

STATE OF MINNESOTA
OFFICE OF ADMINISTRATIVE HEARINGS

FOR MINNESOTA DEPARTMENT OF NATURAL RESOURCES

In the Matter of the Dam Safety and Public
Water Work Permit Application 2016-
0386 for the Fargo-Moorhead Flood Risk
Management Project, Clay and Wilkin
Counties, Minnesota, and Cass and
Richland Counties, North Dakota

DECLARATION OF CHARLES
ANDERSON

1. I am a licensed engineer in the State of Minnesota since 1977 and hold a bachelor's degree in civil engineering. My primary field of practice and expertise has been working with watershed districts and water resource management. I am currently a Senior Professional Engineer of the water resources department within Widseth Smith Nolting (WSN).
2. Our department specializes in water resource management relating to flood control, storm water, and water quality. I have extensive experience in drainage and flood control projects. My work in flood control involves, among other things, extensive study of the use of distributed storage in the Red River Valley, work for watershed districts in connection with flood control and mitigation, and on comprehensive strategies to manage flooding in the Red River Valley. I was a primary architect of the Red River Basin Commission 20% Flow Reduction Strategy that was incorporated into their Long-Term Flood Solutions 2011 report. I serve on the Technical and Scientific Advisory Committee ("TSAC") for the Red River Basin Flood Damage Reduction Work Group and on the

Basin Technical and Scientific Advisory Committee (“BTSAC”) for the Red River Retention Authority.

3. My review of the Fargo-Moorhead diversion project previously played a significant role in identifying the potential for downstream flooding by the Locally Preferred Project as it was proposed by the Diversion Authority in the original 2010 Draft and Final Environmental Impact Statement. My involvement in flood control matters affecting the Fargo Moorhead Metropolitan Area spans a period of many years. In addition to being involved in developing a Red River basin wide strategy for flood control, I have long advocated the need for improved protection in the FM area. However, my active involvement with the Fargo Moorhead Diversion Project has been working with entities who opposed the project as designed. First, I was involved with downstream interests that would have been impacted by the originally proposed project. Currently, I am involved with upstream interests that would be impacted by the staging area that was added to the project to mitigate the downstream impacts.
4. Most recently, I was invited to participate as a member of a Technical Advisory Group that was charged by the Fargo-Moorhead Area Flood Diversion Task Force with assessing project components and alternatives. Throughout my entire period of involvement, I have maintained a basin wide perspective. That is, I have advocated for local flood solutions that do not exacerbate the basin wide flooding problem and, to the extent practicable, that also work toward a basin wide solution.
5. Basin hydrology in general, and particularly the Red River Basin hydrology is a very complex subject. Over time, complex mathematical processes have been developed to aid in hydrologic analysis. Despite these technological advancements (and sometimes

because of them) it is easy to be overwhelmed by data and lose sight of fundamental principles involving both science and policy. At the risk of oversimplification, the following is a brief discussion of those principles as they relate to the Diversion Project:

- a. **Maximize Benefits-Minimize Adverse Impacts.** The overall goal of public water resource projects is to maximize benefits while minimizing adverse impacts (including cost). Proponents tend to focus on the benefits whereas opponents tend to focus on the impacts. In question may be the legitimacy of the benefits and adequate consideration of the impacts.
 - b. **Transference Principle.** Floodwater that is reduced or excluded from one area will necessarily show up somewhere else, likely with adverse impacts.
 - c. **Avoid Protecting Undeveloped Floodplain.** Few would question the legitimacy of excluding water from highly developed urban areas. However, adding flood protection to undeveloped existing floodplain areas with the intent or effect of promoting their future development has not (at least in recent years) been considered wise public policy. This principle is the basis for the state and federal policies that prevent unwise development of floodplain.
 - d. Displaced waters should best be added to areas that would not necessarily be impacted or are already impacted by floodwaters.
6. **Storage.** Storage is key to understanding the hydrologic impacts of most projects. When water is going into storage, downstream flows are reduced. As water comes out of storage, downstream flows are increased.
- a. Storage is a naturally occurring phenomenon in virtually all watershed and river basin systems. Lakes and wetlands are obvious examples of storage. This may be

referred to as level-pool storage. Less obvious but equally important is in-transit storage. As flows increase and river stages rise, the volume of moving water within and adjacent to the river channel increases. Even though the water may be moving and is not level the storage effect is the same.

- b. Mountain streams have relatively minor in-transit storage because most of the water stays within or close to the channel. Conversely, the Red River, because of its broad floodplain, has a huge amount of in-transit storage.
7. The proposed Flood Risk Management Project, AKA the FM Diversion Project, includes many features that affect storage.

Levees

- a. The levees (many of which already exist) have the relatively straightforward effect of restricting water from entering a portion of the floodplain, thereby reducing natural flood plain storage.
- b. Levees may also have the effect of blocking flow that would have occurred across the natural floodplain area. That would have the effect of raising water levels upstream which would add storage above the natural floodplain elevation. That appears likely to be an effect of the existing levee system, offsetting a portion of the lost floodplain storage behind the levees.

Diversion Channel

- a. **Diversion channels tend to reduce storage.** A diversion channel that carries Red River water around the metro area from upstream to downstream would have the effect of lowering water levels along that reach of the river and at the

upstream end. This would diminish both upstream storage and the in-transit storage.

- b. The Corps NED project, a diversion channel on the Minnesota side, would have had those effects.
- c. The Locally Preferred Project, a Diversion Channel on the North Dakota side, has the additional effect of reducing in-transit storage on the Sheyenne River and its tributaries the Maple and Rush Rivers. The diversion channel would run through a vast floodplain area associated with those streams, resulting in a major loss of natural floodplain storage.

Staging Area

- a. The staging area adds a major volume of flood storage and as such has the effect of diminishing downstream flows. As a flood control measure, adding storage at that location had the potential to provide both local and basin scale downstream benefits. Unfortunately, from a basin perspective, it is only designed and operated to mitigate the downstream impacts of the levees and the diversion channel.

8. **Timing.** Timing is a key concept in predicting the downstream impacts of various project alternatives. Each tributary area tends to contribute water to locations on the mainstem during different periods of the flood. For simplicity, we have referred to those areas as early, middle, and late corresponding to when most of the water arrives relative to the flood peak. It would obviously be preferable to reduce, or at least not increase, the amount of water that arrives during the peak/middle period. The drainage area upstream from Fargo tends to contribute most of its water late to the flood at the basin outlet.

Therefore, from a basin perspective you wouldn't want to speed up the delivery of water from this area.

9. Unfortunately, the signature feature of the project, the diversion channel, and the levee system do speed up delivery of water from this area by reducing the storage effect. In recommending this alternative, the Corps apparently valued the local advantages of a diversion channel over its basin scale adverse impacts. The advantage of diversion channels over levees and dams is that, while their design capacity may be exceeded, there is virtually no probability of abrupt and potentially catastrophic failure.
10. Upon giving proper recognition to the downstream basin impacts, the Corps recommended adding the staging area to provide storage for mitigation. A preferable approach at that point in time would, in my opinion, have been to revisit the alternatives and select one with less downstream impact.

Alternatives

11. Alternatives to the project as proposed have been advanced by project opponents.
12. **Distributed storage.** Providing a basin wide goal of 20% peak flow reduction, has been a widely recognized and adopted Red River Basin flood damage reduction objective. Once in place, it would significantly reduce but not eliminate the flood threat to the Fargo Moorhead Metropolitan Area. Its major drawbacks are its unknown timeframe and uncertainty of implementation. As a longtime advocate of distributed storage, I believe that it should be included as part of the long-term flood solution for the FM area. I do agree that it should not be counted on to provide immediately needed 100-year protection. But it will, over time, increase the level of protection and reduce impacts.

13. **NED Design.** The Corps originally recommended construction of its NED Project, a diversion channel located in Minnesota, as it was shown to have the greatest net economic benefit. Largely overlooked was the fact that it also had the least downstream impact. Apparently, that factor was not considered important because, at that time, the Corps did not believe the downstream impacts of any of the alternatives were significant enough to be considered a taking. The Minnesota Diversion channel generally would run through higher ground than much of the North Dakota Diversion called the LPP. When a channel is routed through floodplain, it naturally drains that floodplain during flood events. That fact, often produces local support for routing the channel through floodplain, because the adjacent floodplain is reduced and may now be developed. Advocates for floodplain development may call that conversion a benefit, even though it creates negative impacts elsewhere in the basin.
14. The Minnesota Diversion did not have local support due to no perceived flood control benefits along and adjacent to its alignment. The North Dakota Diversion on the other hand, clearly would provide floodplain development benefits along its alignment. As discussed above, those additional benefits of the North Dakota alignment cause the additional downstream impacts. Therefore, in my opinion, consideration of the Minnesota alignment should have been revived.
15. Although the Minnesota Diversion would not provide adjacent flood control benefits it may be possible to add multipurpose benefits that would garner local support. As an example, I have suggested including transportation benefits by incorporating a TH 75 bypass within the diversion channel corridor.

JPA North Dakota Channel Alternative

16. At the request of the Joint Powers Authority we explored the potential for reducing project impacts by making major changes to the North Dakota Diversion alignment. We targeted two areas that we had identified where the greatest amount of existing floodplain storage was being displaced. One was the expansive floodplain area northwest of Fargo near the confluences of the Sheyenne, Maple, and Rush Rivers. The other was an area to the south of Fargo between the existing urban development and the proposed dam that would form the staging area.
17. Based on our rough modeling analysis we were able to show reductions in impact for both areas of alignment change. The most significant reductions were associated with the changed alignment northwest of Fargo.
18. Upon joining the Technical Advisory Group early in 2018, we were able to take advantage of their members' well developed hydrologic knowledge and skill set to refine the proposed alignment changes. Initial focus was on the northwest area, which we had found to have the greatest effect. The results of their incorporated minor alignment changes and more detailed analysis indicated similar impact reductions with improved buildability. Unfortunately, there was not sufficient time allotted to complete a more detailed analysis of the south area.
19. Based on that work that was done on the JPA concept, the Technical Assistance Group of engineers found that the JPA's alignment changes would lower the staging area elevation by at least 5.4 feet to 916.2. These results clearly justified further analysis, which in my judgment would likely have led to further improvements. However, further analysis of

alignment changes was cut short by the Diversion Authority's decision to apply for permits for another alternative.

20. With additional time and resources, there is little doubt in my mind that several other changes that have been suggested would result in additional improvements.

Second Permit Application

21. The Diversion Authority has applied for a permit to construct a revised version of the project. The revisions are all related to dam alignment of the staging area. There are no apparent changes to the diversion channel alignment. Therefore, the benefits and impacts associated with the loss of floodplain storage in that area are unchanged. As in the previous version of the project, the downstream impacts of the diversion channel are fully mitigated by storing water in the staging area. The location of the stored water has shifted somewhat resulting in less upstream impact in Minnesota and more in North Dakota. In my view, this latest version of the project represents an improvement, however minor.
22. To summarize. This project got off to a bad start by proposing the least basin plan compatible alternative, a diversion channel, and did not include any version of storage. Making matters worse, the locally preferred option protects and promotes development of existing undeveloped floodplain, a dubiously legitimate objective. The addition of storage, by way of the staging area, was a major improvement in that it mitigated the downstream impacts of the diversion channel, but consequently added upstream impacts. Those upstream impacts should be minimized by reducing the nonessential loss of existing floodplain storage.

23. The engineering capability exists to greatly improve this project. However, that will only happen when the direction given to those engineers shifts from maximizing benefits to minimizing impacts.

I declare under penalty of perjury, pursuant to Minn. Stat. §358.116, that everything I have stated in this document is true and correct, and that the opinions here expressed are my professional opinion.

Executed this 31st day of May, 2018, in the County of Douglas, State of Minnesota

/s/ Charles L. Anderson
Charles L. Anderson