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Technical Memorandum

To: Lisa Faye (MnDNR), Colleen Allen (MnDNR), Ralph Augustin (USACE)
From: Barr Engineering Company
Subject: Potential Indirect Wetland Impacts, Fragmentation
Date: March 27, 2015
Project: NorthMet Project
c: Jennifer Saran (PolyMet)

The analysis for the Wetland Data Package v10 for the NorthMet Project included an evaluation of the potential indirect wetland impacts, including fragmentation. The MnDNR and USACE requested additional information regarding wetland fragmentation for inclusion in the EIS. The purpose of this response is to provide a summary of how potential indirect wetland impacts resulting from fragmentation were quantified for the Wetland Data Package v10.

Fragmentation is identified as a potential indirect wetland impact. A wetland may be fragmented as the result of direct impacts that may split a wetland into multiple smaller parts. These parts (fragments) could potentially be isolated from other wetlands and no longer have any adjacent upland watershed area, which may result in the loss of functions and values in the wetland fragment. However, while a wetland may be fragmented by direct impacts, it doesn't always mean that the remaining part (fragment) of the wetland is negatively impacted; only that further evaluation is necessary to determine if the remaining wetland fragment would remain viable, or in other words, will retain its functions and values.

The evaluation conducted to determine if a wetland fragment would remain viable included the following criteria: size of remaining wetland, wetland type, source of hydrology, direction of flow in the area, location in the current watershed, location in the future watershed, and connectivity to other wetlands (Section 5.2, Wetland Data Package v10). These criteria are described as follows:

- Size of Remaining Wetland: The first step in this analysis was to use GIS to identify wetland fragments that were less than about 0.5 acres in size. These wetland fragments were determined to be too small to retain their functions and values and were not considered in the rest of this evaluation. Using size, without considering other criteria, is considered to be a conservative assumption since some of these small wetlands will continue to maintain wetland functions and values.
- Wetland Type: For wetland fragments greater than 0.5 acres in size, the wetland types were reviewed to determine if they were bogs or non-bogs. Bogs included coniferous and open bogs. Non-bogs included sedge/wet meadow, shallow and deep marsh, shrub swamps (including shrub-carr and alder thickets), coniferous and hardwood swamp, and open water wetlands. Each wetland fragment was then evaluated based on its size and the wetland type. Bogs that were

fragmented were not identified as indirectly impacted because they would maintain their functions and values since their primary source of hydrology is precipitation (explained in the next criteria). Small non-bog wetlands that were fragmented were further evaluated to determine their hydrologic sustainability.

- Source of Hydrology: Wetlands are identified as ombrotrophic (precipitation-fed) or minerotrophic (groundwater-fed). The hydrology of ombrotrophic bogs is primarily supported by precipitation; these wetlands are therefore not dependent on the watershed size to maintain their functions and values so they were not identified as indirectly impacted. The hydrology of minerotrophic non-bog wetlands is primarily supported by shallow, groundwater systems that are connected within different scales – wetland watershed, local (e.g., Mine Site) watershed, or regional watershed. Therefore, these minerotrophic non-bog wetlands were further evaluated because they are considered to be dependent on their watershed size to maintain their functions and values and their watersheds would be altered due to construction of Project infrastructure.

- Direction of Flow in the Area: The Mine Site is located in the Upper Partridge River watershed, so water on the Mine Site eventually drains to the Partridge River. A surface water divide is generally located from southwest to northeast near the northern boundary of the Mine Site, so under existing conditions, water in the northernmost area of the Mine Site generally drains north and water in the southern area of the Mine Site generally drains south. For this analysis, we evaluated the location of the non-bog wetlands relative to the Mine Site groundwater divide. Based on the location of wetland fragments on the Mine Site, we noted whether the northern or southern portion of the wetland was directly impacted. This direct impact changes the size of the remaining wetland (fragment) and if the area of the wetland's watershed is modified, it could result in a change to the equivalent flow (expressed as ac-ft/yr per acre of wetland), a measure of hydrologic support. See Section 5.2.1.1 in the Wetland Data Package v10 for additional details.

- Determination of the Wetland's Current Watershed: Bog wetlands are not dependent on watershed area for their hydrology since they are precipitation-fed, therefore the current watershed was not analyzed for the bog wetlands. The current (existing) conditions include the wetlands and watersheds which represent the existing, relatively undisturbed conditions in the Mine Site Area. The watershed for the non-bog wetland is the land area that contributes surface water to the wetland – this includes the upland area and the wetland area. For each non-bog wetland in the analysis, GIS was used to determine the acreage of its watershed area. Large Table 5 in the Wetland Data Package v10 identifies the acreage for each non-bog wetland and its associated watershed for the current (existing) conditions. The location of each non-bog wetland in its current (existing) watershed was compared with its location in the future watershed.

- Location of the Non-bog Wetland Fragment in the Wetland's Future Watershed: During operations, some watershed areas will be directly impacted by the Project and will no longer be considered as a tributary area to the non-bog wetland. Using the same methodology as in the previous criteria, for each non-bog wetland in the analysis, GIS was used to determine the acreage of upland area and wetland area within its watershed area. As a result, the amount of water potentially contributed by the watershed to support the hydrology of the remaining wetland may also change (increase or decrease). Large Table 5 in the Wetland Data Package v10 identifies the acreage for each non-bog wetland and its associated watershed for future conditions, % change in the watershed size, and % change in equivalent yield. If the wetland fragment had a change in equivalent yield of +/- 20%, the non-bog wetland was further determined to have a potential for indirect impacts. Depending on the results of the other criteria, the non-bog wetland fragment was either considered to be indirectly impacted or included as a monitoring location in the hydrology monitoring plan. Other criteria considered included: its location in its future watershed, the amount and location of the direct impact to the wetland, the change in its watershed size, and how much the hydrology (equivalent yield) might change.

- Connectivity to Other Wetlands: Infrastructure at the Mine Site will require excavation and fill to be placed in wetlands, which may divide wetlands into smaller parts (fragments). Some of these wetland fragments will be isolated from other wetlands and will no longer be located within or adjacent to an intact, relatively undisturbed upland. These wetland fragments are not expected to maintain their functions and values. Other wetland fragments will be hydrologically connected to wetlands and will be located within or adjacent to an intact, relatively undisturbed upland. These wetlands are located in the vicinity of the haul roads on the Mine Site. Construction of the haul roads will require excavation and fill with blasted rock that will allow groundwater connectivity for wetlands on either side of the haul road. Each wetland fragment was evaluated based on its location, adjacency to upland, and adjacent infrastructure characteristics to determine if it would be expected to maintain its functions and values.

The purpose of this analysis was to provide an estimate of potential indirect wetland impacts from fragmentation. The wetland fragments that are not expected to maintain their functions and values have been identified in the Wetland Data Package v10. The proposed mitigation for the NorthMet Project is expected to compensate for these indirect wetland fragmentation impacts. The wetland fragments that were not identified as indirectly impacted will included in the hydrology and vegetation monitoring plan that will be developed and implemented for the NorthMet Project.