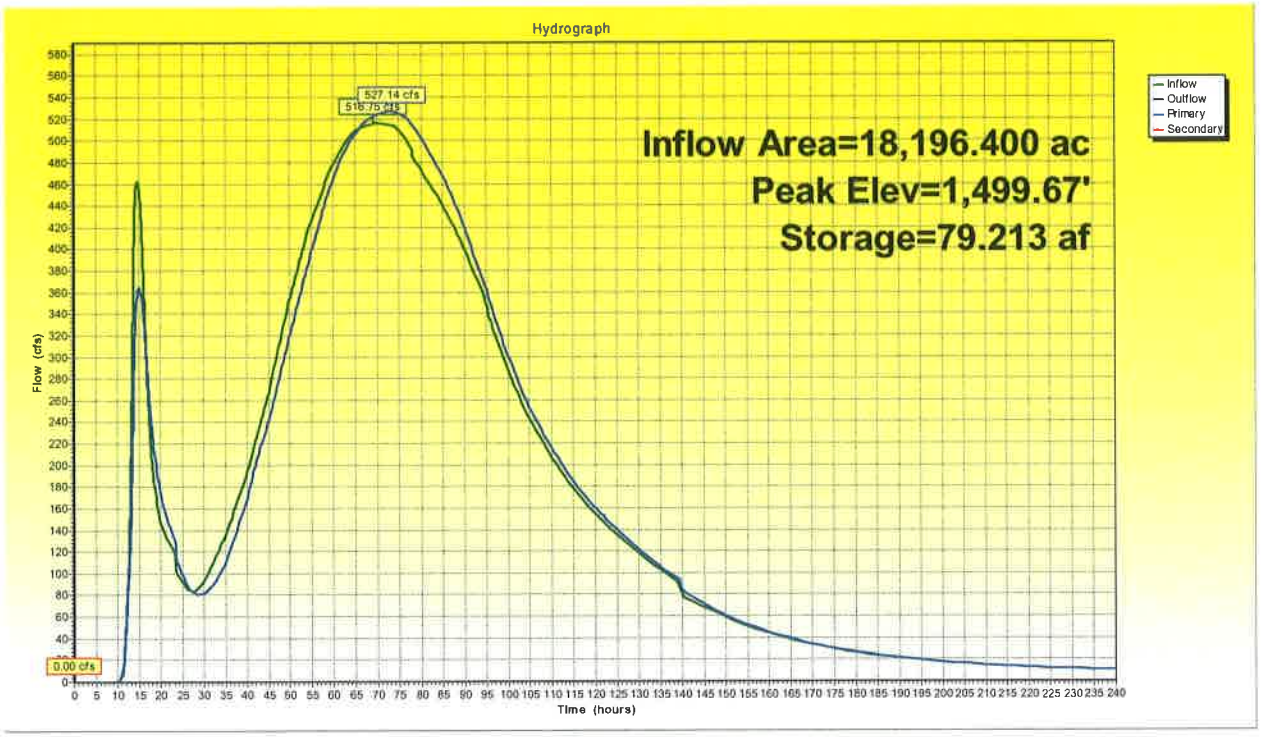

Figure 1 - Existing Conditions, 330th Avenue, 10-Year Event

For the proposed conditions model, the proposed tile sizes, slopes and elevations were used to replace the existing tiles. The Branch B and Branch T WASCOBS were also added into the proposed conditions model. A summary of the existing versus the proposed peak flows at 330th Avenue and at the Main open ditch at Branch B are in the table below.

Change in JD 24 Open Ditch Peak Flow Rate at 330th Avenue					
	2-Year	5-Year	10-Year	25-Year	50-Year
Existing Peak Flow (CFS)	254.9	381.9	527.1	741.3	949.9
Proposed Peak Flow (CFS)	256	382.7	557.8	774.8	969.1
Change (Pro-Ex) (CFS)	**1.1**	**0.8**	**30.7**	**33.5**	**19.2**
Change in JD 24 Open Ditch Peak Flow Rate at Branch B					
	2-Year	5-Year	10-Year	25-Year	50-Year
Existing Peak Flow (CFS)	303.8	455.9	610.4	849.1	1061.9
Proposed Peak Flow (CFS)	285.2	464.3	623.9	866.1	1087.2
Change (Pro-Ex) (CFS)	**-18.6**	**8.4**	**13.5**	**17.0**	**25.3**

As can be seen from the above table at 330th Avenue the existing peak flow rate for the 2-Year and 5-Year events are similar for the proposed 2-Year and 5-Year events, and there is an increase of 20-30 cfs for the 10-Year and 50-Year events with an average increase of 17 cfs over the five events. The change in the peak flow in the open ditch at Branch B is less for the 2-Year event, and between 8-25 cfs for the 5-Year and 50-Year event with an average increase of 9 cfs over the five events. The large reduction in the peak flow for the 2-Year event is because of the Branch B WASCOB.

Figure 2 shows the proposed conditions hydrograph at 330th Avenue for the 10-Year event. There are still two peaks to the hydrograph however the initial peak from the JD 24 Improvement watershed is higher than the existing conditions. However, this higher peak allows the water from the Improvement watershed to be moved downstream before the peak runoff from the 14,500 acre watershed arrives.

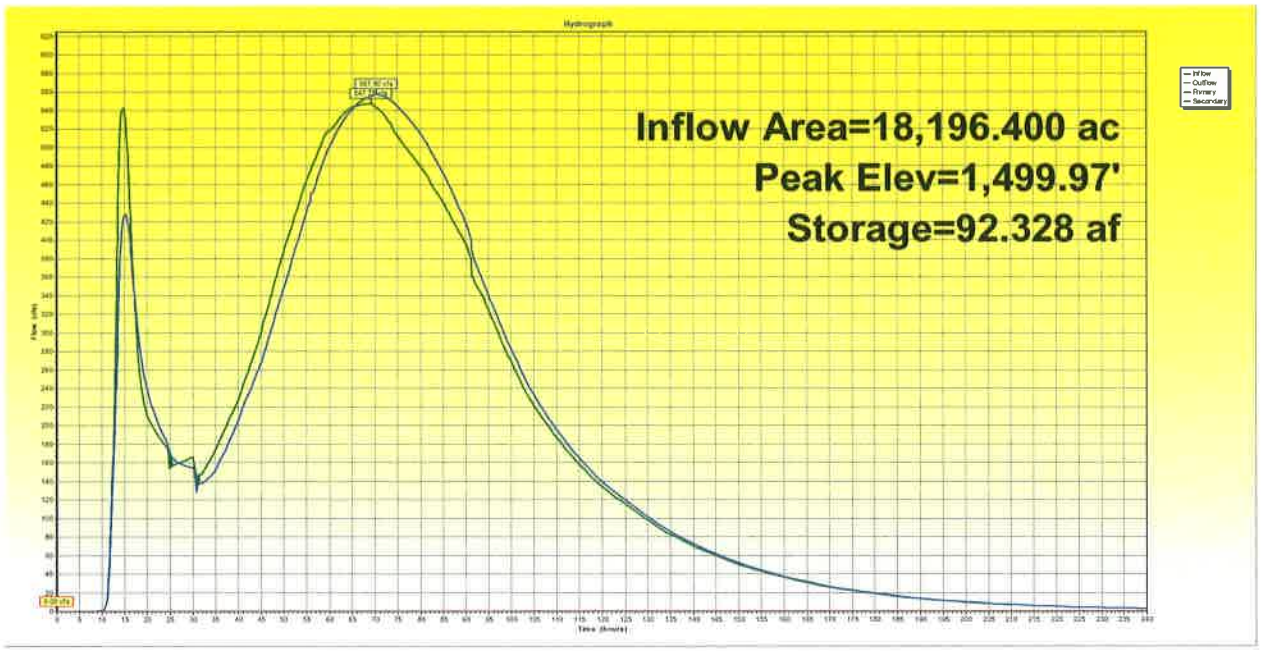

Figure 2 - Proposed Conditions, 330th Avenue, 10-Year Event

A summary of the existing versus the proposed peak elevations at 330th Avenue and at the Main open ditch at Branch B are in the table below. The peak flow is reduced by 0.3' for the 2-Year event and is increased by 0.2' to 0.3' for the 5-Year and greater events.

Change in JD 24 Open Ditch Peak Elevation Upstream of 330th Avenue					
	2-Year	5-Year	10-Year	25-Year	50-Year
Existing Peak Elevation	1496.5	1498.2	1499.7	1501.4	1502.7
Proposed Peak Elevation	1496.2	1498.4	1500	1501.6	1503
Change (Pro-Ex) (FT)	**-0.3**	**0.2**	**0.3**	**0.2**	**0.3**
Change in JD 24 Open Ditch Peak Elevation Downstream of 330th Avenue					
	2-Year	5-Year	10-Year	25-Year	50-Year
Existing Peak Elevation	1496.5	1498.1	1499.5	1501.3	1502.7
Proposed Peak Elevation	1496.2	1498.3	1499.8	1501.5	1503
Change (Pro-Ex) (FT)	**-0.3**	**0.2**	**0.3**	**0.2**	**0.3**

Summary

The proposed conditions model of the change in peak flow rates in the JD 24 Main open ditch at Branch B fluctuates between -18.6 cfs and 25.3 cfs. The 10-Year event for which the model was calibrated for returned a 13.5 cfs increase in the peak flow rate, and the average peak flow rate for the five events is 9 cfs. While this is higher than the 6 cfs increase calculated using the FER methodology, it is still a significant decrease from the 58 cfs increase in the peak flow rate from the PER.

The results of this analysis furthers our opinion that the outlet is adequate for the proposed Improvement.

Additional copies of this information should be distributed to the County Board members prior to the continuation of the Hearing.

Please feel free to contact me with any questions.

Sincerely,
Bolton & Menk, Inc.

Shaun P. Luker, P.E.

cc: Petitioners
Jeff Braegelmann, Petitioner's Attorney
Tim Stahl P.E., County Engineer
Dave Macek – County Ditch Inspector
Royal Larson, Agriland Management & Reality, LLC
Ron Ringquist – Ditch Viewer
Katy Thompson P.E. - Respec