CEMVP-OP-R (MVP-1999-5528-JKA) 15 January 2015

MEMORANDUM

SUBJECT: *Response to Public Comments on Distinguishing Ombrotrophic and Somewhat Minerotrophic Bog Communities for Purposes of Estimating Potential Indirect Impacts*

1. Introduction

Public comments submitted regarding the Supplemental Draft Environmental Impact Statement (SDEIS) for the proposed NorthMet Project included concerns regarding: (1) how ombrotrophic bog communities were differentiated from bog communities that have some degree of mineral inputs from groundwater and/or surface water runoff; and (2) how that determination was applied to estimating potential indirect impacts to bog communities. Four main points were expressed:

a. Inadequate information was used to distinguish ombrotrophic bog communities from bog communities that have some degree of mineral inputs from groundwater and/or surface water runoff.

b. The majority, if not all, of the coniferous bog and open bog communities within the project site are minerotrophic as opposed to ombrotrophic.

c. Ombrotrophic bogs can have flowpath connections with groundwater; therefore, groundwater drawdown due to proposed mine dewatering could impact ombrotrophic bogs.

d. Estimated potential indirect impacts to ombrotrophic bog communities due to proposed mine dewatering should not be rated as "no effect."

The primary source for the discussion in the SDEIS differentiating ombrotrophic bog communities from bog communities that have some degree of mineral inputs from groundwater and/or surface water runoff (hereafter "somewhat minerotrophic bogs") was drawn from information provided in a memorandum dated 7 November 2011 that I authored. This distinction was then applied to estimating potential indirect impacts to bog communities. For example, based on this information, the SDEIS estimated that groundwater drawdown associated with mine pit dewatering would not result in adverse impacts to ombrotrophic bogs but would have a low likelihood of adversely impacting somewhat minerotrophic bogs (e.g., Tables 5.2.3-3 and 5.2.3-4).

2. Classification Systems and Terminology

The SDEIS applied the Eggers and Reed (1997, 2014) classification system of wetland plant communities for mapping wetlands by type and determining impacts and compensatory mitigation by wetland type. This system describes 15 major wetland plant communities in Minnesota of which two are coniferous bogs and open bogs. Both are characterized by a more or less continuous carpet of *Sphagnum* mosses growing on saturated, mineral-poor, nutrient-poor, acidic, peat soils. Ombrotrophic bog communities (solely precipitation-driven), as well as bog communities that are somewhat minerotrophic, are both included within the coniferous bog and open bog designations of Eggers and Reed. Refer to the key in

Eggers and Reed (1997, 2014) to see how coniferous bog communities are differentiated from, for example, coniferous swamp communities.

For purposes of estimating the potential indirect impacts of the proposed project, the Wetlands Impact Assessment Planning (IAP) Group recommended that wetlands identified as coniferous bog and open bog communities under the Eggers and Reed system be subcategorized as either ombrotrophic or somewhat minerotrophic. The primary reference used for this determination was the same source most often recommended by the public comments on the SDEIS: the Minnesota Department of Natural Resources publication, *Field Guide to the Native Plant Communities of Minnesota – The Laurentian Mixed Forest Province* (2003)[hereafter "MnDNR (2003)"]. This guide breaks out plant communities to a finer level of detail – 28 native wetland plant communities are described compared to the 15 major wetland communities of Eggers and Reed. Each of the 28 wetland plant communities is described in detail including soils, hydrology, pH, mineral concentration, nutrients, moss cover, landscape position and indicator plant species. Keys are provided for distinguishing between plant communities. My interpretation is that there is across-the-board agreement by the Co-Lead Agencies, the Wetlands IAP Group, and those who submitted public comments, that MnDNR (2003) is the appropriate standard to differentiate ombrotrophic bog communities from bog communities that are somewhat minerotrophic.

The Acid Peatland System of MnDNR (2003) includes the ombrotrophic bog communities of Northern Spruce Bog (APn80) and Northern Open Bog (APn90). Acid peatlands that receive some degree of mineral inputs from groundwater and/or surface water runoff include Northern Poor Conifer Swamp (APn81) and Northern Poor Fen (APn91).[1,2]

Appendix D "List of Bog Species" in MnDNR (2003) lists 25 species. Text for that appendix states, "Because only those species listed below can persist in the ombrotrophic conditions of bogs, the occurrence of any other species can be considered an indicator of minerotrophic conditions." In my memorandum of November 2011, I referred to Appendix D as a list of "indicator species of ombrotrophic bogs." Comments were received that this characterization is not accurate because these species also occur in minerotrophic peatlands. I will instead refer to the list as "Appendix D" from this point forward.

Dr. Paul H. Glaser, an expert on peatlands with a great deal of research experience in peatlands of northern Minnesota, provided detailed comments including the following criteria for ombrotrophic bogs, which are also listed by MnDNR (2003): (1) landform type is a raised bog (always higher than the peatland margins); (2) absence of fen [minerotrophic] indicator species; (3) surface water chemistry with a pH of <4.2 and Ca concentrations of <2 mg/l; and (4) hydrology and source of minerals is solely from precipitation.

3. Applying the Classifications Based on Field Data

Vegetation data presented in Table 1 of the November 2011 memorandum were collected during ground truthing of representative wetlands by the Wetlands IAP Group in September 2010. The purpose of the field work included checking wetland plant community mapping based on the Eggers and Reed classification system – and delineation of upland/wetland boundaries – by Barr Engineering Company. Dominant species, and all other plant species, observed within each plant community were recorded.

[1] With the exception of this paragraph, I have deliberately avoided introducing additional terms (e.g., poor fen, poor conifer swamp) in the discussion of bog communities. The audience for the SDEIS and FEIS (in preparation) includes the general public and it would be best to minimize technical terms.

[2] Northern Spruce Bog and Northern Poor Conifer Swamp are lumped under "Coniferous Bog" in Eggers and Reed while Northern Open Bog and Northern Poor Fen are lumped under "Open Bog" in Eggers and Reed.

Determining dominant plant species is required for assigning the Eggers and Reed plant community classifications. Some of the non-dominant species were single individuals or small patches (e.g., <1% areal cover), but this level of detail was not recorded in the field as it was not necessary for applying the Eggers and Reed plant community classifications. Additionally, the field review often went to the upland (mineral soil)/wetland (peatland) boundary to check the accuracy of the wetland delineation. This likely resulted in including minerotrophic species when those species were restricted to a narrow band along the upland/wetland boundary.

Others participating in the September 2010 field review collected pH and specific conductivity readings as discussed in the November 2011 memorandum. Additional vegetation sampling was conducted in May 2011 by Barr Engineering Company (Table 2 of that memorandum). All of the above information was compiled in the November 2011 memorandum for discussion by the Wetlands IAP Group.

It was recognized that the September 2010 field work was not ideal for distinguishing ombrotrophic versus somewhat minerotrophic bog communities. Subsequent to that field work, discussions occurred regarding whether more expansive and intensive field work using releves, precise measurements of pH and Ca concentrations, etc., for differentiating ombrotrophic versus somewhat minerotrophic bog communities should be accomplished. This was not implemented, however, due to a determination that more detailed vegetation/pH/Ca/landform data would still not provide a definitive answer regarding potential indirect impacts. Refer to the discussion under 5. Response to Public Comments.

4. Public Comments

Public comments included the assertion that the presence of one or more plant species not listed by Appendix D of MnDNR (2003) precludes a determination that the community is an ombrotrophic bog. However, descriptions of communities of the Acid Peatland System in MnDNR (2003) illustrate that individuals and single clones of minerotrophic species can occur in ombrotrophic bogs:

> Northern Spruce Bog (APn80): "…minerotrophic species are absent or *present only as single individuals or single clones*…"(emphasis added)
>
> Northern Open Bog (APn90): "Minerotrophic indicators are absent or *extremely rare*; vegetation is composed *mostly* of bog species."(emphasis added)

Comments on the SDEIS also questioned whether any ombrotrophic bog communities exist within the NorthMet Project site. However, consider the following examples. During the field inspection of Wetland Number 885, the Wetlands IAP Group noted a convex landform ("raised bog"), and other characteristics of ombrotrophic bogs, and reached consensus that this wetland was an ombrotrophic bog community. In Wetland Number 974, 11 of the 25 species on Appendix D were recorded with a total absence of any minerotrophic species. The pH was recorded as 5.5 versus <4.2 for ombrotrophic bogs, but pH strips are not very precise (order of magnitude – pH 5.5 could range from pH 4.5 to pH 6.5) and this was a one-time sample. In Wetland Number 640, eight of the 25 species on Appendix D were recorded along with one minerotrophic species, which could have been one individual growing in a microhabitat or along a transition zone with a different plant community. The pH was measured at 6.0 (indicating a range from 5.0 to 7.0), but specific conductivity was the lowest of any wetland measured during the September 2010 field work (19 uS/cm).

Another comment was that ombrotrophic bog communities can have flowpath connections with groundwater. Thus, they could be sensitive to impacts due to groundwater drawdown unless they support perched watertable mounds (i.e., perched recharge mounds). Perched recharge mounds may exist within the NorthMet Project site, but confirmation of this would require an extensive study using nests of

piezometers installed above and below the confining layer(s) to demonstrate presence/absence of a perched water table mound. Overall, the comments submitted, and literature cited (e.g., Siegel and Glaser 1987), were convincing on the point that ombrotrophic bogs can have flowpath connections to groundwater.

5. Response to Public Comments

One course of action would be to conduct additional field work in coniferous bog and open bog communities and apply the releve method for vegetation sampling, obtain precise measurements of pH, conduct water quality sampling to determine Ca concentrations, and determine landform (e.g., "raised bog"). Depending upon the level of detail, this could result in more precise mapping of ombrotrophic bog communities versus somewhat minerotrophic bog communities. However, this additional information would not provide a definitive answer regarding the extent of potential indirect impacts to bog communities. Major uncertainties would remain: (1) because ombrotrophic bogs are precipitation-driven systems, to what degree, if any, would these communities be impacted by groundwater drawdown due to mine dewatering; and (2) are flowpath connections with groundwater present within some or all of the ombrotrophic bog communities within the project site?

Given the uncertainties stated in the previous paragraph, and concerns expressed with how ombrotrophic versus somewhat minerotrophic bog communities were differentiated, an alternative approach would be to make more conservative assumptions of impacts and assign all bog communities within the 0-1,000 foot analog zone the same category for likelihood of wetland hydrology effects (see Tables 5.2.3-3 and 5.2.3-4 and Figure 5.2.3-11 in the SDEIS). Ombrotrophic bog communities would then be moved from the "no effect" category to the "low likelihood" category. The 0-1,000 foot zone from the proposed mine pits was described by Adams and Liljegren (2011) as a zone where significant surficial groundwater drawdown is most likely to occur, and is most likely to be measurable. Therefore, it would be reasonable to assume that all wetland types within this zone would experience some degree of hydrology effects due to groundwater drawdown. Some reviewers may be concerned that "low likelihood" for hydrology impacts due to groundwater drawdown is not accurate and instead should be "moderate likelihood" or "high likelihood." The bottom line is that the potential for indirect impacts to all bog communities within the 0-1,000 foot analog zone is acknowledged. In the event that the NorthMet Project is permitted and constructed, monitoring would be required to verify whether indirect impacts occur and, if so, the magnitude of those impacts.

For the 1,000-2,000 foot analog zone, Adams and Liljegren (2011) stated that drawdown of the surficial groundwater may occur but would likely be much less than the 0-1,000 foot zone and may not be discernible from natural variation. The SDEIS assigned both ombrotrophic bogs and somewhat minerotrophic bogs the same category for this zone ("no effect"). Should the NorthMet Project be permitted and constructed, monitoring would verify whether the "no effect" designation is accurate.

6. Summary

a. The appropriate standard for differentiating ombrotrophic from somewhat minerotrophic bog communities – MnDNR (2003) – was selected for purposes of the SDEIS.

b. More expansive and intensive field work (e.g., releves, precise measurements of pH and Ca concentrations) to map ombrotrophic versus somewhat minerotrophic bog communities is not warranted because it would not provide a definitive answer regarding the extent of potential indirect impacts to bog communities.

c. Ombrotrophic bogs, although precipitation-driven, can have flowpath connections with groundwater; therefore, these wetlands could be impacted by groundwater drawdown.

d. A conservative approach would be to include in the FEIS (in preparation) a change to impact projections. It is recommended that ombrotrophic bog communities within the 0-1,000 foot analog zone be assigned the same category for likelihood of hydrology effects as somewhat minerotrophic bogs to acknowledge a potential for adverse impacts. This more conservative approach (i.e., err on the side of projecting greater wetland impacts) would be responsive to substantive public comments received on this issue. If the NorthMet Project is constructed, monitoring would quantify any adverse hydrology effects.

7. Conclusion

It is important to recognize that the distinction between types of bog communities was used to estimate potential indirect impacts for discussion purposes in the SDEIS. These estimates would not be used to determine compensatory mitigation requirements. In the event that all necessary permits are issued and the NorthMet Project is constructed, any compensatory mitigation requirements to offset indirect wetland impacts would be based on field data collected during monitoring. Monitoring would include a network of monitoring wells/dataloggers and permanent vegetation plots established in representative wetlands (including communities mapped as ombrotrophic bogs) to quantitatively measure any indirect impacts. Monitoring would confirm or refute assumptions made in the SDEIS (and FEIS, in preparation) regarding indirect impacts. If, for example, monitoring documents that mine pit dewatering is adversely impacting wetlands within one or more analog zones: (1) the severity of that impact would be determined; (2) adaptive management options to avoid or minimize those adverse impacts would be evaluated; and (3) additional compensatory mitigation (beyond that specified for direct impacts) would be required as warranted.

8. POC. Questions on the above can be directed to steve.d.eggers@usace.army.mil or (651) 290-5371.

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Literature Cited

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