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722 27th Avenue NW
Calgary, Alberta Canada
T2M 2J3
403.282.1616

February 21, 2015

David Seeliger, *P.Eng.*
Senior Water Resources Engineer
MPE Engineering Ltd.
Suite 320, 6715 – 8 Street NE
Calgary, Alberta T2E 7H7

Dear Mr. Seeliger:

Re: Janet Master Drainage Plan – Wetland Inventory and Assessment

This letter report provides an inventory, classification and mapping of wetlands within the Janet Area Structure Plan (ASP). The report includes wetland classification and mapping, relative importance of wetland types, an evaluation and identification of areas of sensitivity, potential impacts of stormwater drainage on wetlands and associated mitigation strategies.

Thank you for considering HAB-TECH for this work. Please do not hesitate to contact me by email at jvargas@hab-tech-env.com or by phone at 403-239-9726 should you have any questions or concerns.

Sincerely,

ALBERTA SOCIETY of Professional Biologists
Javier G. Vargas
1452
PROFESSIONAL BIOLOGIST

Javier G. Vargas, *M.Sc.*, *P.Biol*
Principal, Terrestrial Ecologist

WETLAND INVENTORY AND ASSESSMENT

Wetland Classification and Mapping

Wetlands previously mapped by Rocky View County in the Janet Master Drainage Plan area were classified based on the Stewart and Kantrud Wetland Classification System (Stewart and Kantrud 1971). This classification system has been widely used in the settled areas (White Zone) of southern Alberta for wetland assessment and compensation.

Reconnaissance-level field visits were conducted between October 14th and 17th 2014. A total of 164 wetland polygons were visited (Figure 1). The majority of the surveyed wetlands were mapped previously by Rocky View County, but had not been classified according to the Stewart and Kantrud system. Photographs were taken at each visited wetland, and botanical information sufficient to identify wetland class and dominant wetland vegetation association(s) and physiognomy was collected.

Ground truth information from the field reconnaissance sites was used in combination with on-screen visual interpretation of high resolution orthophotos (2010 and 2012) to classify all of the wetlands mapped by Rocky View County for the Janet MDP study area. The majority of wetland boundaries were not modified and only the boundary of a few larger wetlands were modified or added. Wetland boundary assessment was outside of the scope of this project. It was however noted during field visits and during orthophoto classification that: 1) some wetlands were not mapped - in particular small wetlands; 2) some wetlands were partially mapped (e.g. only the central wetter portion was mapped, but not the surrounding wet-meadow and low-prairie zones); 3) some mapped wetlands were part of a single larger wetland - in such cases the individual polygons were merged; and 4) some areas mapped as wetlands were in fact not wetlands. The above issues will need to be addressed when more detailed and site-specific development planning is conducted.

Table 1 summarizes the number and size of wetlands in the Janet MDP area by Stewart and Kantrud class, in addition to man-made ponds, and Rocky View wetland polygons that were found not to be wetlands upon field inspection.

Table 1 Wetland polygons and Classes identified for the Janet MDP area

Type	# Polygons	Min Size (ha)	Max Size (ha)	Average Size (ha)	Total Area (ha)
Ephemeral/Temporary wetland - Class I/II	26	<0.1	0.4	0.1	2.6
Ephemeral/Temporary wetland - Class I/II Tilled	136	<0.1	0.4	0.1	11.7
Seasonal wetland - Class III	71	<0.1	3.0	0.3	18.9
Seasonal wetland - Class III Tilled	31	<0.1	0.7	0.1	4.4
Semi-Permanent wetland - Class IV Tilled	14	0.1	3.5	0.9	13.2
Semi-Permanent/Permanent wetland - Class IV/V	31	<0.1	97.0	7.3	226.4
Manmade Ponds	65	<0.1	8.1	0.5	31.0
Not a Wetland	100	-	-	-	-

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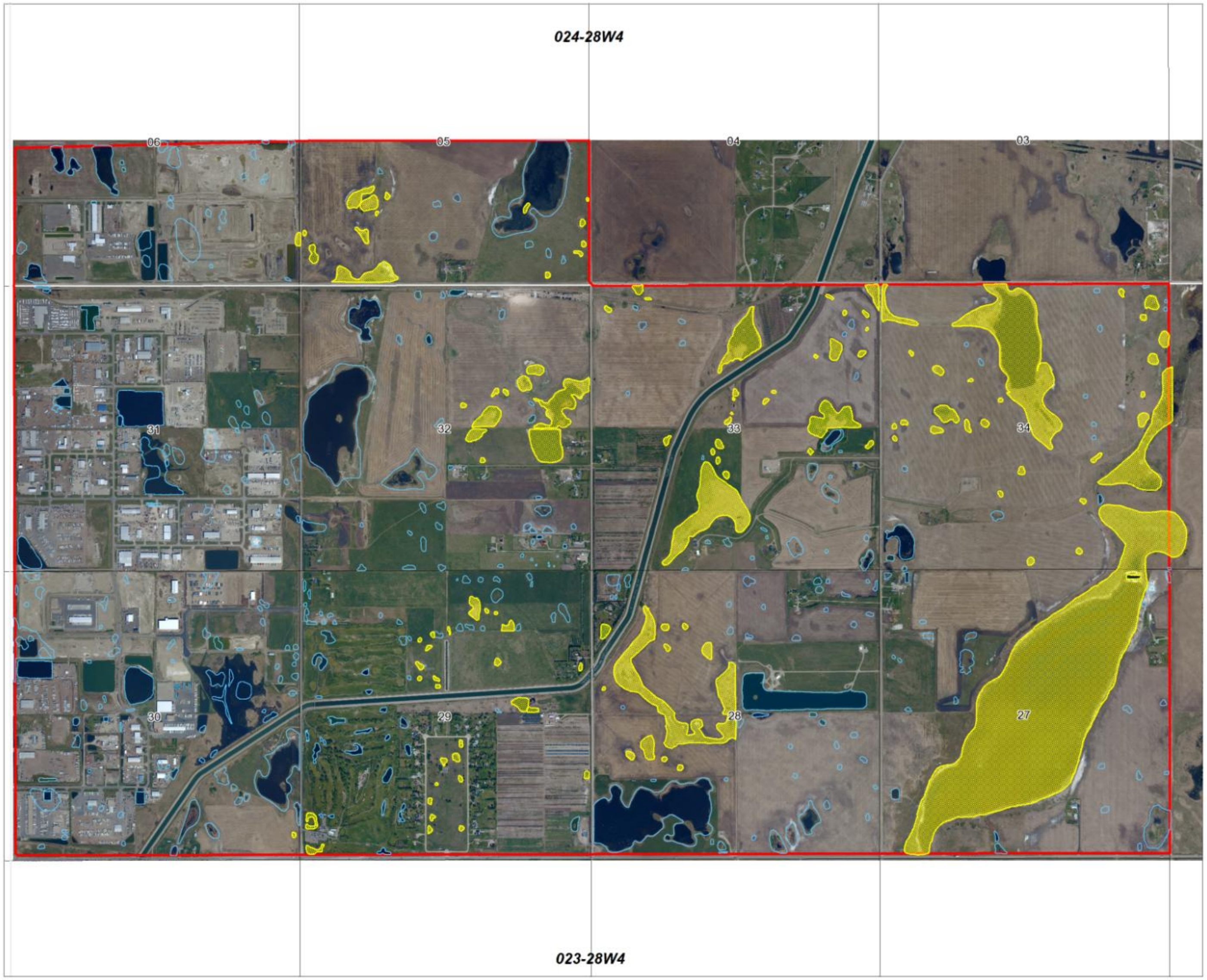

Figure 1. Reconnaissance-level field sites - Janet master drainage plan area.

Legend

- Area Structure Plan
- Section Line
- Township Line
- Potential Wetlands
- Areas Surveyed

Ortho Flown: 2012

0 0.5 1 km.

Scale 1 : 20,000

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Wetland Type Descriptions

The 374 classified and mapped wetlands (including man-made ponds/dugouts) comprise 308.2 ha (13.2%) of the Janet MDP area (Figure 2). Semi-permanent/permanent wetlands (Class 4/5) are the most abundant and also the largest wetlands, with an average size of 7.3 ha (Table 1). Class 4/5 wetlands occupy 226.4 ha (31 polygons). Semi-permanent (Class 4) tilled, seasonal (Class 3), temporary (Class 2) and ephemeral (Class 1) wetlands are generally smaller and occupy a total of 50.8 ha (combined = 278 polygons). Manmade dugouts and ponds comprise 31.0 ha (65 polygons). The majority of the tilled wetlands are ephemeral/temporary wetlands. Descriptions of each mapped wetland type/grouping are provided below.

Ephemeral/Temporary Wetlands (Class I/II)

Ephemeral wetlands are characterized by low-prairie vegetation occupying the central area of the wetland. Surface water is maintained for only a brief period in the early spring before the bottom ice seal disappears. Temporary wetlands are characterized by wet-meadow vegetation in the deepest part of the wetland. Surface water is maintained for a few weeks after spring snowmelt or heavy rainfall events (Stewart and Kantrud 1971).

A total of 162 wetlands within the study area were classified as ephemeral/temporary. These 'drier' wetlands comprised 14.3 ha of the study area (Appendix 1 - Photos 1 and 2). The ephemeral/temporary wetlands were divided into two groups. The first group included wetlands that were recently and completely cultivated (i.e. Ephemeral/Temporary Wetlands Tilled – Class I/II). A total of 136 ephemeral wetlands covering 11.7 ha were tilled – Class I/II. All these wetlands were dominated by agronomic species, although some had patches of foxtail barley (*Hordeum jubatum*), northern reed grass (*Calamagroastis inexpansa*), smooth brome (*Bromus inermis*), Nuttall's salt-meadow grass (*Puccinellia nuttalliana*) and dandelion (*Taraxacum officinale*). Native ecological integrity and functionality of these wetlands is severely compromised by frequent tilling that impedes the development of natural wetland processes and habitat characteristics.

The second group included ephemeral/temporary wetlands that had not been cultivated in recent years. A total of 26 wetlands covering 2.6 ha were classified as Ephemeral/Temporary Wetlands – Class I/II. Such wetlands typically contained the following invasive species: Smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), clover (*Trifolium sp.*), stinkweed (*Thlapsi arvense*), Kentucky bluegrass (*Poa pratensis*), dandelion (*Taraxacum officinale*), Canada thistle (*Cirsium arvense*) and perennial sow thistle (*Sonchus arvensis*). In some instances native species such as slender wheat grass (*Elymustrachycaulus ssp. trachycaulus*), Nuttall's salt-meadow grass, foxtail barley, and fine sedges (*Carex spp.*) were found. Native floristic composition and structural diversity of these wetlands are significantly limited due to grazing, past tillage and/or non-native plant invasion. As a result these wetlands have low habitat suitability for wildlife species at risk or rare plants. Native ecological integrity of these wetlands is generally low.

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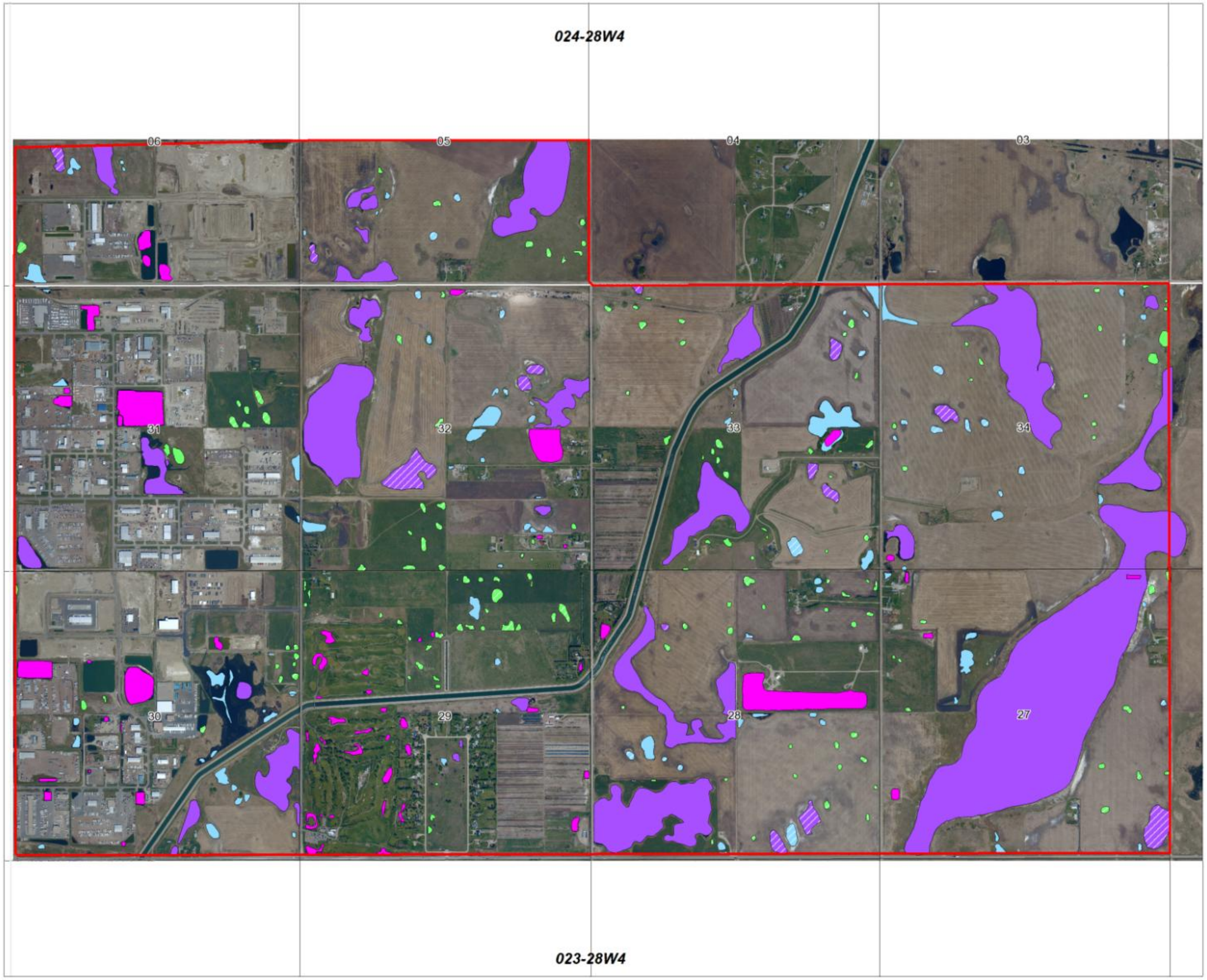

Figure 2. Wetland Classification - Janet master drainage plan area.

Legend

- Area Structure Plan
- Ephemeral-Temporal Wetland - Class I-II
- Ephemeral-Temporal Wetland - Tilled Class I-II
- Seasonal Wetland - Class III
- Seasonal Wetland - Tilled Class III
- Semi-permanent-permanent Wetland - Class IV-V
- Semi-permanent Wetland - Tilled Class IV
- Man-made Pond

Ortho Flown: 2012

0 0.5 1 km.

Scale 1 : 20,000

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Seasonal Wetlands (Class III)

Seasonal wetlands are characterized by shallow-marsh vegetation occurring in the deepest portion of the wetland. Surface water is usually maintained in spring and early summer (Stewart and Kantrud 1971). A total of 102 of the wetlands mapped in Figure 2 were classified as seasonal and occupied 23.3 ha of the study area (Appendix 1 - Photos 3 and 4). These wetlands were divided into two groups. The first group included seasonal wetlands that had been recently tilled. Thirty-one wetlands covering 4.4 ha were classified as Seasonal Wetlands Tilled – Class III. These wetlands were dominated by agronomic species and were generally highly degraded, with low native floristic composition and limited structural diversity. Shallow-marsh plant species found in the deepest portion of these wetlands were: slough grass (*Bechmannia syzigachne*) and coarse sedges (*Carex spp*) mixed with wet-meadow plant species such as foxtail barley and Nuttall's salt-meadow grass.

The second Class III group included seasonal wetlands that had not been cultivated in recent years. A total of 71 wetlands covering 18.9 ha were classified as Seasonal Wetlands – Class III. These wetlands were characterized by a shallow-marsh zone in the deepest portion of the wetlands dominated by one or more of the following species: slough grass, creeping spike-rush (*Eleocharis palustris*), awned sedge (*Carex atherodes*), and golden dock (*Rumex maritimus*). Patches of common cattail occurred sporadically. Other wetland species that were frequently observed included: foxtail barley, wire rush (*Juncus balticus*), Nuttall's salt-meadow grass, tickle grass (*Agrostis scabra*) and tufted hairgrass (*Deschampsia caespitosa*). The low-prairie and wet-meadow zones of these wetlands were usually invaded by non-native plant species. The ecological integrity for these wetlands were predominantly rated as moderate.

Semi-Permanent/Permanent Wetlands (Class IV/V)

Semi-permanent wetlands are characterized by deep-marsh vegetation in the deepest portion of the wetland. Surface water is maintained throughout spring and summer and sometimes into fall and winter. Permanent wetlands are characterized by a deep-water zone with submerged vegetation in the deepest portion of the wetland and surface water is maintained throughout the year (Stewart and Kantrud 1971).

A total of 45 of the wetlands were classified as semi-permanent/permanent and occupied 239.5 ha of the study area (Appendix 1 - Photos 5, 6 and 7). These wetlands were divided into two groups. The first group included semi-permanent wetlands that had been cultivated in dry years. Fourteen wetlands covering 13.2 ha were classified as Semi-permanent Wetland Tilled – Class IV. These wetlands were generally located within cultivated fields, and as a result, litter cover was shallow and sparse, and structural and floristic diversity was limited. These wetlands were characterized by deep marsh vegetation in the deepest portion of the wetland, which was dominated by common cattail, bulrushes (*Scirpus spp.*) and bare soil. The shallow-marsh zone of these wetlands was dominated by slough grass and to a lesser extent foxtail barley. The outer vegetation rings of wet-meadow/low prairie zones were cultivated.

The second group includes semi-permanent/permanent wetlands that had not been cultivated in the deep-marsh and shallow marsh zones. Accurately distinguishing between these permanent and semi-permanent wetlands requires detailed historical air photo analysis to assess open water permanence, which was outside of the scope of this inventory. Historical air photo analysis is typically conducted at the individual property assessment level of planning. A total of 31 wetlands covering 226.4 ha were classified as Semi-permanent/permanent Wetlands – Class IV/V. The more shallow wetlands were characterized by deep marsh vegetation in the deepest portion of the wetland, which was dominated by common cattail and/or bulrushes. Some of these wetlands were characterized by a shallow water or mudflat zone interspersed or surrounded by common cattail, duckweed (*Lemna minor*), and/or bulrushes. In the deeper wetlands, vegetation in the deep-water zone was sparse or absent and dominated by common cattail and bulrushes. Duckweed was also found in patches of standing water. Patches or outer rings of shallow-marsh and wet-meadow vegetation were sometimes present. The shallow-marsh zone, when present, was characterized by the same species described for the shallow-marsh zone of the Seasonal Wetlands – Class III. Common species in the wet-meadow zone were: foxtail barley, Nuttall's salt-meadow grass, fine sedges, and wire rush. The native ecological integrity of these wetlands was generally rated as high.

Dugout/Man-Made Ponds

Even though dugouts and man-made ponds are not typically classified as wetlands, they were mapped as such by Rocky View County. A total of 65 Dugout/Man-Made Ponds were mapped occupying 31.0 ha of the study area. Some dugouts occurred in upland areas while some were located inside of natural wetlands. Man-made ponds were often wetland basins prior to excavation/construction. Some of these supported scattered wetland vegetation such as common cattail, reed canary grass and foxtail barley (Appendix 1 - Photo 8).

Non-Wetland Polygons

A total of 100 polygons mapped by the County as wetlands were no longer wetlands, upon site inspection. These were likely ephemeral to temporal wetlands in the past, but no defined wetland basins or wetland vegetation were observed during the field visits (Photo 9) or the former wetland had been removed as a result of development.

Relative Importance/Value of Wetland Types

According to Alberta's *Water Act* (Government of Alberta 1996) all wetlands in the province are important from hydrological, ecological and socio-economical perspectives, regardless of class or type. This is reflected in the strict wetland policy that requires an approval and/or license to alter or destroy a water body including, dredging, filling, diverting, and drainage. Rocky View County adopted policies in 2010 with the purpose of conserving and managing wetlands and riparian lands. These policies help the County to fulfill its legislative mandate through meeting legal and statutory requirements for the protection of provincial water resources.

The definition of a water body in the *Water Act* is as follows:

"Water body means any location when water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or occurs only during flood, and includes but is not limited to wetlands and aquifers".

Implicit in the latest Alberta Wetland Policy (2013) is a recognition that not all wetlands are of equal value and that the value or importance of each individual wetland is determined by its relative abundance, supported biodiversity, ability to improve water quality, importance to flood reduction and human uses.

The "relative wetland value" concept embraced by the new Alberta Wetland Policy (2013) is closely related to the concept of wetland functionality (Bond *et al*. 1992, Clairain 2002, Fennessy *et al*. 2004, City of Calgary 2004, Adamus, 2013). Wetland functionality provides the basic knowledge to assess the relative importance of specific wetlands and the impacts of specific proposed developments. Wetland impact assessments are one of the requirements to apply for an approval to disturb a wetland (Alberta Environment 2007) and determine compensation and mitigation activities.

Factors used to measure the relative functional value of wetlands include hydrological, biological/ecological, and socio-economic elements. **Table 2** lists some of the most important factors to take into consideration when assessing the functionality of a wetland. Assessment of the relative importance of individual wetlands lies outside of the scope of this project and is in fact not applicable to this level of sub-regional planning and wetland classification. There are however some inherent differences in the level of ecological importance of the wetland classes mapped in **Figure 2** and described above. These include: 1) regional rarity; 2) wetland native ecological integrity; 3) plant and wildlife biodiversity potential; and 4) size and connectivity.

Regional rarity

Native habitats occurring in short supply (rare) in a regional context are considered to be more significant than abundant habitats in the context of preserving landscape diversity and the plant and animal species that these landscapes support (Noss 1993; Council on Environmental Quality 1993; Noss and Cooperrider 1994). Even though all wetlands are considered uncommon at a regional level, the least common wetlands in the study area in terms of frequency of occurrence are Class 4 semi-permanent/permanent wetlands (n=45). The least rare wetlands in the Janet MDP area are Class I/II ephemeral/temporary wetlands of which there are 162 (136 tilled and 26 untilled). A total of 102 Class III seasonal wetlands were mapped and were intermediate in terms of frequency of occurrence with 31 affected by past tilling and 71 being untilled.

The relative abundance of different wetland classes in the Janet MDP area is consistent with findings by AECOM (2011) for the Shepard Regional Drainage area. A total of 76 wetlands were mapped for that project including: a single Class I wetland; eleven Class II (8 untilled and 3 tilled/weedy), 34 Class III (31 untilled and 7 tilled/weedy); 28 Class IV (17 untilled and 11 tilled/weedy); and two Class V wetlands.

Table 2. Wetland Functions Overview
Wetland Function
Hydrological Function
Contribution to recharge or discharge of water supply aquifers
Flood protection
Erosion control
Usable surface water
Storage of agricultural run-off
Containment of toxics: surface run-off/discharge flow
Sediment flow stabilization
Biological/Ecological Function
Habitat for migratory birds
Habitat for amphibians and reptiles
Habitat for vertebrate species at risk
Habitat for supporting rare plant species
Habitat for supporting rare plant communities
Support of plant species diversity
Support of vegetation structural diversity
Ecological integrity
Socio-Economical Function
Contribute to visual diversity of landscape
Recreational opportunities
Education and nature interpretation
Accessibility to public
Contribution to crop irrigation
Tourism or other commercial use
Source of domestic or industrial water supply

Wetland native ecological integrity

Invasion of native habitats by non-indigenous or "introduced" species of plants can result in a loss of native plant species, changes in community structure and function, and alterations in the physical structure of the system (Drake *et al*. 1989; Desserud and Naeth 2010).

Habitat loss (urban/industrial development, agricultural land clearing and tillage) is the main disturbance factor observed in the Janet MDP study area. As such, tilled wetlands have inherently lower native ecological integrity than non-tilled wetlands. However, tilled wetlands have the potential to at least partially recover their native ecological integrity after agricultural activities have ceased (Bartzen *et al*. 2010). Moreno-Mateos *et al*. (2012) concluded that after disturbance occurred, wetlands either recover very slowly or move towards alternative states that differ from reference conditions. Such alternative states, even though not pristine, can nonetheless provide important ecosystem services such as water storage, reduction in sedimentation and nutrient loading, plant biodiversity, carbon sequestration (Gleason *et al*. 2011), and wildlife habitat (Begley *et al*. 2012).

The occurrence and abundance of invasive plant species in prairie wetlands is generally greater in drier classes than in wetter classes, and tilled wetlands tend to support more weedy species than untilled wetlands.

Plant and wildlife biodiversity potential

Ecosystems that support a high level of diversity of plant species tend to be structurally diverse and productive (Meffe and Carroll 1997). These areas in turn support a wide variety and abundance of insect and animal forms. Permanent (Class V) and semi-permanent (Class IV) wetlands generally support a higher number of vegetation zones than seasonal and temporal wetlands. Each vegetation zone contains unique plant communities and structural assemblages providing a variety of habitats for wildlife species. They together have the potential to provide numerous reproductive, forage and cover opportunities or “niches” for survival and reproduction for several wildlife (and plant) species. Ephemeral and temporary (Class I/II) wetlands support low structural diversity and generally lower vertebrate species richness than do semi-permanent and permanent wetlands (AECOM 2011).

Wetland size and connectivity

Large wetlands or wetland complexes (with multiple wetland zones) offer secure ‘core’ areas for certain wetland wildlife and plant species. Small wetlands that lack “core” areas are more prone to isolation, non-native plant invasion and fragmentation. In addition, small and isolated wetlands are not able to support all the species and number of individuals that a large multi-zoned wetland does. The largest wetlands in the study area are semi-permanent/permanent wetlands with average sizes of 7.3 ha. The smallest are ephemeral and temporary (Classes I and II) which average only 0.1-ha. AECOM (2011) noted the strong influence of wetland size on habitat significance as follows:

- >100-ha Very High
- 10 to 100-ha High
- 1 to 10-ha Moderate
- <1-ha Low

Synthesis of Relative Wetland Value

Table 3 summarizes relative wetland value ratings (Low, Moderate, High, Very High) for the seven wetland classes that occur in the Janet MDP area.

Table 3. Relative Wetland Value Ratings for Janet MDP Area

Type	Regional Rarity	Native Integrity	Biodiversity Potential	Wetland Size
Ephemeral/Temporary wetland - Class I/II	H	M	M	L
Ephemeral/Temporary wetland - Class I/II Tilled	L	L	L	L
Seasonal wetland - Class III	L	H	H	M
Seasonal wetland - Class III Tilled	M	L	L	L
Semi-Permanent wetland - Class IV Tilled	H	H	H	H
Semi-Permanent/Permanent wetland - Class IV/V	M	VH	VH	VH
Manmade Ponds	L	L	L	M

It is clear from Table 3 that the larger and untilled semi-permanent (Class IV) and permanent (Class V) wetlands have the highest wetland value from an ecological/biological perspective. Tilled Class IV wetlands and untilled Class III wetlands are also highly important ecologically. These findings are consistent with those of AECOM (2011) for the Shepard Regional Drainage Area. The authors of that report rated the habitat significance of individual wetlands (native and disturbed) and extant patches of native and semi-native grasslands, and woodland/tall shrub. Criteria used for their ratings included: % Native; Size, Water Bird Importance; occurrence of Species of Concern; and, occurrence of provincial or regional Environmentally Significant Areas (ESA).

Type	# Low	Moderate	High	Very High
Ephemeral wetland - Class I	1	0	0	0
Temporary wetland - Class II	5	0	1	0
Temporary wetland - Class II-Weedy/Tilled	3	0	0	0
Seasonal wetland - Class III	18	9	4	0
Seasonal wetland - Class III - Weedy/Tilled	6	1	0	0
Semi-Permanent wetland - Class IV	4	3	3	7
Semi-Permanent wetland - Class IV - Weedy/Tilled	5	6	0	0
Permanent wetland - Class V	0	0	2	0

Potential Impacts of Stormwater Drainage on Wetlands

Some of the potential impacts of stormwater drainage and management on wetlands in the study area include:

- Increase of surface water runoff because of impervious surfaces;
- Decrease in water quality entering the wetlands. Contaminants, sediments and nutrients are transported by stormwater. Aquatic and semi-aquatic wildlife and fish habitat might be affected;

- Increase in the potential for creation of erosion channels in the wetland;
- Reduction in floodwater storage capacity; and,
- Alteration of native plant community composition and wildlife habitat.

Changes in water regime and water permanence have the greatest potential to alter wetland plant structure and composition and therefore wildlife habitat and populations. Increased water input into wetlands will generally result in reductions in low-prairie, wet-meadow, shallow-marsh, and deep-marsh wetland zones, and increases in open water. Reduction of plant and structural diversity provided by the different wetland zones will result in a more homogeneous environment where wildlife habitats are reduced or lost.

Mitigation Strategies

According to the new Alberta Wetland Policy (Alberta Environment 2013) and the Provincial Wetland Restoration/Compensation Guide (Alberta Environment 2007), mitigation is the process used to reduce loss of wetlands by:

- Avoiding impacts to wetlands;
- Minimizing impacts and requiring applicable compensation; and
- Compensating for impacts that cannot be avoided or minimized.

Avoidance of impacts on wetlands, including the establishment of appropriate setbacks (AESRD 2012) from wetlands (especially those with highest levels of permanence and functionality), is the most desirable mitigation strategy (AESRD 2013). Setbacks of as much as 50-m are required from Class 3 to 7 wetlands on coarse textured sands and gravels and alluvial sediments. Provision should be planned for ongoing protection and management of wetland buffers. Regular access may be needed for emergencies, to manage recreational activities, and resource management purposes including vegetation management. However, road construction should be avoided, and access routes should be left in a natural state to promote infiltration (AESRD 2012).

When avoidance is not possible, then minimization/mitigation of impacts is preferred. Mitigation measures to minimize impacts on wetlands should consider the protection, maintenance or enhancement of wetland conditions such as: water quality, flow regime, wetland zonation, plant and wildlife diversity and potential to harbor plant and animal species at risk. Implementation of Best Management Practices (BMPs) to control quality and quantity of stormwater should be considered at early design stages. Those BMPs can be Source Control BMPs, Lot-Level BMPs, Stormwater Conveyance System BMPs, and End-of Pipe Systems (Alberta Environment 1999)

When avoidance and minimization is not possible, then compensation should be taken into consideration. Wetland compensation supports the concept of no further loss of wetland area in the province by restoring wetlands to replace the lost ones. Wetland restoration is done by wetland restoration agencies (i.e. Ducks Unlimited).

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APPENDIX 1

Wetland Photographs

Photo 1. Ephemeral to Temporary wetland – Class I-II.

Photo 2. Ephemeral to Temporary wetland – Class I-II Tilled.

Photo 3. Seasonal wetland – Class III.

Photo 4. Seasonal wetland – Class III Tilled.

Photo 5. Semi-permanent wetland – Class IV.

Photo 6. Semi-permanent wetland – Class IV Tilled.

Photo 7. Permanent wetland – Class V.

Photo 8. Manmade pond/dugout.

Photo 9. Mapped by Rocky View County as wetland, but no longer is a wetland.