

MANITOBA INFRASTRUCTURE - WATER MANAGEMENT AND STRUCTURES

LAKE MANITOBA AND LAKE ST. MARTIN OUTLET CHANNEL PROJECT

PRECONSTRUCTION ENVIRONMENTAL FIELD WORK – WETLANDS (CONS15843)

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EXECUTIVE SUMMARY

WSP Canada Group Limited (WSP) was retained by Manitoba Infrastructure (MI) to complete pre-construction investigations to support environmental assessments for the Lake Manitoba and Lake St. Martin Outlet Channel Project (the Project) in the Interlake region of Manitoba. Investigations included updates to upland and wetland mapping, heritage resource investigations and additional terrestrial surveys for plant and wildlife species of conservation concern. These pre-construction investigations were requested to support the Environmental Impact Statement (EIS) filed by MI in 2019 with provincial and federal regulators. This current report presents updated fine-scale wetland and upland vegetation mapping completed as part of the vegetation pre-construction survey work package. It fills gaps in the previous background study mapping, which resulted when the alignments for various project components were adjusted after completion of the background studies. The updated mapping was used to estimate the potential extent of wetland and upland habitat impacts resulting from Project construction, for use in future construction monitoring and wetland compensation planning for the Project.

The Project includes the construction of two new water diversion (“outlet”) channels as a permanent flood control management system for the Lake Manitoba and Lake St. Martin region of Manitoba, as well as associated infrastructure in support of channel construction including re-routing of Provincial Road (PR) 239 and construction of a Manitoba Hydro’s distribution line. The Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba with Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Combined, these two channels will convey water from Lake Manitoba through Lake St. Martin to Lake Winnipeg in a manner that alleviates overland flooding in the Lake St. Martin area of Manitoba, such as occurred in the 2011 and 2014 floods. Mapping addressed each Project component separately, to provide the impacted area of upland and wetland habitats within the LMOC, PR 239 re-route, LSMOC and Manitoba Hydro’s distribution line project areas.

Updated, 1:5,000 scale mapping was prepared using GIS analysis of remote sensing data (LIDAR, orthoimagery and multi-spectral Sentinel 3 imagery), and confirmed using ground-truthing (field work) completed during pre-construction vegetation surveys for the Project in July and August, 2020. A total of 121 sites were sampled in the ground-truthing program, and included all land cover types within the Project study areas. Using the study areas used in the EIS, we established a Project Disturbance Area (PDA) that encompassed the right-of-way of each Project component, and a modified Local Assessment Area (LAA). The PDA was used to estimate the direct and indirect effects of Project clearing and permanent infrastructure construction. The modified LAA was the maximum area in which all Project environmental effects might be expected, and described the potential habitat impacts relative to the surrounding landscape. Specifically, the PDA for each project component was:

- 400 m wide (200 m from centreline) for the LMOC and LSMOC, and
- 50 m wide (25 m from centreline) for PR 239 re-route and Manitoba Hydro’s distribution line

The total area of the current PDA was 2,023 ha, including 1,030 ha for the LMOC, 891 ha for the LSMOC, 56 ha for the PR 239 re-reroute and 46 ha for Manitoba Hydro’s distribution line. The modified LAA for the two outlet channel alignments was 1.5 km from Project centreline (3 km wide area in total). For Manitoba Hydro’s distribution line, the modified LAA was smaller: 200 m from centerline (400 m wide area in total) and for PR 239 re-route, it was 125 m from centerline (250 m wide area in total).

Manitoba does not have a comprehensive land cover classification system for mapping. Wetland and upland habitat classifications drew on a variety of classification systems, including the Stewart and Kantrud system used to manage wetland compensation requirements in Manitoba. Wetland Classes II through V could be identified using the GIS mapping method. Class I ephemeral wetlands could not be reliably mapped and were excluded. Peatlands and swamps are not addressed in that classification system; such habitats were classified using the

Canadian Wetland Classification system. Upland forest land cover was based on the Manitoba Forest Ecosystem Classification system (Zoladeski, et al., 1995). Watercourses, waterbodies and all anthropogenic land cover types followed the EOSD Land Cover classification for the Manitoba area (Wulder and Nelson, 2003).

The Project lies in the Interlakes Region, which includes two different Ecoregions. The LMOC and PR 239 re-route study areas are within the Interlake Plain Ecoregion, characterized by relatively flat terrain, with distinct, ridged drumlind topography and swales that often support large wetland complexes. This area has also been developed for agricultural use, with extensive clearing in upland areas. The LSMOC and Manitoba Hydro's distribution line study areas lie within the southern part of the Mid-Boreal Lowland Ecoregion, a less developed area dominated by poorly drained, flat bogs and fens.

While impacted areas were estimated for all upland and wetland land cover, impact analysis also aimed to inform MI's wetland compensation discussions with Manitoba Conservation and Climate and the Manitoba Habitat Heritage Corporation (MHHC). For each Project component, we assumed the entire PDA would experience direct or indirect impacts to wetlands from temporary clearing effects and access, and construction of permanent infrastructure. Impact analysis also addressed Manitoba Hydro's distribution line, but MI will not provide compensation for any impacts on that work, which will be completed by Manitoba Hydro. Some wetland impacts could possibly be avoided during construction, through minor alignment adjustments and reduced clearing. A final confirmation of impacted wetlands based on the surveyed, as-built construction footprint should be used to finalize compensation requirements.

Manitoba's Wetland Compensation Policy and *The Water Rights Act Regulation* require avoidance and/or compensation for Stewart and Kantrud classes III and higher. However, a financial compensation option is defined only for Stewart and Kantrud Class III wetlands. Impacts to Class II and V wetlands are allowed for projects supporting public interests, such as flood protection, but licensing for removal and compensation for impacts must be confirmed with Manitoba Conservation and Climate. Given this requirement, and on-going wetland compensation planning, initial estimates of compensation requirements were based on the areal extent of Class III wetlands only.

For the four Project components, the extent of Class III wetland impact within the PDA was estimated as follows:

- LMOC PDA impacts: 197.91 ha
- PR 239 PDA impacts: 1.06 has
- LSMOC PDA impacts: 0.11 ha
- Manitoba Hydro Distribution Line PDA impacts: None.

The LMOC and PR 239 re-route alignments pass through areas with extensive marsh wetland habitat, and in each modified LAA, Class III to Class V marsh habitat is abundant, and will remain unaffected by the Project activities. The alignments of the LSMOC and Manitoba Hydro's distribution line lie within an area of extensive peatland habitat. Marshes are fairly limited in this area, and the potential impacts to such habitats are predicted to be relatively small. Avoidance or minimization during construction may help to reduce the potential impact to Class III and other wetlands. For this reason, the final impacted areas should be confirmed using as-built surveys of the completed Project.

Wetland compensation in the Project Wetland Compensation Plan will be based on the requirements of *The Water Rights Act* and its regulation. Currently, Schedule D of *The Water Rights Regulation* requires compensation only for Class III wetland impacts, based on a financial formula (2 x impacted area x \$6,000 per acre). Impacts to Class IV and V wetlands, swamps and peatlands must also be considered in the approval of a license under the Act, but the form of compensation is not specified. Recommendations included in the MI Wetland Compensation Plan could consider the following options:

- Monetary compensation, based on an area-based approach, as has been done for other government departments.
- Enhancement options to help sustain remnant wetlands affected by construction, particularly in the swamp and peatland areas of the northern Project area.
- Conservation of MI owned lands that support diverse or abundant wetland habitat through establishment of a conservation easement on wetlands, or the entire land parcel. Such an option replaces lost habitat at a 3:1 ratio (i.e., the area conserved would represent 1/3 of the required compensation in area). An argument can be made to obtain credit for a conservation easement on a large parcel (e.g., a quarter section), since this would more effectively meet goals of watershed / landscape level protection.

Construction monitoring recommendations will also be informed by impacts predicted in this study, but will also consider less well understood hydrological impacts, including potential changes in shallow groundwater flow that could alter the water supply to adjacent wetlands. If self-directed wetland enhancement is adopted for compensation, monitoring would also be recommended to confirm that enhancements are performing as anticipated.

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1 INTRODUCTION

WSP Canada Group Limited (WSP) was retained by Manitoba Infrastructure (MI) to complete pre-construction investigations to support environmental assessments for the Lake Manitoba and Lake St. Martin Outlet Channel Project (the Project) in the Interlake region of Manitoba (Appendix A, Figure 1). Investigations including updated upland and wetland mapping, heritage resource investigations and additional terrestrial environmental surveys for plant and wildlife species of conservation concern (SOCC) in support of the pre-construction surveys were completed in 2020 to supplement baseline environmental information previously collected and documented in background reports for the Project's Environmental Impact Statement (EIS; SG Environmental Services Inc., 2016a, 2016b, 2017) developed in support of the Project.

This wetland mapping report describes updates to existing wetland mapping prepared for Project as part of the vegetation survey. These updates were prepared at the request of MI to refine the coarse scale wetland mapping used in the EIS (SG Environmental Services Inc., 2016a, 2016b, 2017). It also describes the ground truthing (field survey) used to confirm the updated mapping, using information collected during the pre-construction vegetation surveys completed for the Project in July through August of 2020. Finally, this report summarizes the potential extent of wetland impacts predicted from construction activities, for use in future construction monitoring and wetland compensation planning for the Project.

1.1 Project Background

The Project includes the construction of two new water diversion ("outlet") channels as a permanent flood control management system for the Lake Manitoba and Lake St. Martin region of Manitoba, as well as associated infrastructure in support of channel construction including re-routing of Provincial Road (PR) 239 and construction of a Manitoba Hydro's distribution line (refer to Appendix A, Figure 1). The Lake Manitoba Outlet Channel (LMOC) will connect Lake Manitoba with Lake St. Martin and the Lake St. Martin Outlet Channel (LSMOC) will connect Lake St. Martin to Lake Winnipeg. Combined, these two channels will convey water from Lake Manitoba through Lake St. Martin to Lake Winnipeg in a manner that alleviates overland flooding in the Lake St. Martin area of Manitoba, such as occurred in the 2011 and 2014 floods.

In 2019, MI filed an EIS with Federal and Provincial regulators for the construction of the outlet channels. To further support the Project, including confirming information outlined in the EIS and its supporting background reports, pre-construction heritage resource investigations and terrestrial environmental surveys for plant and wildlife SOCC were undertaken in July through August 2020. The pre-construction surveys were developed as three work packages and involved both a desktop review and supporting field investigations.

- **Work Package 1** involved the completion of a pre-construction vegetation field investigation to assess the Project Development Area (PDA, see Section 1.2) of both the LMOC and the LSMOC, the re-route of PR 239 and Manitoba Hydro's planned distribution line for the presence of plant SOCC. The focus of the vegetation investigation was to survey for occurrences of plant SOCC in areas of low sampling density identified in the EIS and previously non-surveyed areas of native vegetation that can support SOCC, including wetland transition zones and areas of shallow bedrock. In addition, fine resolution wetland mapping was completed as a desktop mapping exercise, with ground truthing of mapping completed during the vegetation surveys to aid in identifying wetland transition zones for the vegetation surveys and to inform habitat mapping for plant and wildlife SOCC.

- **Work Package 2** involved completion of a pre-construction wildlife field investigation to assess previously non-surveyed areas with high potential for wildlife within the Local Assessment Area (LAA, see Section 1.2) of both the LMOC and the LSMOC, the PR 239 re-route right-of-way and Manitoba Hydro's planned distribution line. The focus of the investigation was on species at risk most likely to be impacted by the Project within the LAA including species such as the red-headed woodpecker and the Eastern whip-poor-will.
- **Work Package 3** involved the completion of a pre-construction Heritage Resource Impact Assessment (HRIA) to assess the presence of heritage resources within the PDA of the LMOC, LSMOC, the PR 239 re-route and Manitoba Hydro's planned distribution line as well as development of a Heritage Resource Protection Plan (HRPP). The focus of the investigation was on areas of high potential for heritage and archaeological resources within the PDA.

Note that information collected during the pre-construction vegetation, wildlife and heritage resources surveys has been provided as separate summary reports in support of the Project. This report documents the wetland mapping aspects of Work Package 1.

1.2 Study Area

The EIS was supported by past mapping completed for background vegetation studies of the LMOC, LSMOC and PR239 projects within three scales of study areas: the Project Development Area (PDA, the right-of-way for the project component), Local Assessment Area (LAA, 1 km beyond the PDA), and Regional Assessment Area (RAA, 5 km beyond the PDA). The PDA was generally adopted for the overall updating exercise, but added areas not previously addressed in the background studies. Alignments changed slightly on the two outlet channel routes and the PR 239 alignment after the baseline studies were completed, and Manitoba Hydro's distribution line was not assessed in the EIS or baseline studies. In part, this current study was to address gaps in the original mapping products incorporated into the EIS.

The current Project PDA includes the physical space or directly affected area where Project components and activities will occur and the immediately adjacent area, generally corresponding to the designated ROW for each of the Project components. The PDA for each project component includes:

- 400 m wide area (200 m from centreline) for the LMOC and LSMOC, and
- 50 m wide area (25 m from centreline) for PR 239 re-route and Manitoba Hydro's distribution line.

The total area of the current PDA is 2,023 ha, including 1,030 ha for the LMOC, 891 ha for the LSMOC, 56 ha for the PR 239 re-reroute and 46 ha for Manitoba Hydro's distribution line.

In the EIS, the LAA was the maximum area within which Project environmental effects might be predicted for most resources, including both direct and indirect effects on a Valued Component (VC). The LAA applied in the vegetation (and wetland) EIS discussion included the PDA and adjacent areas where indirect environmental effects might reasonably be expected to occur (generally 1 km beyond the PDA). In this current update of the wetland mapping, we used a 'modified LAA', based on the availability of fine resolution orthoimagery and LIDAR data provided by MI and the anticipated zone of influence of construction disturbance beyond the PDA, which was specific to each Project component. These two data inputs dictated the extent of updated mapping that could be completed, which for the two outlet channels, was slightly wider than the LAA used in the EIS. The PDA for the outlet channels was 200 m from centerline, and the LAA used in the EIS was 1 km from the PDA, or 1.2 km from centerline overall (2.4 km wide area in total). The modified LAA for these two outlet channel alignments used in this current assessment was 1.5 km from Project centreline (3 km wide area in total). For the Manitoba Hydro's

distribution line, the modified LAA was smaller: 200 m from centerline (400 m wide area in total) and for the PR 239 re-route, it was 125 m from centerline (250 m wide area in total).

The resulting mapping allowed analysis of both direct and indirect effects to wetlands and other vegetation communities resulting from Project activities within the PDA and modified LAA, thus meeting a key objective of the update. Specific to wetlands, the modified LAA included the immediately adjacent areas where indirect effects associated with clearing and infill inside the PDA might be expected. Direct effects anticipated to occur within the PDA involved both temporary disturbance for clearing for the channel, side berms and access, as well as permanent disturbance from channel excavation, berm construction and any permanent access. The LAA used for wildlife and heritage resources remained similar to that used in the original EIS (1 km beyond the PDA).

The RAA is the area that provides context to the changes occurring in the LAA for each VC. For example, this could include the area occupied by the VC population, so that effects to the VC can be characterized or quantified. The RAA is also the area within which the Project's environmental effects may interact or accumulate with the environmental effects of other projects or activities that have been or will be carried out such that cumulative environmental effects may potentially occur. The RAA for each VC depends on physical and biological conditions and the type and location of other past, present, or reasonably foreseeable projects or activities that have been or will be carried out. The current wetland mapping update did not extend to the vegetation RAA previously used in the EIS, since both indirect and direct effects were anticipated to occur mainly within the PDA and modified LAA.

1.3 Historical Wetland Mapping

Wetland mapping submitted as part of the previous EIS and supporting documents drew from coarse resolution regional mapping by other agencies. As noted above, alignments of the two outlet channel routes and PR 239 re-route were slightly changed after baseline vegetation work was completed, and Manitoba Hydro's distribution line was added as the Project progressed, resulting in changes that created gaps in the assessed wetland areas along the alignment. The objective for the updated wetland mapping was to improve on the resolution and accuracy of previous mapping, both through digital mapping methods and with ground truthing, and to fill the analysis gaps. To do so required an understanding of the previous analysis approach, and the GIS methods used to generate the original vegetation mapping (for both uplands and wetlands).

The previous assessments included vegetation mapping for the PDA (or disturbance footprint), the LAA (1 km beyond the project footprint) and the Regional Assessment Area (RAA, 5 km beyond the project footprint). Previous mapping used two publicly-available data sources:

- The Enhanced Wetland Mapping, produced by Ducks Unlimited Canada (DUC, c. 2018)
- The Earth Observation for Sustainable Development (EOSD) Land Cover Classification (Wulder and Nelson, 2003)

Both data sets offered continuous mapping of the LMOC and LSMOC study areas, but both were derived from relatively coarse scale satellite data (about 1,50,000 scale). Final mapping was at a similarly coarse scale (about 1:50,000). As a result, neither dataset accurately delineated or classified wetlands at the scale needed for wetland impact analysis, and compensation planning for wetland loss.

Wetland and upland habitat mapping are both constrained by the type and scale of remote sensing data used in the analysis. Whether using manual mapping techniques (e.g., interpretation from aerial imagery), or automated GIS analysis of remote sensing data (including satellite imagery and LIDAR data), delineation cannot extend beyond the original scale of input data. Classification is further limited if input data does not offer the full, multi-

spectral ‘bands’ of modern satellite imagery, since the mapping will rely solely on the visual image. Soil moisture and vegetation vigour can both be identified using infra-red spectrum data, and contribute much to vegetation mapping in forested areas. Similarly, LIDAR data at sufficient resolution can help to identify the drainage networks and depressions, where wetland habitats are more likely to form. The EOSD Land Cover mapping used 25 m Landsat imagery circa 2000, and had a published accuracy rating of 85% (Nishi, et al., 2009). Further, it focused on mapping the boreal forest land base; wetlands were not a focal point (Wulder, 2002). The DUC Enhanced Wetland Mapping used 30 m resolution imagery, and had similarly coarse output resolution. This dataset used a refined GIS analysis to identify wetlands by shape (object-based analysis), and had limited field checking, and therefore also resulted in coarse scale mapping insufficient to predict wetland impacts with certainty. EIS reviewers and MI both requested improved mapping for wetlands and uplands, and more refined impact prediction based on the improved mapping product.

WSP proposed to update this mapping using GIS-based wetland and terrestrial land cover mapping techniques that would improve on these past mapping exercises, focusing on the PDA and the immediately adjacent lands. Mapping was constrained in part by coverage of the input orthoimagery and LIDAR data available from MI, which were limited to an area within 1.5 km of centreline (the modified LAA). However, this data was much finer resolution than that used previously, which facilitated mapping of wetland and upland areas at 1:5,000 scale. This mapping, and ground-truthing provided more accurate wetland and upland community delineation and characterization, resulting in impact predictions with higher confidence. For wetlands, the improved mapping allowed a more accurate assessment of the potential wetland impact, which could in turn inform compensation value in terms of both area and ecological function. The new mapping also supported the vegetation and wildlife survey work. Lastly, this mapping method is repeatable, which allows base maps to be readily updated as part of future monitoring programs, if desired by MI.

1.4 Study Objectives

The overall objectives of the pre-construction surveys, and for the wetland mapping component of Work Package 1, aimed to provide fine resolution, field-confirmed mapping of both wetlands and uplands, for the following overall purposes:

- Confirm findings from the original EIS
- Fulfill remaining pre-license and pre-monitoring requirements of the Project
- Support consultation and engagement activities
- Aid future planning and environmental projection plan development for plant SOCC and plant species of interest to Indigenous groups and traditional land use areas

Specific to wetlands, future steps of assessment include developing a Wetland Compensation Plan based on Manitoba legislation and considering federal guidance. Two separate reports will document the wetland compensation proposed for the project and construction monitoring recommendations, respectively. The Wetland Compensation Plan will be provided by MI to the Manitoba Habitat Heritage Corporation (MHHC), to finalize compensation-related requirements for the Project.

2 STUDY METHODS

2.1 Desktop Analysis

Wetland mapping using desktop methods is broadly regarded as challenging due to the variation in wetland form and seasonal variation in water permanence. Wetlands can range from graminoid marsh to shrubby or wooded swamp, and graminoid, shrubby or wooded bog or fen, and from permanent open water forms to sites with ephemeral, temporary, seasonal, or semi-permanent to permanent inundation. Given this variation in visual appearance of wetlands, differentiating wetlands from upland habitat using interpretation of aerial imagery alone is particularly difficult. Interpretation is further limited by the resolution of imagery used: coarse resolution input data results in mapping of similar scale. Fine-resolution imagery offers the ability to identify smaller features in more detail, and can be particularly useful when combined with ground truthing. To complete the mapping update, WSP used the fine-scale orthoimagery and LIDAR provided by MI in an automated GIS classification mapping approach to delineate and classify wetlands, and added the classification of adjacent upland habitats to complete the mapping update within the modified LAA. This desktop method offers the advantage of faster mapping of potential wetlands and upland habitats across large landscapes. This process also eliminates the labour-intensive task of hand digitizing for preliminary mapping, thus a considerable cost savings to a project. The preliminary mapping can then be readily checked through ground truthing, and refined through both automated analysis and manual adjustment. The sections below describe the approach used to map the wetland and upland habitats within the PDA and modified LAA, and to refine them based on field survey and manual aerial imagery interpretation.

2.1.1 Input Data Sources

MI provided 1 m resolution LIDAR coverage (as Digital Elevation and Surface Models) and 5 cm orthoimagery, both of which extended 1.5 km from the centreline of the channel, road and transmission line (i.e., the modified LAA). We also used publicly available remote sensing data (Sentinel 2 multispectral imagery, 10 m resolution), for multi-spectral analysis to identify wetland areas using soil moisture detection and national DEM datasets (1:50,000 scale). Sentinel 2 imagery is flown weekly, and is thus very current. It also provides key spectral bandwidths used for mapping vegetation and soil wetness. Although Sentinel 2 coverage extends across broad areas, because its resolution is coarser than the desired update mapping scale, final mapping relied on the MI input data, and thus was constrained to that coverage area.

The EIS used field survey data to identify plant communities, including upland and wetland sites. Unfortunately, although generalized survey locations were documented in report maps, the specific locations of those sites were not. As a result, previous survey efforts could not be used as either inputs to the GIS analysis, or checks on the mapping outputs. Instead, ground truthing surveys conducted as part of the vegetation surveys were used as training and confirmation wetland data sources for the GIS wetland mapping process, as described below.

2.1.2 Initial Delineation Mapping

Wetland mapping was initially completed using automated GIS classification techniques that combined Sentinel 2, orthoimagery, MI LIDAR and national DEM terrain data to delineate and classify wetlands and upland land cover. An automated classification uses various types of input descriptors to identify natural features like wetlands and upland habitats, drawn from available data sources. Generally, the initial step uses watershed / topography analysis to identify drainage systems and depressions that may collect surface water using the terrain data.

These depressions then are classified using the imagery sources (Sentinel 2 and orthoimagery) to identify wetland classes. Uplands can be classified from imagery data in a subsequent step, once wetland delineations are field confirmed. However, in this Project area, the terrain was relatively flat, with limited relief. The northern Project areas (LMOC and Manitoba Hydro's distribution line) crossed through very flat terrain, resulting in broad peatland communities. The southern Project area (LSMOC and PR 239 re-route) crossed broad floodplains with glacial scarring that created long, narrow depressions through the modified LAA. While the 1 m LIDAR data offered the best detail for mapping terrain features, it was too limited in its vertical resolution (i.e., minimum of 1 m depth depressions) and spatial extent (1.5 km from centreline) to identify depressions in this context. Instead, as described below, a GIS wetland mapping technique that relied more on multi-spectral and visual imagery was used (USDA, 2014; Wu and Lane, 2016), modified to fit the limitations of both the available data, and terrain constraints.

Wetland identification and mapping was performed using a hierarchical approach, based on analysis of satellite imagery, topographic indices generated from terrain data, and field observations. As a first step, probable wetland areas were identified from a pixel-based classification of multispectral Sentinel 2 data (10 m resolution). We selected early June 2019 and 2020 Sentinel imagery, which provided two years of comparative data from periods of highest water level, to maximize spectral (infrared) response for soil moisture detection. This spectral data was used to calculate the Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI), two key indicators of wetland vegetation and soil moisture. Classification then was performed using a Random Forest algorithm with the following input variables: Red, Green, and Blue (RGB) bands, infrared band, NDVI and NDWI. In addition to the spectral band indices, indices from the terrain LIDAR dataset were extracted and included in the classification: the Topographic Wetness Index (TWI) and the Depth to Water Index (DTW).

For the first iteration of mapping analysis, 'training' sites, or confirmed wetlands that would be used to help select the best predictive parameters for use in mapping, were selected based on previous large-scale mapping, visual interpretation and field survey data from the early summer vegetation surveys conducted in July as part of Work Package 1. Wetland delineation was extracted from this first classification iteration. Those areas were then assessed during the late summer vegetation surveys conducted in August. This data allowed assessment of the accuracy of the delineations and confirmation of wetland classes along the survey area. A second object-based classification¹ was performed to evaluate wetland classes, using a series of descriptive statistics extracted from previous satellite and topographic layers. A final verification was performed using visual interpretation of the orthoimagery and field ground truthing data to ensure accuracy of wetland classification and delineation. This step served to confirm mapped wetlands (confirmation data sources).

2.2 Ground Truthing Field Surveys

Field confirmations included both ground truthing surveys and visual checks (Table 2-1). Ground truthing surveys completed during the early (July 6-12, 2020) and late summer (August 6- 12, 2020) vegetation surveys described plant community composition. Early summer data provided initial training points for wetland classification and both early and late data were used to confirm initial and final stages of wetland and upland classifications. An aerial check of the initial mapping by helicopter survey (visual checks) along the linear PDAs during late summer plant SOCC surveys also helped to confirm mapped (spatial) delineations. During aerial surveys, broad zones of

¹ An object-based classification is a GIS technique that identifies shapes (e.g, wetlands) based on grouping of adjacent pixels with similar characteristics, based on terrain, spectral information or derived indices from those data. A predictive model indicates which parameters should be considered in the analysis, and results thus combine a number of diagnostic features related to a particular wetland or upland class (often determined from 'training' data).

habitats were checked, as well as specific wetland sites. Specific wetlands were also checked in more detail during the aerial surveys (visual and ground check surveys), to confirm differentiations among forested and marsh wetland classes. In total, ground truthing checked 120 sites, representing each mapped wetland and upland type within each of the Project components (i.e., LSMOC, LMOC, Manitoba Hydro's distribution line, and PR 239 re-route). See Table 2-1 below for a summary of survey effort and Table B1, Appendix B for a full list of habitat ground truthing sites.

Table 2-1 Field Ground Truthing Sites by Project Component and Broad Habitat Type

Surveys by Type and Component	LMOC	PR 239	LSMOC	Distribution Line	Total
Early Summer Plant SOCC Ground Survey	10	5	14	6	35
<i>Forested</i>	2	2	2	4	10
<i>Wetland</i>	8	3	11	2	24
<i>Disturbance/ Anthropogenic</i>			1		1
Late Summer SOCC Ground Survey	4	4	4	15	27
<i>Forested</i>	1	2	0	8	11
<i>Wetland</i>	1	2	4	7	14
<i>Disturbance/ Anthropogenic</i>	2	0	0	0	2
Wetland Ground Check (Helicopter)	6	0	1	1	8
<i>Wetland</i>	2	0	1	1	4
<i>Disturbance/ Anthropogenic</i>	4	0	0	0	4
Visual Checks	3	0	6	42	51
Total	23	9	25	64	121

*One sample site was completed in the overlap between the LMOC and PR 239 PDA footprints, and was included in both study area totals, leading to a total of 121 survey sites.

2.3 Wetland Classification

Manitoba does not have a comprehensive land cover mapping classification, and instead uses a variety of classification systems relevant to specific management purposes. The land cover mapping used in the original EIS included a combination of the DUC Enhanced Wetland Classification for Boreal Wetlands system and the Canadian Land Cover Classification system. These systems did not translate well to impact assessment, due to coarse scale / lack of specific habitat descriptions, and poor fit with Manitoba's wetland compensation process. To map the diverse types of wetlands and uplands in the northern and southern Project areas, we combined relevant aspects of four classification systems, selected for their applicability to regulatory and impact assessment requirements (Table 2-2).

For wetlands, both the Stewart and Kantrud (1971) system and the Canadian Wetland Classification System (National Wetlands Working Group, 1997) were used (Table 2-2). The combination allowed identification of the marshes in the southern Project areas (LMOC and PR 239) and the organic and swamp wetland types in the northern Project areas (LSMOC and hydro distribution line). Further, the Stewart and Kantrud system is used in Manitoba's wetland compensation process, which will facilitate discussions yet to be completed regarding compensation for wetland impacts. For upland habitats, forests were classified using the Manitoba Forest Ecosystem Classification system (Zoladeski et al., 1995). Watercourses, waterbodies and all anthropogenic land cover types followed the EOSD Land Cover classification for the Manitoba area (Wulder and Nelson, 2003).

The Stewart and Kantrud classification differentiates wetlands based on the duration of wetted conditions in the deepest part of the wetland. Wetlands range from permanent waterbodies to those that have open water for only part of the year. The system includes two wetlands that support water only briefly during the year (Class I and II wetlands, see wetland classes in Table 2-2). Of these, only Class II wetlands could be accurately identified in this updating exercise. Class I wetlands could not be mapped accurately using the GIS mapping approach, since by definition, such areas are wet only briefly in early spring, or during rain events. Mapping such sites would require considerable aerial photo interpretation and field confirmation, and ultimately would not inform compensation requirements. Neither Class I nor Class II wetlands require compensation under Manitoba's *Water Rights Act* or its regulations.

2.4 Final Mapping and Impact Analysis

The last step of mapping was to review the delineations and classifications of both uplands and wetlands manually, using aerial interpretation against the orthoimagery, and revising as required. During this step, the reviewer (one of the vegetation field crew) could also compare mapped classification to field data survey points for additional referencing, as well as drawing on their field experiences during early and late summer surveys and the aerial surveys. Once wetland and upland mapping was finalized, the mapping was checked by our senior reviewer. About 25% of the mapping was spot checked for accuracy in delineation and classification.

Once wetland mapping was finalized, the impact areas were estimated by wetland and upland habitat type, using the PDA as the overall footprint of disturbance. Since the PDA includes the entire designated right-of-way, disturbance may be slightly over-estimated. However, this area provides a reasonable estimate of the potential direct and indirect disturbance to wetlands, and thus can help inform wetland compensation planning. Construction disturbance will likely extend over most of this area, and is anticipated to include permanent disturbance from excavation of the outlet channel and construction of berms to each side from the excavated soil, and temporary disturbance for access. Such construction activities will likely require infilling or berming of the Class III, IV and V wetlands within the PDA, and may also disrupt shallow groundwater flow supporting wetlands retained within the modified LAA. As a starting point for discussion of compensation, the PDA footprint offers a good approximation of anticipated wetland impacts.

Manitoba's water policies acknowledge the need to manage drainage to reduce flood risk on certain watersheds, as well as the need to avoid loss of wetland habitat, which can affect both provincial biodiversity and water availability goals (Government of Manitoba, no date). Under Manitoba's Wetland Policy and supporting legislation (the *Water Rights Act*), impacts to Class III wetlands must be compensated. The *Water Rights Act* does not allow for loss of Class IV and V wetlands except in certain situations, including flood protection activities. Such impacts must be reviewed with Manitoba Conservation and Climate (the regulatory authority), and the MHHC (an approved wetland conservation and restoration agency) to confirm the form and process of compensation, as part of the project licensing application process. In this case, overall wetland impact and compensation requirements will be refined based on confirmed disturbance limits, identified through post-construction monitoring and an as-

built survey of disturbance limits, and confirmation of compensation requirements for Class IV and V wetlands. However, to inform development of the Wetland Compensation Plan, an initial estimate of project wetland impacts was determined based on GIS analysis of the total area of all wetlands within the PDA footprint, with a focus on Class III wetlands.

Table 2-2 Project Merged Land Cover Classification System and Habitat Descriptions²

Merged System Class	Description
Forested¹	
V1	Balsam Poplar Hardwood and Mixedwood; mixed stands dominated by balsam poplar and trembling aspen in the overstory. The understory is herb and shrub rich, but ground moss cover is sparse. Occurring on deep, moist mineral soils of morainal, lacustrine, glaciofluvial, or fluvial origin.
V4	White Birch Hardwood and Mixedwood; usually mixedwood stands dominated by white birch in the overstory, often with and admixture of jack pine. Stands are usually herb and shrub rich. Occurring generally on fresh to moist, well to rapidly drained, fine to coarse-textured mineral soils.
V5	Aspen Hardwood; hardwood stands of trembling aspen, sometimes with a small admixture of other species. The understory is relatively herb and shrub rich. Occurring on a deep, moist, upland mineral soils, mostly on flat to slightly undulating terrain.
V24	Jack Pine Conifer; Jack pine-dominated, even-aged stands. The understory is variable, usually with <i>Arctostaphylos uva-ursi</i> in the dwarf shrub layer. The herb layer is typically sparse. Feather moss is discontinuous and occurs in scattered patches. Found on rapidly drained, fresh, coarse-textured soils.
V28	Jack Pine-Black Spruce/Feather Moss; Jack pine-black spruce stands with an open understory. The dwarf shrub and herb layers are poorly developed, with scattered occurrences of <i>Alnus crispa</i> , <i>Linnaea borealis</i> , <i>Aralia nudicaulis</i> and <i>Cornus canadensis</i> . The forest floor is covered by a continuous carpet of feather moss. Occurring on fresh to moist, fine-textured soils.
Wetlands and Water	
Bog²	
Basin Bog	Topographically confined peatland with poor nutrients and level surface; water input limited to snowmelt, rain and local surface run-off.
Fen²	
Basin Fen	Topographically confined peatland; water inputs consisting of snowmelt, rain, surface runoff, and groundwater.
Horizontal Fen	Uniformly vegetated peatland on broad depressions or plains; water inputs consisting of snowmelt, rain, surface runoff, and groundwater.
Shore Fen	Peatland situated adjacent to lakes or ponds with firmly anchored surface peat; water inputs consisting of snowmelt, rain, surface runoff, groundwater and surface flow.

² For more description of these vegetation communities, please see the Vegetation Report.

Merged System Class	Description
Stream Fen	Peatland located in main channel or along banks of permanent or semi-permanent streams; water inputs consisting of snowmelt, rain, surface runoff, groundwater and surface flow.
<i>Marsh³</i>	
Class II	Temporary graminoid/forb mineral wetland with wet meadow plant community; surface water is present for a short period of time after snowmelt or a heavy rainfall.
Class III	Seasonal graminoid/forb mineral wetland with shallow wetland plant community; surface water is present throughout the majority of the growing season, but is typically dry by the end of summer.
Class IV	Semi-permanent graminoid/forb mineral wetland with deep wetland community; surface water is present for most or all of the year, except in periods of drought.
Class V	Permanent graminoid/forb mineral wetland with open water community; surface water is present throughout the year.
<i>Swamp²</i>	
Basin Swamp	Topographically confined shrubby or treed wetland with less than 40 cm of organic soil.
Lacustrine Swamp	Shrubby or treed wetland with less than 40 cm of organic soil occurring along the shores of permanent ponds or lakes; water level affected by lake during high water periods.
Lagg Swamp	Sloping shrubby or treed wetland with less than 40 cm of organic soil occurring between upland mineral terrain and peatlands.
Riverine Swamp	Shrubby or treed wetland with less than 40 cm of organic soil occurring along banks of rivers and permanent and intermittent streams; subject to flooding when stream or river waters are high.
Unconfined Flat Swamp	Broad shrubby or treed wetland with less than 40 cm of organic soil among other kinds of wetlands with poorly defined edges.
<i>Water Bodies⁴</i>	
Water Bodies	Consists of all open water including lakes, rivers, streams, ponds and lagoons.
Disturbance/Anthropogenic⁴	
Agricultural Cropland	Consists of all lands dedicated to the production of annual cereal, oil seed, and other specialty crops
Bare Rock, Gravel and Sand	Exposed areas of bedrock with little or no vegetation, or exposed areas such as sand dunes and beaches. Also included are all gravel quarry/pit operations, mine tailings, burrow pits, and rock quarries.
Cultural Features	Built-up areas such as cities and towns, peat farms, golf courses, cemeteries, shopping centers, large recreation sites, auto wreckyards, airports, cottage areas, and race tracks.
Forage Crops	Consists of perennial forage such as alfalfa and clover or blends of these with tame species of grass.

Merged System Class	Description
Forest Cutovers	Areas where commercial timber has been completely or partially removed by logging operations.
Roads and Trails	All highways, secondary roads, trails, cut survey lines or right-of-way such as railway lines, and transmission lines.

Notes:

- 1 Forest ecosystem classification for Manitoba (Zoladeski, et al., 1995)
- 2 Canadian Wetland Classification System (National Wetlands Working Group, 1997)
- 3 Prairie Pothole Wetland Classification System, Stewart and Kantrud (1971)
- 4 Manitoba Land Cover Classification (LCC) is based on the EOSD Land Cover Classification system (Wulder and Nelson, 2003)

2.5 Wetland Compensation and Monitoring Recommendations

MI will follow the requirements of the Manitoba *Water Rights Act* and its regulations for wetland compensation on this Project. The Wetland Compensation Plan, to be compiled under separate cover, will inform discussion with Manitoba Conservation and Climate, and its designated restoration agency, the MHHC, regarding the form of compensation. Manitoba Hydro will be provided with the impact analysis findings, to facilitate their own discussions on compensation for Manitoba Hydro's distribution line, since construction of this Project component will be completed by them, rather than MI. Recommendations identified in this report will help inform these subsequent discussions, by providing options to replace wetland habitat, in areal and functional terms. Construction monitoring will also be informed by the predicted areas of impact, to ensure wetland losses are minimized or avoided, where possible.

3 ENVIRONMENTAL SETTING

3.1 Terrain and Climate Conditions Classification

The Project lies within the Boreal Plains Ecozone, an area formed through glaciation, with relatively less bedrock influence than the more northern boreal parts of Manitoba (Smith et al., 1998). More specifically, the LMOC and PR 239 re-route study areas are within the Interlake Plain Ecoregion, a landform underlain by low relief Palaeozoic limestone bedrock, with a general surface form of a level to ridged, lake terrace complex. It is covered almost entirely with glacial deposits. Terrain is generally flat, with a distinct north to south trending drumlinoid or ridged and swale topography formed from subglacial deposition, with slopes of 1 to 3%. Ridges are generally well drained with upland forest vegetation, while the swales are poorly drained, and support wetland communities. The LSMOC and Manitoba Hydro's distribution line study areas lie within the southern part of the Mid-Boreal Lowland Ecoregion, in an area smoothed by clay, silt and sand glacial deposits from Lake Agassiz, which have now developed into poorly drained flat bogs and horizontal fens. These characteristic physiographic features are evident in aerial imagery of the Project study areas: southeast to northwest trending shallow drumlin ridges are very evident in the cleared southern LMOC and PR 239 study areas, and the complex patterns of bog, fens and small streams dominate the northern LSMOC and Manitoba Hydro distribution line study areas.

Climate in both Ecoregions is characterized by short, moderately warm summers and long cold winters (Smith et al., 1998). Mean annual temperatures in the Interlake Plain Ecoregion range from 1 °C to 2.4 °C and annual

precipitation is seasonally variable, but ranges from 500mm to 525mm, much of it as rain. Conditions are similar in the Mid-Boreal Lowlands, with slightly cooler annual temperatures and more precipitation. This combination of relatively high precipitation inputs and low levels of annual evapotranspiration contributes to wetland and waterbody development, particularly in such flat terrain. The Interlakes support large to very large lakes (Smith et al., 1998), including the three major lakes to be connected by the proposed outlet channel (Lake Winnipeg, Lake St. Martin, Lake Manitoba). Flooding issues are also linked to the low relief: at times of high seasonal precipitation, surface flows in the south will collect in low-lying swales between drumlins and ridges, or in the lowland floodplains adjacent larger lakes. The resulting landscape includes complexes of large graminoid marsh and shrubby swamp wetlands of temporary to seasonal water duration, with smaller to moderately large kettle ponds³ supporting permanent to semi-permanent open water. In the north, surface flows are held in extensive peatlands.

The Interlakes Ecoregion has subhumid, moderately cold to cold, Cyroboreal soil climate (Smith et al., 1998). Soils in this Ecoregion are mainly well to imperfectly drained Chernozemic Dark Gray soils, with Chernozemic Black soils in the southern and northwest, associated with very calcareous, clayey glaciolacustrine overlays. Eutric Brunisols and shallow Gray Luvisols form on till and some glaciolacustrine deposits, while Organic Mesisols associated with peatlands and peaty phase Humic Gleysols occur in large parts of the central and northern parts of the Ecoregion. Surficial deposits range from loamy glacial till, varying from deep (>30 m) to very shallow (<20 m) deposits to water-worked areas with veneers to blankets of glaciolacustrine sand, gravel and boulder deposits (Smith et al., 1998). In some places limestone bedrock is at or near surface, particularly near erosional remnants, scapes and drumlinoid ridges. Mesisols are dominant in the Mid-Boreal Lowlands Ecoregion, within the LSMOC study area.

In the Interlakes Plain Ecoregion, trembling aspen is the dominant forest cover, with balsam poplar and white spruce mixedwood stands (Smith et al., 1998). Depressional areas support sedges, meadow grasses and willows, and reed and cattail emergent species in deeper marshes. In the Mid-Boreal Lowlands Ecoregion, dominant conifers include white and black spruce, jack pine and tamarack and deciduous cover includes white birch, trembling aspen, and balsam poplar.

3.2 Anthropogenic Influences

The LMOC and PR 239 project components occur within an agriculturally developed landscape, cleared of much of its natural vegetation, except within poorly drained areas supporting wetland habitat. Most of this development occurred prior to 1984, the earliest imagery available for review using Google Earth, and does not appear to have substantially changed since that time. Roads, pasture and some cropland development have converted the natural landscape to a more anthropogenic one, from a vegetation and hydrology perspective. Small drainage channels have been created to drain agricultural areas, and while wetlands remain within these areas, water permanence appears to have been reduced to temporary or seasonal duration. Many still support wetland characteristics (wetland vegetation, seasonal flooding), while some are hayed during drier years.

The PR 239 alignment follows an existing road for much of its length. Corners at the intersections with other roads will be rounded into curves in two locations, crossing over lands currently used for agricultural production. Otherwise, the road development will occur in lands already highly modified for cropland or pasture uses.

³ Kettle ponds form in morainal landscapes, where deep depressions (kettles) alternate with hilly terrain (knobs).

The LSMOC study area passes through swamps and poorly drained peatlands that have experienced far less development. Few roads have been developed in the broader region; none lie near the outlet channel alignment, or the hydroline alignment. The western end of the hydroline will reach near PR 513 to Dauphin River, which generally parallels the western edge of the RAA. A short section of outlet channel was constructed within the LSMOC, and has separated bog and fen habitat in places (see Figure 2, Appendix A). Drying effects are also evident in this area, where surface flows into these areas has been interrupted.

The Project lies within the traditional lands of several Indigenous communities. Traditional and cultural use of these areas was described in part during updates to the vegetation, wildlife and heritage resource studies, and through the Indigenous engagement program. In general, certain wetland plants important for traditional use may occur in the Project study areas, as well as wildlife important for hunting and trapping uses, especially in the northern study areas (LSMOC and hydro distribution line alignment).

4 WETLAND CHARACTERIZATION AND IMPACT ANALYSIS

The PDA for the outlet channels (LMOC and LSMOC), PR 239 re-route and Manitoba Hydro distribution line includes lands likely to be disturbed, and some lands that may experience limited or no impact depending on construction requirements (e.g., within the designated right-of-way, avoidable during construction). As noted in section 2.4, the total overall area within the PDA may not be directly or indirectly impacted by construction of the outlet channel, and thus may not require compensation. However, to inform the initial discussion on compensation with Manitoba Conservation and Climate and MHHC, we assumed the entire PDA would require some level of disturbance resulting in direct or indirect impacts to wetlands. It may be possible that some wetland impacts can be avoided during construction, based on the updated mapping provided here. A final confirmation of impacted wetlands based on the surveyed, as-built construction footprint should be used to finalize compensation requirements. Manitoba Wetland Compensation Policy requires avoidance and/or compensation for Stewart and Kantrud Class III and higher; Class II temporary wetlands and Class I ephemeral wetlands do not require compensation. Accordingly, although total marsh wetland areas are provided in the sections below, only Stewart and Kantrud Class III and higher will inform compensation planning. As noted previously, Class I wetlands could not be mapped, and thus are not included in the summaries below.

More specifically, although *The Water Rights Act* requires a license application for any project impacting wetlands of Stewart and Kantrud Classes III, IV and V, or draining areas with organic soils (i.e., peatlands), under *The Water Rights Regulation*, only Class III wetlands specifically require compensation. Projects are to avoid impacts to Class IV and V wetlands, except for projects that are necessary for public safety (e.g., flood control works), where such impacts may be unavoidable. Accordingly, areas impacted within the PDA are discussed below, but for compensation, only the total area of Class III wetland impacts is currently identified. The compensation approach for Class IV and V wetlands must be confirmed with Manitoba Conservation and Climate. Specific recommendations for compensation of impacts to the Class III, IV and V wetlands will be discussed separately in the Wetland Compensation Plan, using the required formula for an area based compensation cost for Class III wetlands, and with any other compensation arrangements confirmed for Class IV and V wetland impacts.

4.1 Lake Manitoba Outlet Channel

Table 4-1 provides a summary of the overall upland and wetland land cover found within the LMOC PDA. The total impacted area was determined based on the predicted zone of direct impact within this area, which in this case corresponded to the PDA for each project component. In total, 353.63 ha of wetland habitat lies within the PDA. Class III seasonal marshes were the predominant wetland type within the LMOC PDA, totalling 197.70 ha.

The wetland impacts identified in the EIS for the LMOC found different results, both in terms of wetland classes and overall areas. This reflects the difference in scale and accuracy of mapping completed in this update, as well as new mapping for the alignment routing now captured in this current assessment. During the mapping process, we noted certain wetlands were often mistyped in the EOSD mapping used in the EIS. In particular, pastures and Class III wetlands were sometimes mapped as Class IV wetlands, which would overestimate the wetland area within the PDA. The changes in both the form and extent of impacts thus will differ from the original EIS assessment.

Table 4-1 Wetland Classification within the Modified LAA and LMOC PDA

Broad Land Cover Category	Land Cover Class	Area in LMOC Modified LAA (ha)	Area in LMOC PDA (ha)	Estimated Impacted Area in the PDA (ha)	Compensation Area (ha) ¹
Uplands					
Disturbed	Agricultural Cropland	264.16	162.70	162.70	N/A
	Cultural Features	4.69	2.31	2.31	N/A
	Forage Crops	480.44	303.52	303.52	N/A
	Roads and Trails	13.70	4.79	4.79	N/A
Forest	V1	78.19	47.33	47.33	N/A
	V5	135.14	91.07	91.07	N/A
Other Water/Bare	Bare Rock, Gravel and Sand	0.47	0.35	0.35	N/A
	Water Bodies	480.85	64.18	64.18	N/A
Undefined Upland	Undefined Upland	3,534.26	N/A	N/A	N/A
Wetlands					
Marsh	Class II	325.22	68.01	68.01	N/A
	Class III	1,120.53	197.91	197.91	197.91
	Class IV	638.87	38.38	38.38	N/A
	Class V	297.29	0.83	0.83	N/A

Broad Land Cover Category	Land Cover Class	Area in LMOC Modified LAA (ha)	Area in LMOC PDA (ha)	Estimated Impacted Area In the PDA (ha)	Compensation Area (ha) ¹
Swamp	Basin Swamp	102.85	47.76	47.76	N/A
	Lacustrine Swamp	1.75	0.74	0.74	N/A
Total Wetlands		2,486.52	353.63	353.63	197.91
Overall Total		7,478.41	1029.88	1029.88	197.91

Notes:

- ¹ Under *The Water Rights Regulation*, only Class III marsh habitat requires compensation through the financial agreement with MHHC, or self-performed habitat restoration within a project. Compensation for impacts to other marsh wetlands, swamps and peatlands are determined through discussion with Manitoba Conservation and Climate, and MHHC.

4.2 Provincial Road 239 Re-route

Table 4-2 summarizes the overall upland and wetland land cover found within the PR 239 re-reroute PDA (i.e., the road right-of-way), including upland and wetland types. Unlike the LMOC PDA, basin swamp wetlands were most abundant here, followed by Class II wetlands. The overall total wetland habitat within the PR 239 re-reroute PDA was relatively low (9.11 ha), with a total of 1.06 ha of Class III marsh wetlands. As noted previously, actual disturbance to wetlands within the PDA may depend on construction approach. Infilling impacts to wetlands, including Class III wetlands along this alignment may be possible during construction. Final confirmation of permanent wetland impacts should be determined from the as-built survey of the new road, including any side ditching. Temporary impacts during construction would typically include sediment release, or accidental spills of contaminants, both of which can be easily avoided through environmental controls during construction.

Table 4-2 Wetland Classification within the Modified LAA and PR 239 Re-route PDA

Broad Land Cover Category	Land Cover Class	Area in PR 239 Re-route Modified LAA (ha)	Total Impacted Area In PR 239 Re-route PDA (ha)	Estimated Impacted Area In the PDA (ha)	Compensation Area (ha) ¹
Upland					
Disturbed	Agricultural Cropland	127.29	10.69	10.69	N/A
	Cultural Features	1.41	0.02	0.02	N/A
	Forage Crops	90.29	10.18	10.18	N/A
	Roads and Trails	25.51	17.86	17.86	N/A
Forest	V1	16.44	1.52	1.52	N/A
	V5	70.54	6.56	6.56	N/A
Other Water/Bare	Water Bodies	2.91	0.01	0.01	N/A

Broad Land Cover Category	Land Cover Class	Area in PR 239 Re-route Modified LAA (ha)	Total Impacted Area In PR 239 Re-route PDA (ha)	Estimated Impacted Area In the PDA (ha)	Compensation Area (ha) ¹
Undefined Upland	Undefined Upland	1,456.18	N/A	N/A	N/A
Wetlands					
Marsh	Class II	124.65	4.12	4.12	N/A
	Class III	277.71	1.06	1.06	1.06
	Class IV	172.33	0.71	0.71	N/A
	Class V	25.36	N/A	N/A	N/A
Swamp	Basin Swamp	104.68	3.22	3.22	N/A
Wetland Total		704.73	9.11	9.11	1.06
Overall Total		1,790.57	55.95	55.95	1.06

Notes:

- Under *The Water Rights Regulation*, only Class III marsh habitat requires compensation through the financial agreement with MHHC, or self-performed habitat restoration within a project. Compensation for impacts to other marsh wetlands, swamps, and peatlands are determined through discussion with Manitoba Conservation and Climate, and MHHC.

4.3 Lake St. Martin Outlet Channel

Table 4-3 provides a summary of the overall upland and wetland land cover found within the PDA and impact areas related to the LSMOC. This outlet channel passes through extensive peatlands, including a range of bogs and fens, many of which are contiguous (Figure 2, Appendix A). Fens were the most abundant wetland type in the PDA, and horizontal fens comprised the main type of fen within this area. Fen wetlands occupy flat terrain, and are fed by both groundwater and surface water flows. They can also have slow levels of surface flow. The outlet channel, where it bisects such wetlands will have both direct and indirect effects that extend beyond the PDA. Such effects are evident along the existing segments of the outlet channel in this area. Considerations of wetland impact should include the full PDA and the immediately adjacent modified LAA, where the outlet channel bisects peatlands. Swamps were also relatively abundant in the LSMOC PDA, and were often found adjacent fens and bogs, where terrain sloped up slightly, such that soils were not inundated year round. Neither swamps nor peatlands are addressed in Manitoba's Wetland Compensation Policy, and only the small area of Class III marsh impact (0.11 ha) requires compensation under *The Water Rights Regulation*.

The wetland impacts identified in the EIS found different results, both in terms of wetland classes and overall areas. This reflects the difference in scale and accuracy of mapping completed in this update, and the changes in the alignment after the EIS. The LSMOC route changed significantly in the current design, which will affect the overall totals and types of wetlands included in the total PDA. During the mapping process, we noted fewer difference between our mapping and the EOSD mapping used in the EIS. However, wooded uplands were sometimes identified as peatlands or swamps, which would influence overall total impact areas. The changes in both the form and extent of impacts thus will differ from the original EIS assessment.

Table 4-3 Wetland Classification within the Modified LAA and LSMOC PDA

Broad Land Cover Category	Land Cover Class	Area in LSMOC Modified LAA (ha)	Total Impacted Area In the LSMOC PDA (ha)	Estimated Impacted Area In the PDA (ha)	Compensation Area Requirements (ha) ¹
Uplands					
Disturbed	Forest Cutovers	36.95	30.47	30.47	N/A
	Roads and Trails	31.30	15.13	15.13	N/A
Forest	V1	87.59	4.45	4.45	N/A
	V5	78.96	22.34	22.34	N/A
Other Water/Bare	Bare Rock, Gravel and Sand	9.17	3.69	44.32	N/A
	Channel	58.30	44.32	1.39	N/A
	Water Bodies	573.61	1.39	30.47	N/A
Wetlands					
Marsh	Class III	15.05	0.11	0.11	0.11
	Class IV	42.40	N/A	N/A	N/A
Peatland	Basin Bog	722.66	114.10	114.10	N/A
	Basin Fen	196.54	40.94	40.94	N/A
	Horizontal Fen	3,335.27	333.26	333.26	N/A
	Shore Fen	126.18	4.84	4.84	N/A
	Stream Fen	1,728.69	232.53	232.53	N/A
Swamp	Basin Swamp	7.22	3.78	3.78	N/A
	Lacustrine Swamp	71.59	10.66	10.66	N/A
	Lagg Swamp	158.29	11.46	11.46	N/A
	Riverine Swamp	12.81			
	Unconfined Flat Swamp	80.17	18.06	18.06	N/A
Wetland Total		6,496.87	769.74	769.74	0.11
Overall Total		7,372.75	891.53	891.53	0.11

Notes:

- Under *The Water Rights Regulation*, only Class III marsh habitat requires compensation through the financial agreement with MHHC, or self-performed habitat restoration within a project. Compensation for impacts to other marsh wetlands, swamps and peatlands are determined through discussion with Manitoba Conservation and Climate, and MHHC.

4.4 Manitoba Hydro's Distribution Line

The overall upland and wetland land cover and impacts found within Manitoba Hydro's distribution line PDA are summarized in Table 4-4. As with the LSMOC, the PDA had various types of fen peatland and swamp wetlands, but in this case, the PDA crossed mainly through swamps. No Class III marsh wetlands were found in this PDA, and thus no compensation is required under *The Water Rights Regulation*. Unlike the outlet channel construction process, however, Manitoba Hydro's distribution line will disturb a much smaller footprint than that within the identified distribution line PDA. Temporary impacts may occur during construction access, but the line will be supported by towers, and thus the area of permanent wetland loss will be much smaller. MI will provide this information to Manitoba Hydro for its own compensation discussions. The information below is provided for completeness of the analysis only.

Table 4-4 Wetland Classification within the Modified LAA and PDA, for the Hydro Line

Broad Land Cover Category	Wetland Class	Area in Manitoba Hydro's Distribution Line Modified LAA (ha)	Area in Manitoba Hydro's Distribution Line PDA (ha)	Estimated Impacted Area In the PDA (ha)	Compensation Area (ha) ¹
Uplands					
Disturbed	Forest Cutovers	4.47	0.50	0.50	N/A
	Roads and Trails	21.24	7.27	7.27	N/A
Forest	V1	113.60	7.68	7.68	N/A
	V24	39.69	4.29	4.29	N/A
	V28	6.14	0.24	0.24	N/A
	V4	58.92	4.22	4.22	N/A
	V5	120.12	6.57	6.57	N/A
Other Water/Bare	Bare Rock, Gravel and Sand	16.48	N/A	N/A	N/A
	Waterbody	34.09	0.64	0.64	N/A
Wetlands					
Marsh	Class III	15.05	N/A	N/A	N/A
	Class IV	45.44	N/A	N/A	N/A
Peatland	Basin Bog	7.23	0.23	0.23	N/A
	Basin Fen	70.61	2.16	2.16	N/A
	Horizontal Fen	260.34	1.84	1.84	N/A
	Stream Fen	183.94	0.246	0.246	N/A
Swamp	Lacustrine Swamp	61.28	0.10	0.10	N/A

Broad Land Cover Category	Wetland Class	Area in Manitoba Hydro's Distribution Line Modified LAA (ha)	Area in Manitoba Hydro's Distribution Line PDA (ha)	Estimated Impacted Area In the PDA (ha)	Compensation Area (ha) ¹
	Lagg Swamp	99.06	4.12	4.12	N/A
	Riverine Swamp	12.81	0.89	0.89	N/A
	Unconfined Flat Swamp	76.02	4.64	4.64	N/A
Wetland Total		831.78	14.23	14.23	0
Overall Total		1,249.53	45.63	45.63	0

Notes:

- Under *The Water Rights Regulation*, only Class III marsh habitat requires compensation through the financial agreement with MHHC, or self-performed habitat restoration within a project. Compensation for impacts to other marsh wetlands, swamps and peatlands are determined through discussion with Manitoba Conservation and Climate, and MHHC.

5 WETLAND COMPENSATION AND MONITORING RECOMMENDATIONS

As noted previously, construction monitoring recommendations and the Wetland Compensation Plan will be documented in separate reports, to inform subsequent discussions regarding these Project requirements with the responsible agencies. This report has more clearly identified the types of wetlands likely to be impacted by construction and operation of the outlet channels, the PR 239 re-route and Manitoba Hydro's distribution line. In particular, direct impacts, and the areal extent of the Project activities, can be readily quantified as an areal summation. Functional and indirect effects on the various wetlands may also be considered for both compensation and during construction monitoring. These future assessments will consider the findings of the vegetation and wildlife reports, and traditional land use provided by Indigenous stakeholders.

Manitoba's wetland compensation approach is a no-net loss approach, linked to a broader framework that aims to provide integrated watershed-based land and water planning management. The 2003 Water Strategy outlined the fundamental elements of Manitoba's Wetland Policy, including direction to consider watershed impacts and impacts to fish, wetlands, watershed management and other effects. Legislative mechanisms to require wetland compensation are provided through two main Acts, further described below.

The Water Rights Act and Regulation (amended 2019): Regulates use and diversion of water in Manitoba, including water diversion created by infilling or alteration of wetlands. Permission (rights) to remove wetlands must be obtained by a license under *The Water Rights Act*, for loss or alteration of 'sensitive' wetlands and particularly Class III, IV, and V wetlands (Stewart and Kantrud classification). Wetland impacts include reduction in the physical size or a change that would affect the wetland classification (e.g., a change to hydrology that would alter duration of inundation). A new regulation under this Act, enabled by the *Sustainable Watersheds Act* (2019) streamlines the approval process for lower risk, lower impact drainage projects and water control works that meet certain requirements. These require a registration, while more complex, higher impact works require more through

review and licensing. Projects that eliminate or alter Class III, IV and V wetlands, or drain Class 6 or 7 soils or unimproved organic soils (e.g. peatlands) must proceed through the licensing process. Compensation can be through two options:

- Self directed project, described in a compensation plan, or
- Financial payment based on the area of impact paid under an agreement negotiated with an approved wetland restoration or enhancement agency (currently only the MHHC).

Self-directed projects can include restoration of previously drained wetlands, or conservation of existing wetlands. Conservation can include protection of lands supporting wetland habitats through a conservation easement, or through legislative protections. The financial payment is also intended to support restoration or conservation, but depending on land availability, compensation may not necessarily be within the same watershed. Where government agencies hold lands within a given project area, conservation through an easement or other legislative protections can help to offset compensation requirements.

The Sustainable Watersheds Act (2018) amended various Acts, including *The Water Rights Act*, as described above, and the *Manitoba Habitat Heritage Act*. The changes to the *Manitoba Habitat Heritage Act* established the MHHC as a wetland restoration and enhancement agency, able to enact a compensation agreement negotiated under *The Water Rights Act*. Enhancement and restoration were defined in *The Water Rights Act*, and can include increasing the size of a wetland, improving its hydrology or vegetation in the wetland or adjacent uplands, or conserving a wetland through a conservation agreement. Restoration would return an existing but disturbed Class III, IV or V wetland to its original condition. Under a compensation agreement using financial payment, responsibility for design and implementation of such projects lies with MHHC; a project proponent is responsible only for payment of the compensation amount.

The Water Rights Act provides the legislative tools to protect riparian, wetland and other sensitive landscapes in the province. As with many jurisdictions, Manitoba's Wetland Policy framework requires avoidance, minimization, and compensation, and these steps must be described in an application for a license under the Act. Avoidance and minimization have been considered during earlier stages of Project planning, in fact the LMOC and LSMOC PDA's have been reduced by almost 70 ha with the current changes. Compensation must now be negotiated with Manitoba Conservation and Climate, and with MHHC (for financial compensation), and will be based on past compensation approaches negotiated with provincial departments, including MI. To inform negotiations for a compensation agreement, this report has identified direct and indirect impacts anticipated for all wetland types in the Project PDA, and included functional impacts related to indirect effects of altered hydrology. However, as prescribed under *The Water Rights Act*, such negotiation will focus on impacts to Stewart and Kantrud wetland Classes III, IV, and V. Currently, a financial compensation formula exists only for Class III habitat. Although the Act notes that projects that may drain peatlands must also be assessed through the licensing process, compensation requirements for such impacts have not yet been established.

Compensation recommendations described in the Wetland Compensation Plan will be based on the requirements of *The Water Rights Act* and its regulations. Currently, Schedule D of *The Water Rights Regulation* requires compensation only for Class III wetland impacts, based on a financial formula (2 x impacted area x \$6,000 per acre). Impacts to Class IV and V wetlands and peatlands must also be considered in the approval of a license under the Act, but the form of compensation is not specified. Recommendations included in this plan could consider the following options:

- Monetary compensation, based on an area-based approach, as has been done for other government departments.

- Enhancement options to help sustain remnant wetlands affected by construction, particularly in the peatland areas of the northern Project area.
- Conservation of MI owned lands that support diverse or abundant wetland habitat through establishment of a conservation easement on wetlands, or the entire land parcel. Such an option replaces lost habitat at a 3:1 ratio (i.e., the area conserved would represent 1/3 of the required compensation in area). An argument can be made to obtain credit for a conservation easement on a large parcel (e.g., a quarter section), since this would more effectively meet goals of watershed / landscape level protection.

Construction monitoring recommendations will similarly be informed by predicted impacts, but will also consider less well understood hydrological impacts, including potential changes in shallow groundwater flow that could alter the water supply to adjacent wetlands. If self-directed wetland enhancement is adopted for compensation, monitoring would also be recommended to confirm that enhancements are performing as anticipated.

6 SUMMARY

The proposed Project will require the excavation of two outlet channel, berms and access, which will likely generate direct and indirect impacts to wetlands within the right-of-way, described in this assessment as the Project Disturbance Area (or PDA). Similarly, the PDA associated with the construction of the new alignment of PR 239 and the installation of the Manitoba Hydro Distribution Line provides an approximate disturbance footprint for each of these project components. The PDA estimates the entire disturbance footprint of potential wetland impacts for these projects, and provides a preliminary estimate of the compensation requirements for these projects. That estimate can be used to initiate compensation planning required under *The Water Rights Act* regulation, for the Class III, IV and V wetlands that specifically require compensation. Although provincial wetland and water policies aim to conserve other types of wetlands, including peatlands and swamps - disturbance to these types of wetlands do not currently require compensation. MI is developing a Wetland Compensation Plan for wetland-related impacts associated with the LMOC and LSMOC, the PR 239 re-route, and the distribution line that will be owned and operated by Manitoba Hydro.

Construction environmental monitoring plans will encourage avoidance or minimize wetland impacts where feasible during construction, and thus, wetland impacts remain an estimate at this point. Final impacts can be determined from as-built survey of the constructed road and outlet channels, and confirmation of indirect effects such as disruption of surface and shallow groundwater flows to adjacent wetlands or remnant wetlands.

Based on the current PDA limits, the LMOC will impact mainly Class III wetlands (197.91 ha), with a smaller area of impact to Class IV (38.38 ha) and V (0.83 ha) wetlands. The PR 239 re-route project will affect a relatively small amount of Class III habitat (about 1.06 ha), and a small area of Class IV wetland (0.71 ha). The LSMOC crosses an area of extensive fen and bog peatland and swamps, but outlet channel construction will potentially disturb only a small area of Class III marsh habitat (0.11 ha).

The form of wetland compensation required for projects is outlined in *The Water Rights Act* regulation, and allows a financial payment, self-directed restoration or conservation activities. The LMOC, LSMOC and PR 239 re-route projects offer opportunities to fulfill compensation requirements using any of these options, or a combination of them. However, the form of conservation must be confirmed through discussion with Manitoba Conservation and Climate, and MHHHC, since a financial compensation formula exists only for impacts to Class III wetlands. While impacts to Class IV and V wetlands and drainage of swamps and peatlands are generally

not permitted under the Act, provincial policy and legislation recognizes the need for impacts to these wetlands for flood protection and other activities in the public interest. Impacts, and compensation to the Class III, IV and V wetlands, and potential disturbance of swamp and peatland habitat along the LSMOC alignment must be confirmed with Manitoba Conservation and Climate during the licensing process for the outlet channel projects. MI is considering compensation options involving a potential combination of financial compensation and conservation through conservation easements on other MI lands in the local area. Such options will be explored in more detail in the Wetland Compensation Plan.

7 CLOSURE

This update study aimed to address gaps in previous wetland mapping prepared as part of previous vegetation background studies, and the EIS for the LMOC, LSMOC and PR 239 projects, including the associated Manitoba Hydro Distribution Line. The resulting wetland and upland mapping is provided at fine resolution (1:5,000 scale), and was developed and confirmed through field surveys and interpretation of terrain and aerial imagery, as well as senior review. Mapping of such extensive areas, at fine resolution, may still contain minor errors in delineation or classification, despite quality assurance checks. Regardless, based on comparison to previous, coarse-scale mapping, the current estimates of impacted wetland areas have improved in terms of wetland classification and areal extent. The estimates of wetland impact provided in this study offer a sound basis for planning wetland compensation options by MI, however, given potential for further minimization or avoidance of impacts during construction, a final reconciliation of impacted areas is recommended, based on planned construction monitoring and as-built survey of the constructed infrastructure. Where temporary disturbances can be successfully restored through site reclamation, the affected area could also be removed from the initial compensation estimate. Accordingly, the areal extent of impacts identified in this study offer a starting point for planning of wetland compensation, but should be supplemented with post-construction confirmation of wetland impacts.

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APPENDIX

A FIGURES





Legend

- Lake Manitoba Outlet Channel (LMOC)
- Lake St. Martin Outlet Channel (LSMOC)
- Manitoba Hydro's Distribution Line
- PR 239 Re-Route
- Roads
- Watercourse

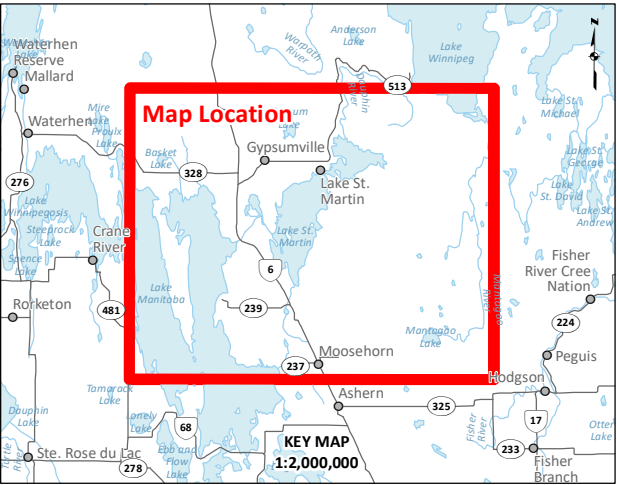
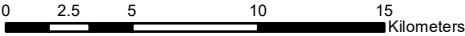


Figure 1A: Project Location Overview

Lake Manitoba & Lake St. Martin

Manitoba, Canada

Scale: 1:300,000



Universal Transverse Mercator (Zone 14)
North American Datum (1983)



Report By: DW
Drawn by: JH
Reviewed By: KT

WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



- Legend**
- Project Development Area (PDA)
 - Manitoba Hydro's Distribution Line
 - Roads
 - Watercourse

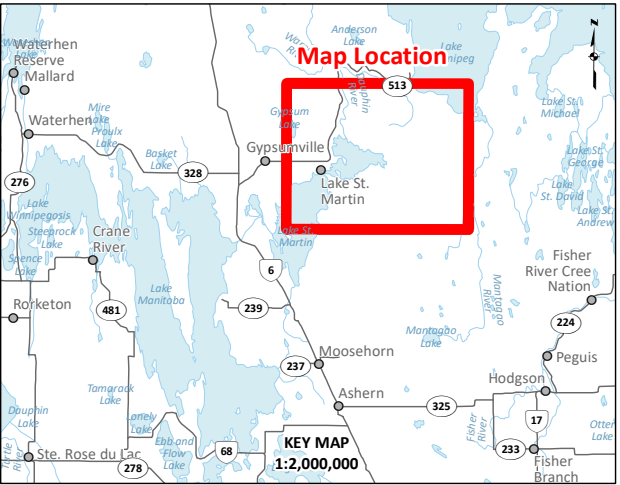
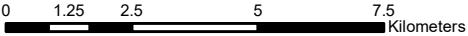


Figure 1B: Project Location - Lake St. Martin Outlet Channel and Manitoba Hydro's Distribution Line

Lake Manitoba & Lake St. Martin

Manitoba, Canada

Scale: 1:150,000



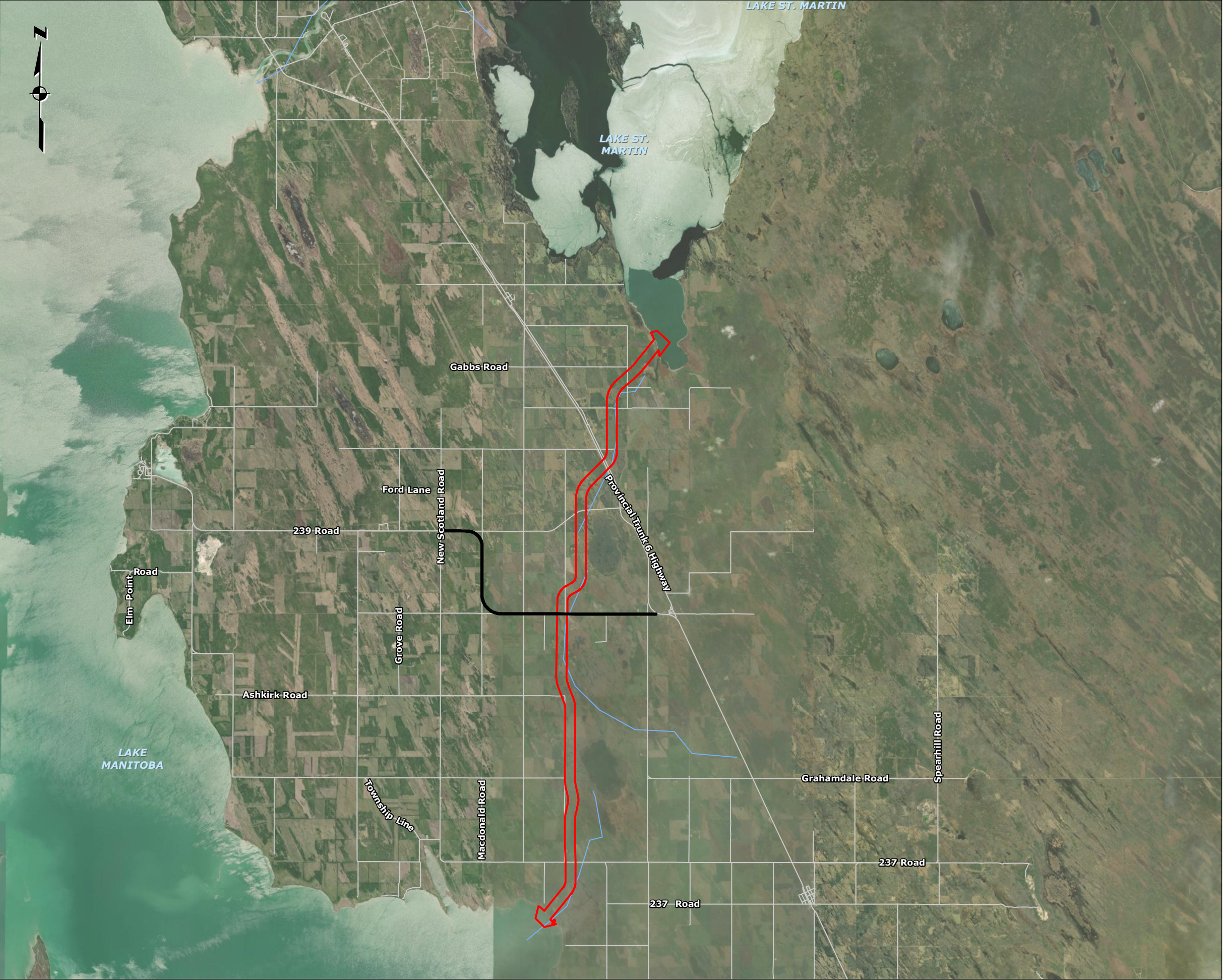
Universal Transverse Mercator (Zone 14)
North American Datum (1983)



Report By: DW
Drawn by: JH
Reviewed By: KT

WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



- Legend**
- Project Development Area (PDA)
 - PR 239 Re-Route
 - Roads
 - Watercourse

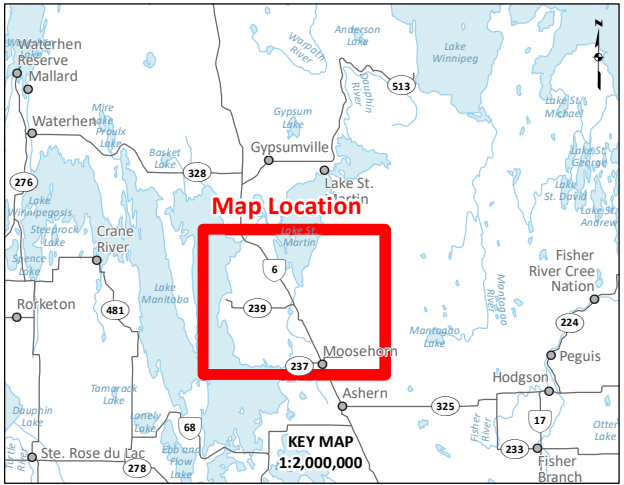


Figure 1C: Project Location - Lake Manitoba Outlet Channel and PR 239 Road Re-route

Lake Manitoba & Lake St.Martin

Manitoba, Canada

Scale: 1:150,000

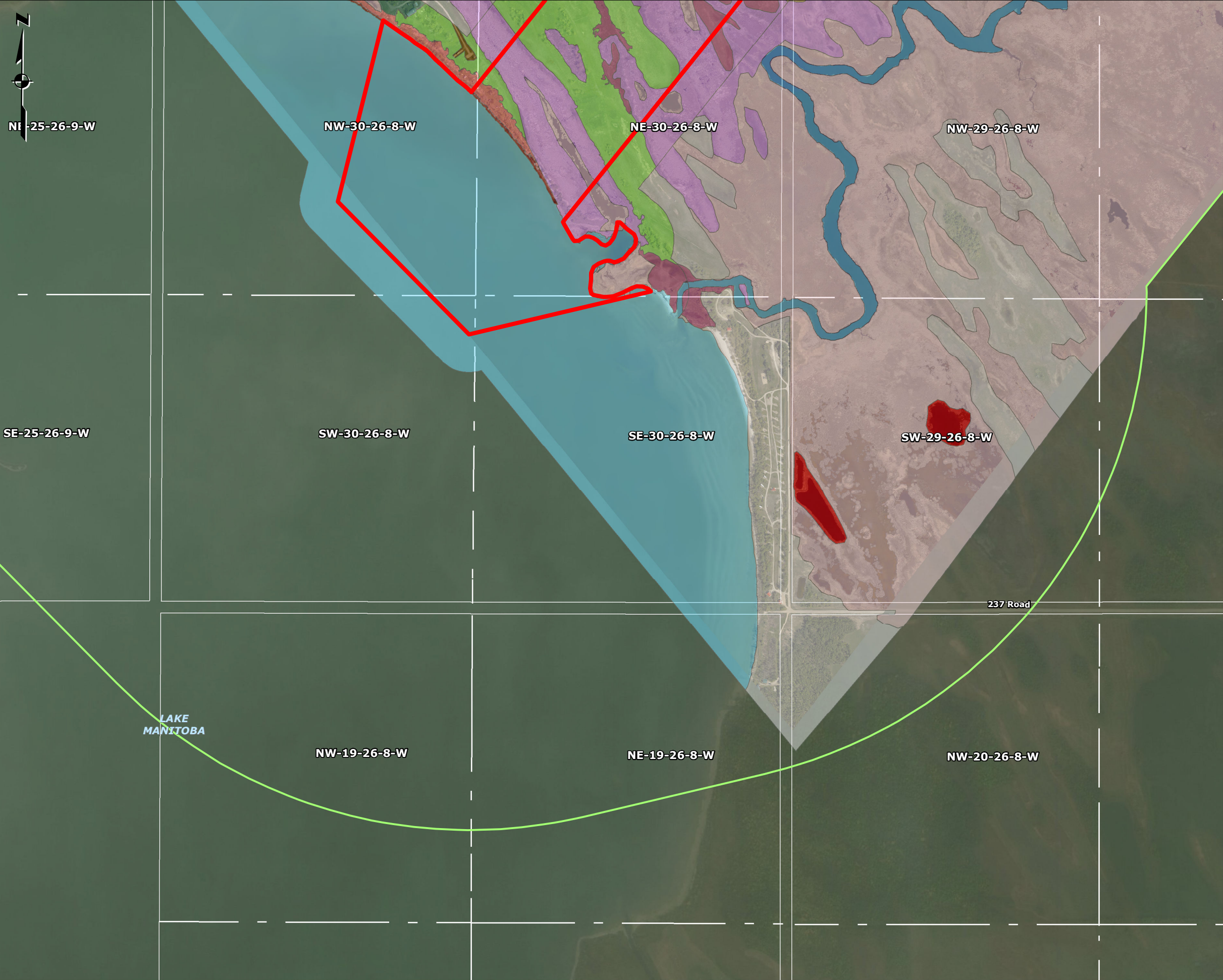
0 1.25 2.5 5 7.5 Kilometers

Universal Transverse Mercator (Zone 14)
North American Datum (1983)



Report By: DW WSP Job #: 20M-00910-00
Drawn by: JH Date: September 10, 2020
Reviewed By: KT Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



Legend

Project Development Area (PDA)

Modified Local Assessment Area (LAA)

Classification

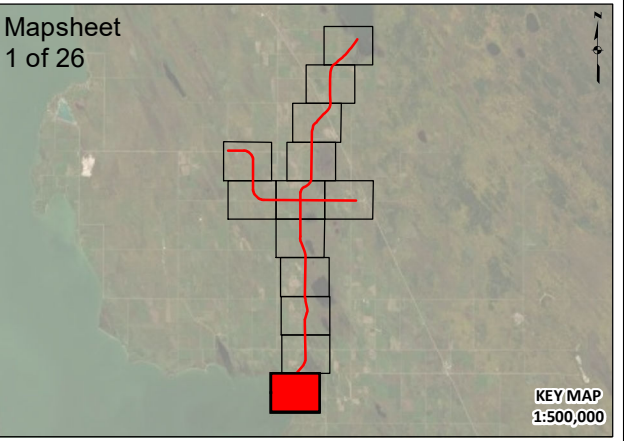
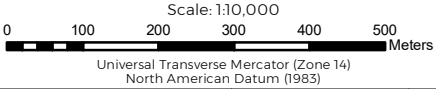
Bare Rock, Gravel and SandClass II WetlandClass III WetlandClass IV WetlandClass V WetlandCultural FeaturesForage CropsLacustrine SwampRoads and TrailsVI = Balsam Poplar Hardwood and MixedwoodUndefined uplandWater Bodies

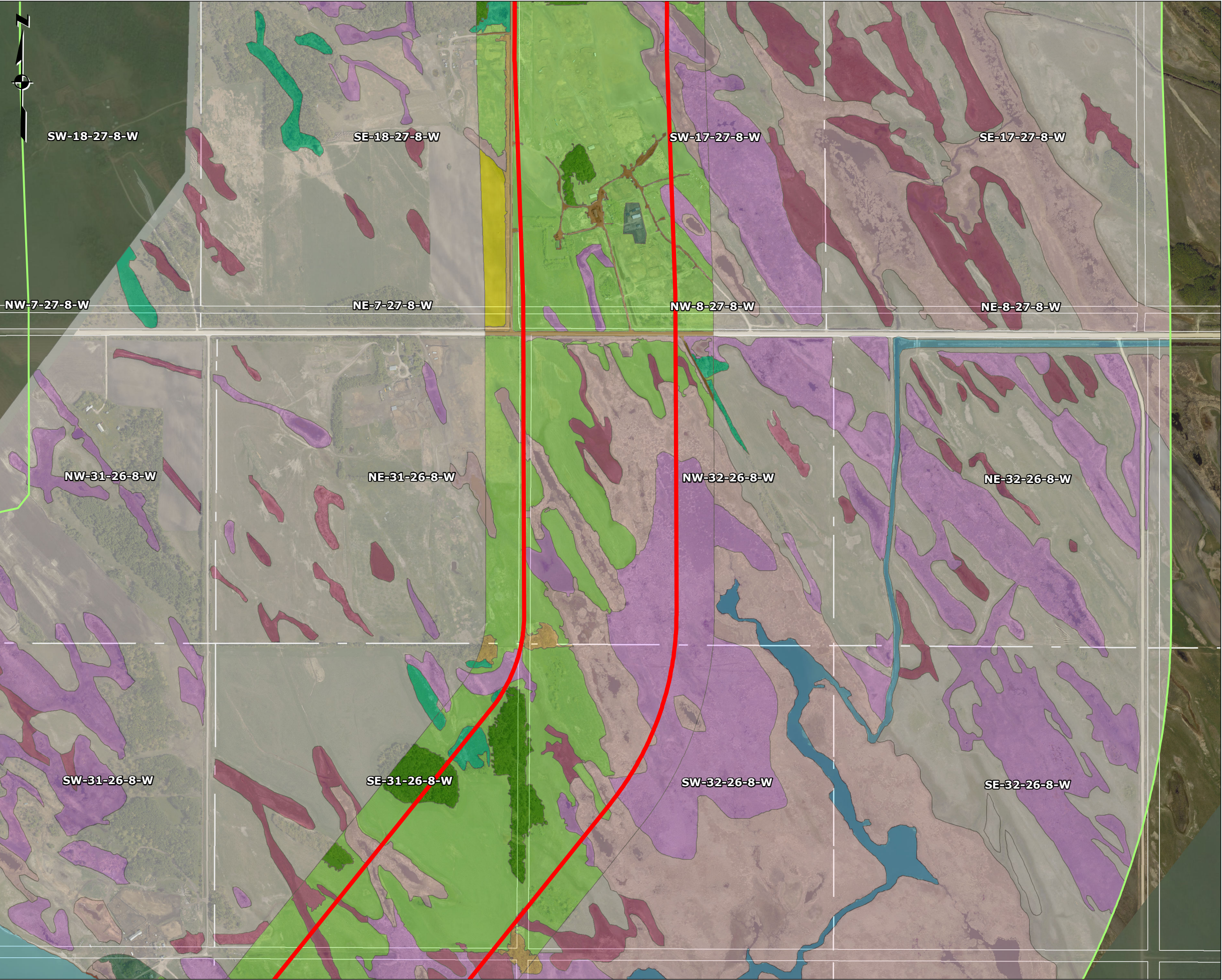
Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada



Report By: DP
Drawn by: JH
Reviewed By: DK

WSP Job #: 20M-00910-00
Date: September 10, 2020
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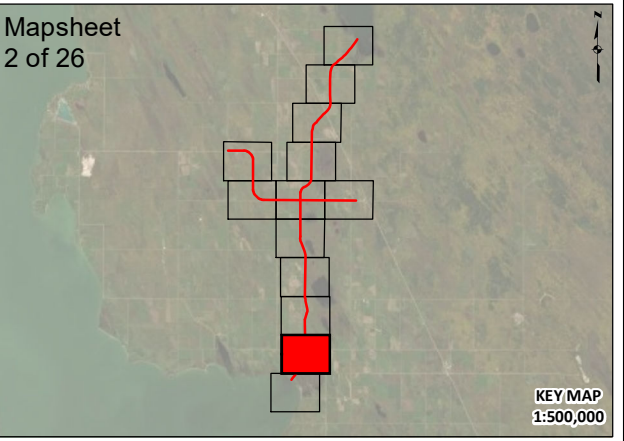


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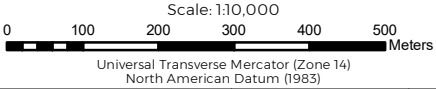
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)

Classification

- Agricultural Cropland
- Bare Rock, Gravel and Sand
- Basin Swamp
- Class II Wetland
- Class III Wetland
- Class IV Wetland
- Cultural Features
- Forage Crops
- Roads and Trails
- VI = Balsam Poplar Hardwood and Mixedwood
- V5 = Aspen Hardwood
- Undefined upland
- Water Bodies



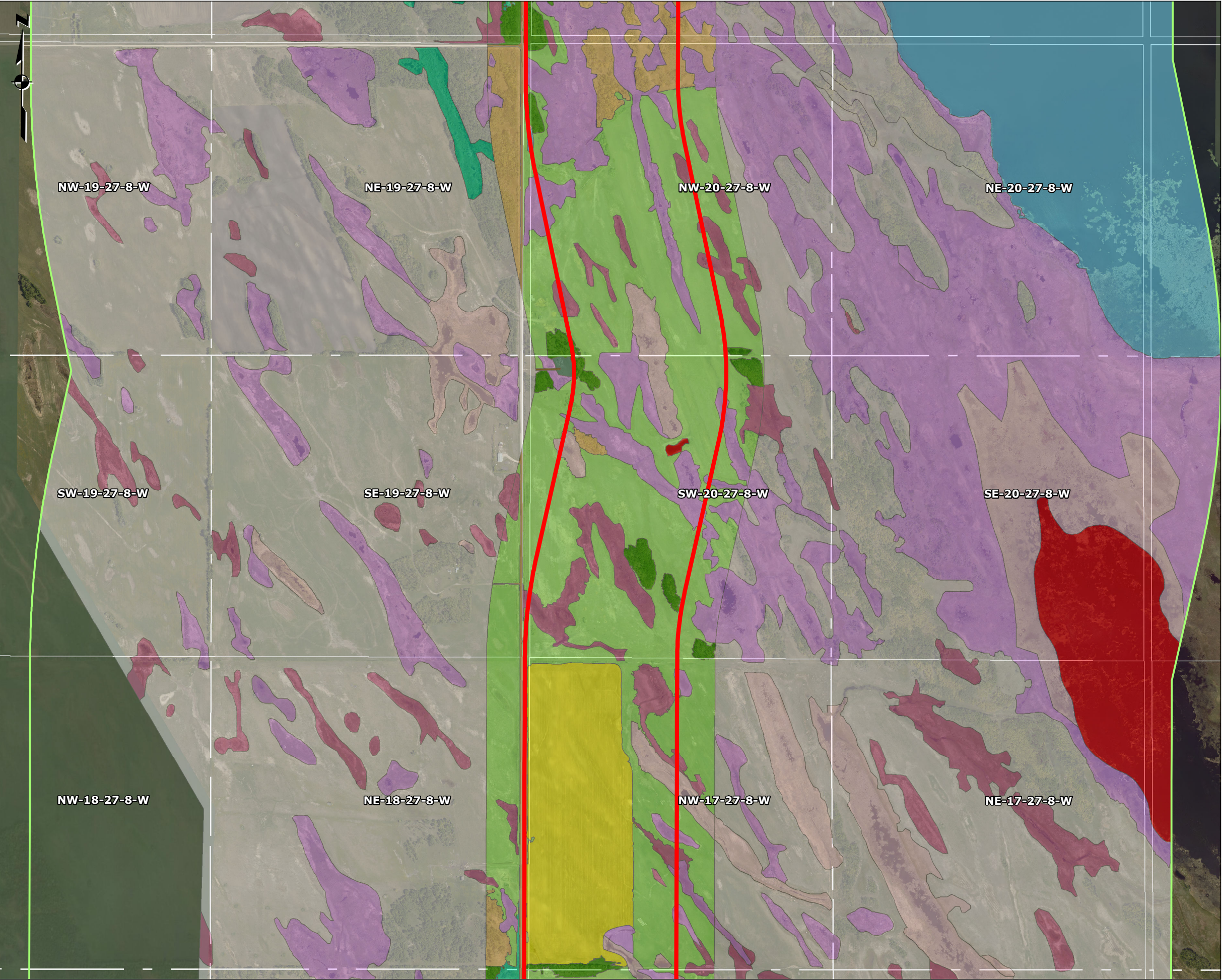
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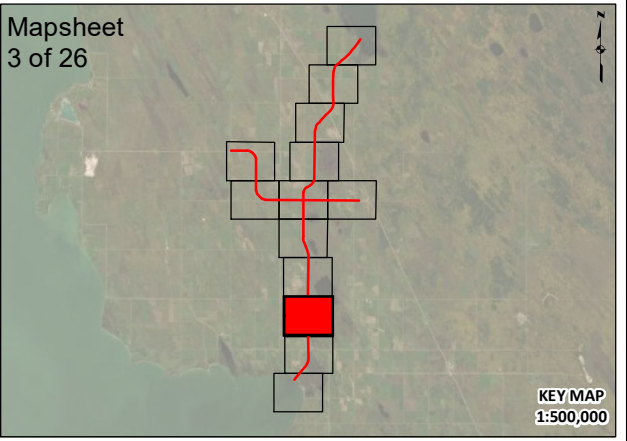


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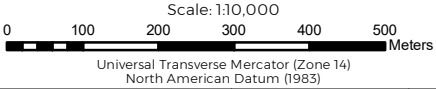
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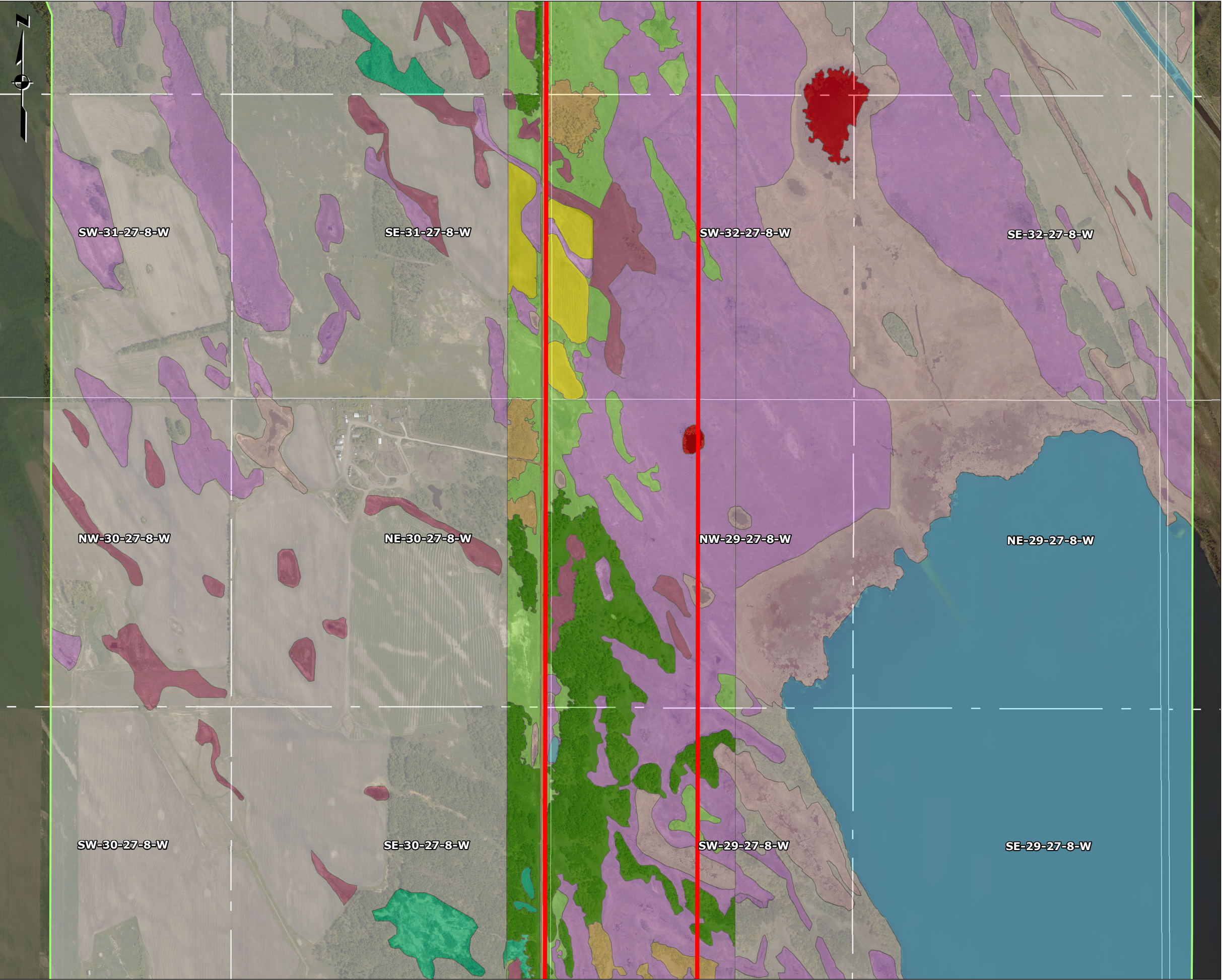
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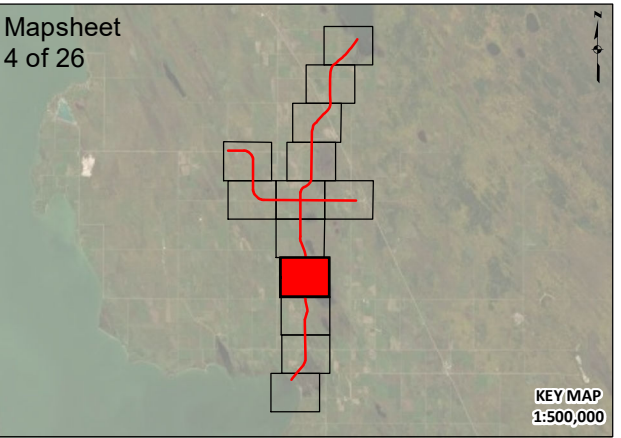


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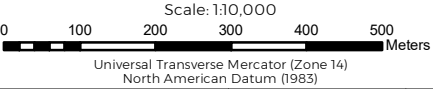
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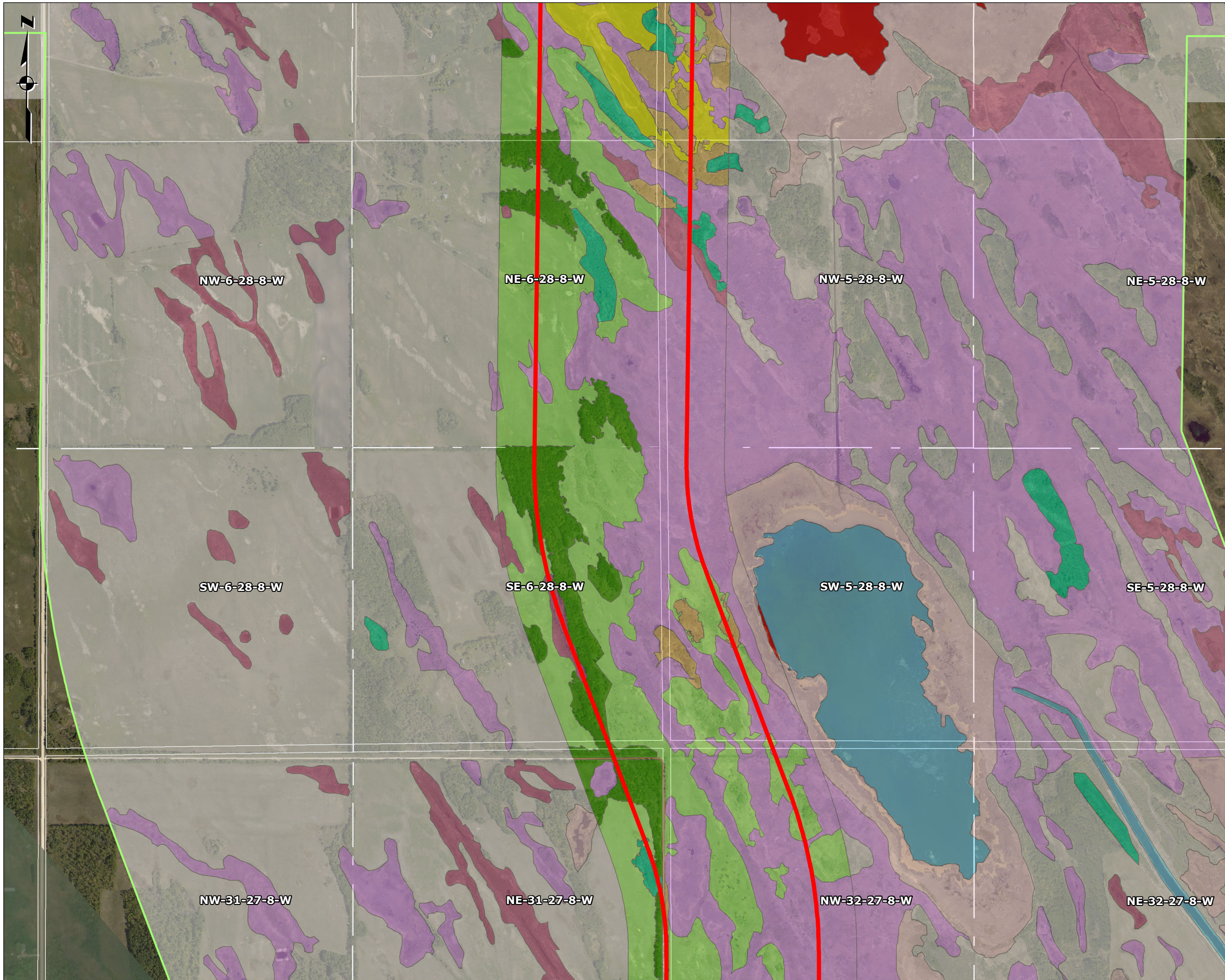
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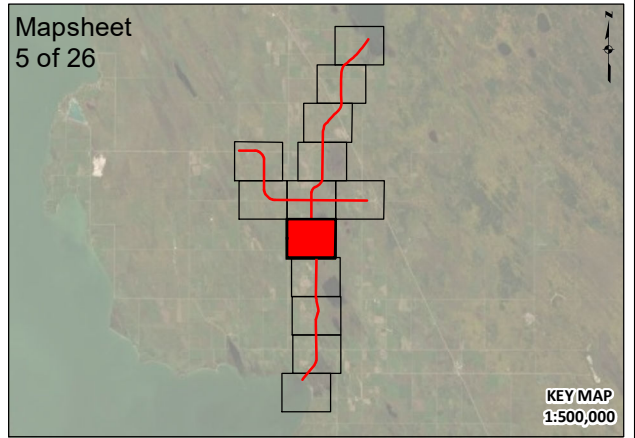
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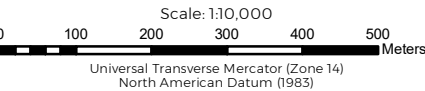
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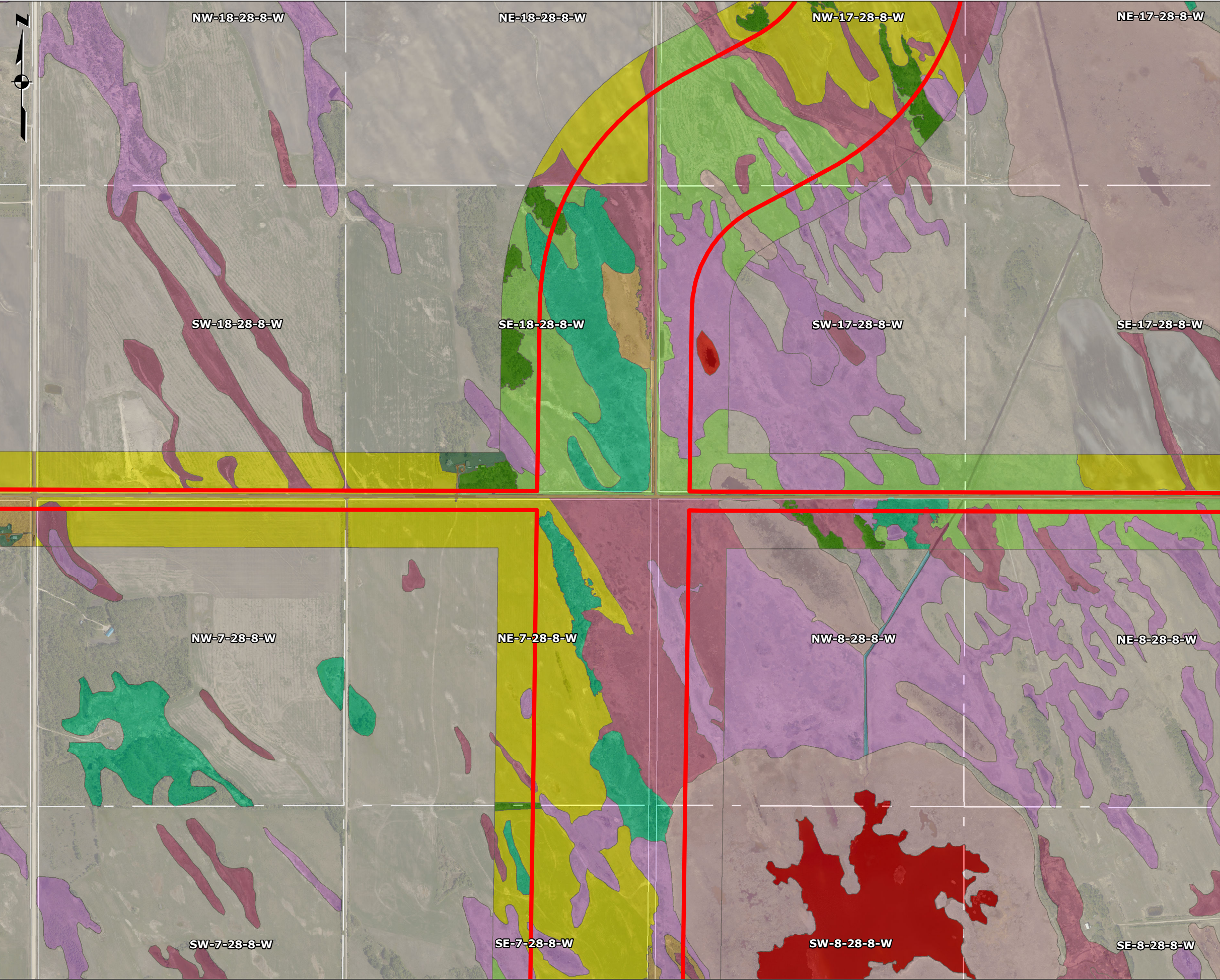
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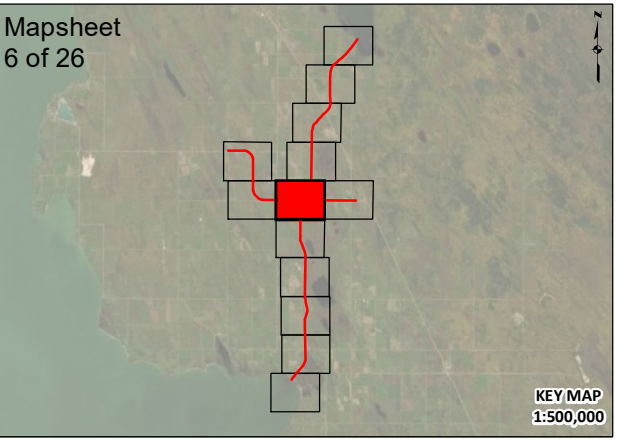


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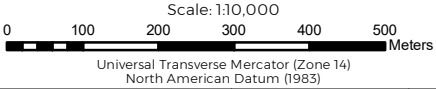
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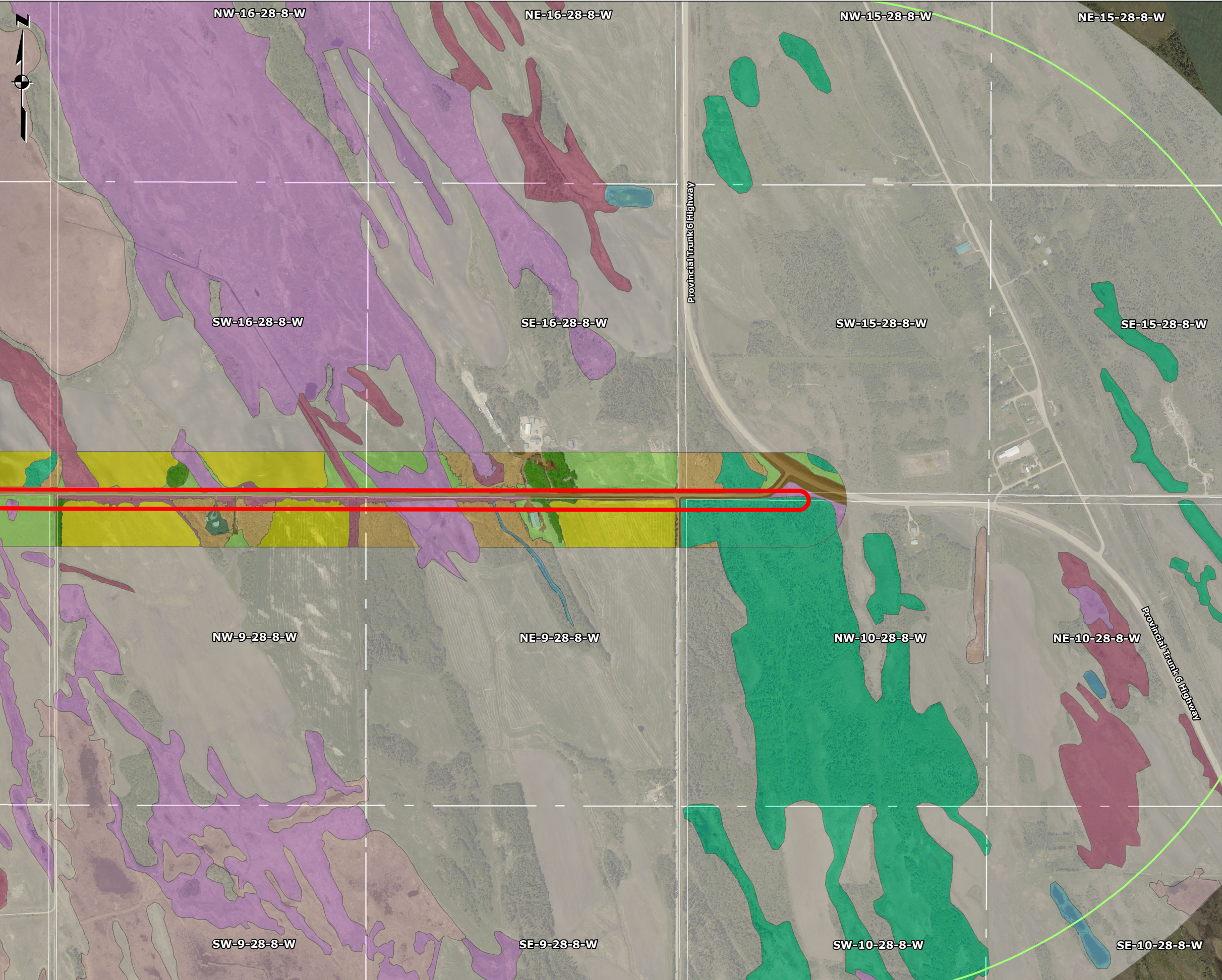


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Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP WSP Job #: 20M-00910-00
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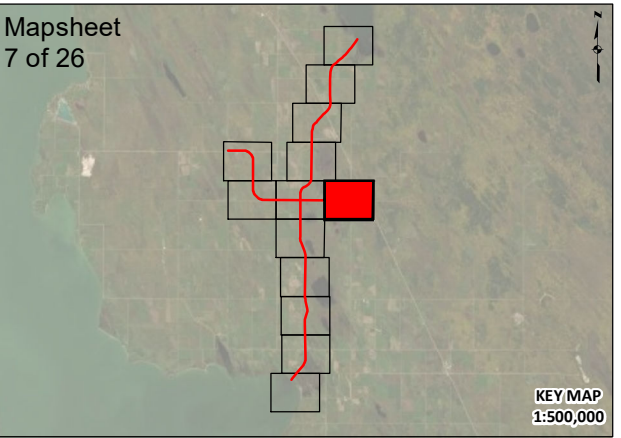


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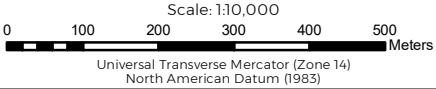
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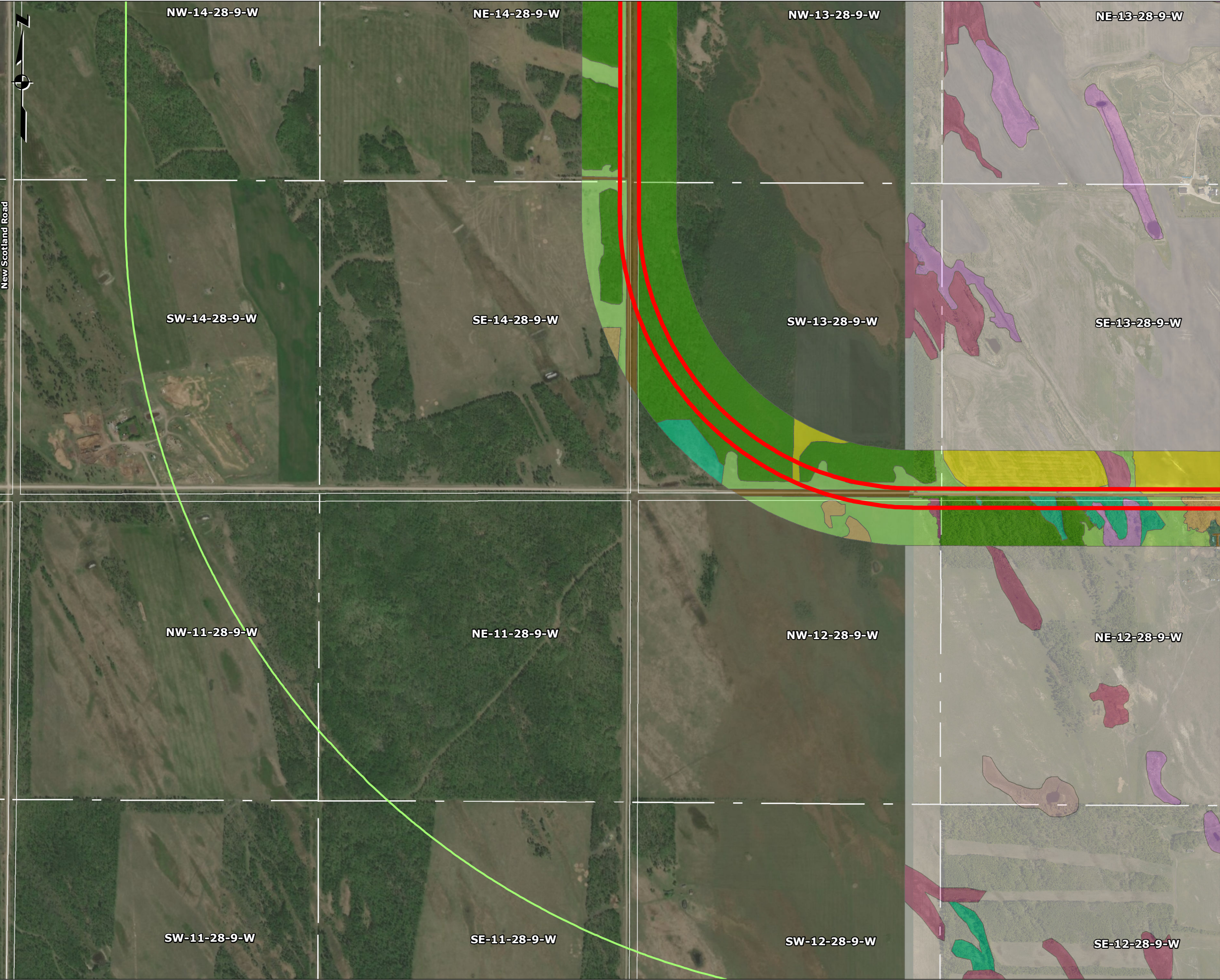


**Figure 2: Pre-construction Survey
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Lake Manitoba & Lake St.Martin
Manitoba, Canada**



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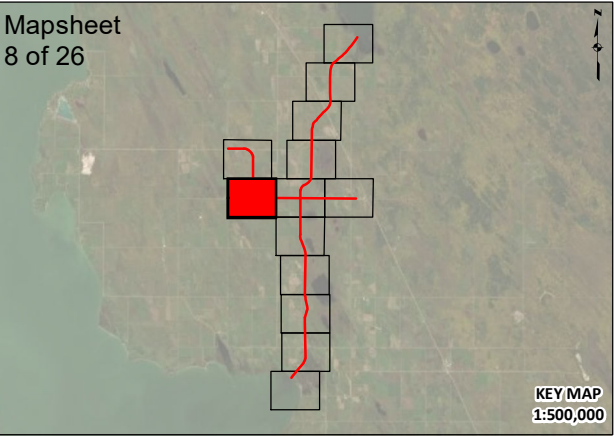


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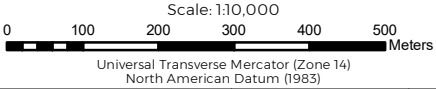
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- V5 = Aspen Hardwood
- Undefined upland

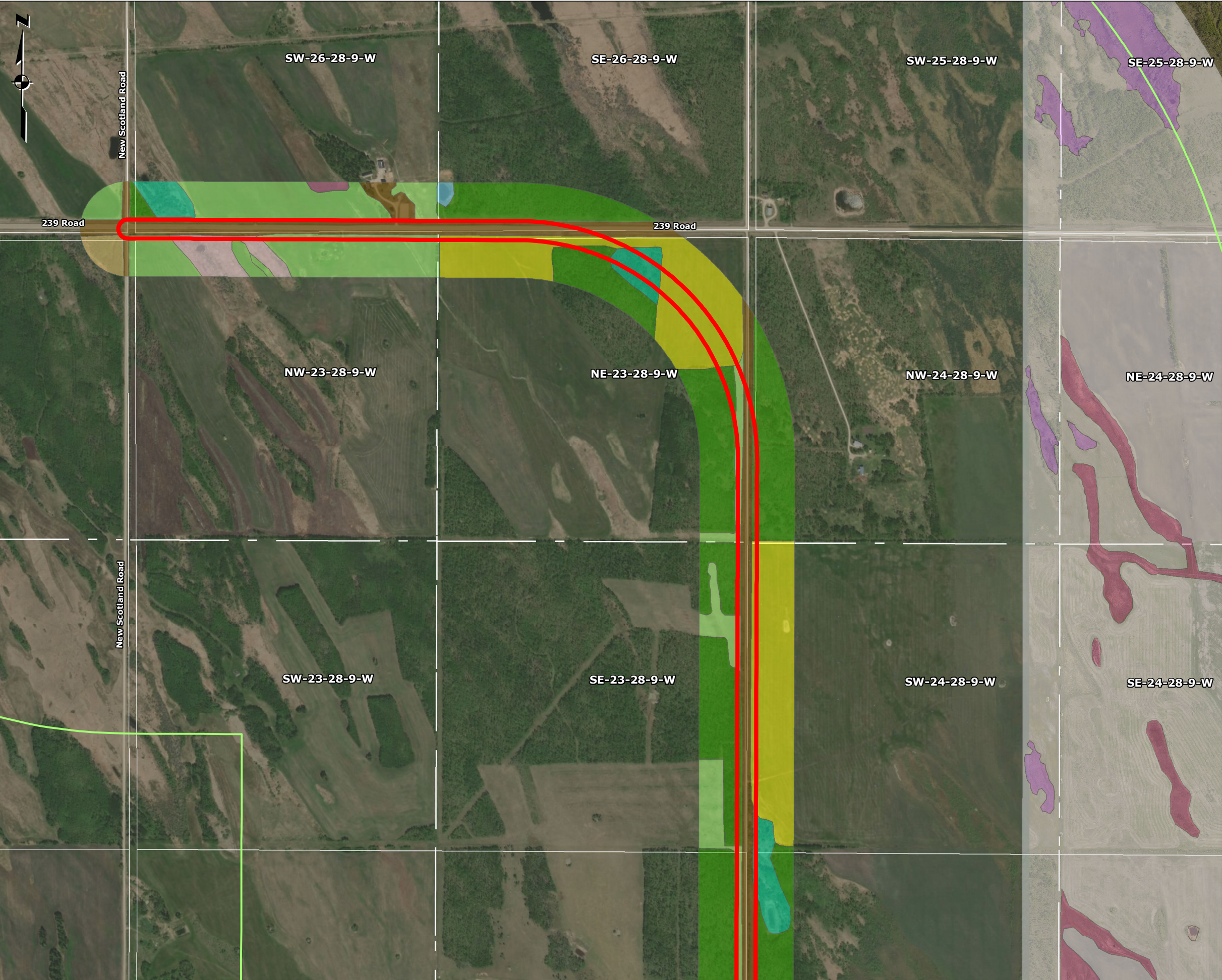


**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP WSP Job #: 20M-00910-00
 Drawn by: JH Date: September 10, 2020
 Reviewed By: DK Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure

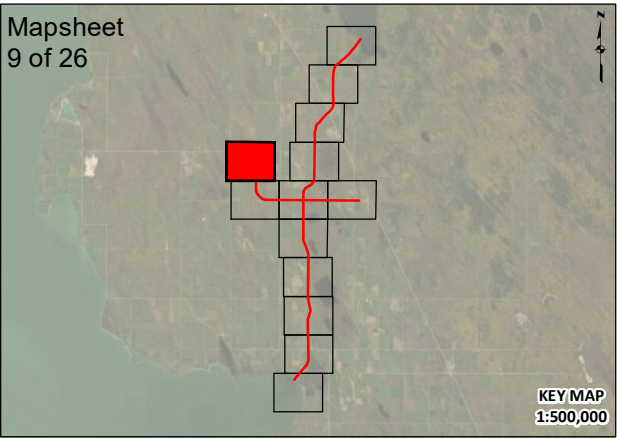


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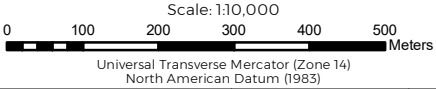
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)

Classification

- Agricultural Cropland
- Basin Swamp
- Class II Wetland
- Class III Wetland
- Class IV Wetland
- Forage Crops
- Roads and Trails
- V1 = Balsam Poplar Hardwood and Mixedwood
- V5 = Aspen Hardwood
- Undefined upland
- Water Bodies

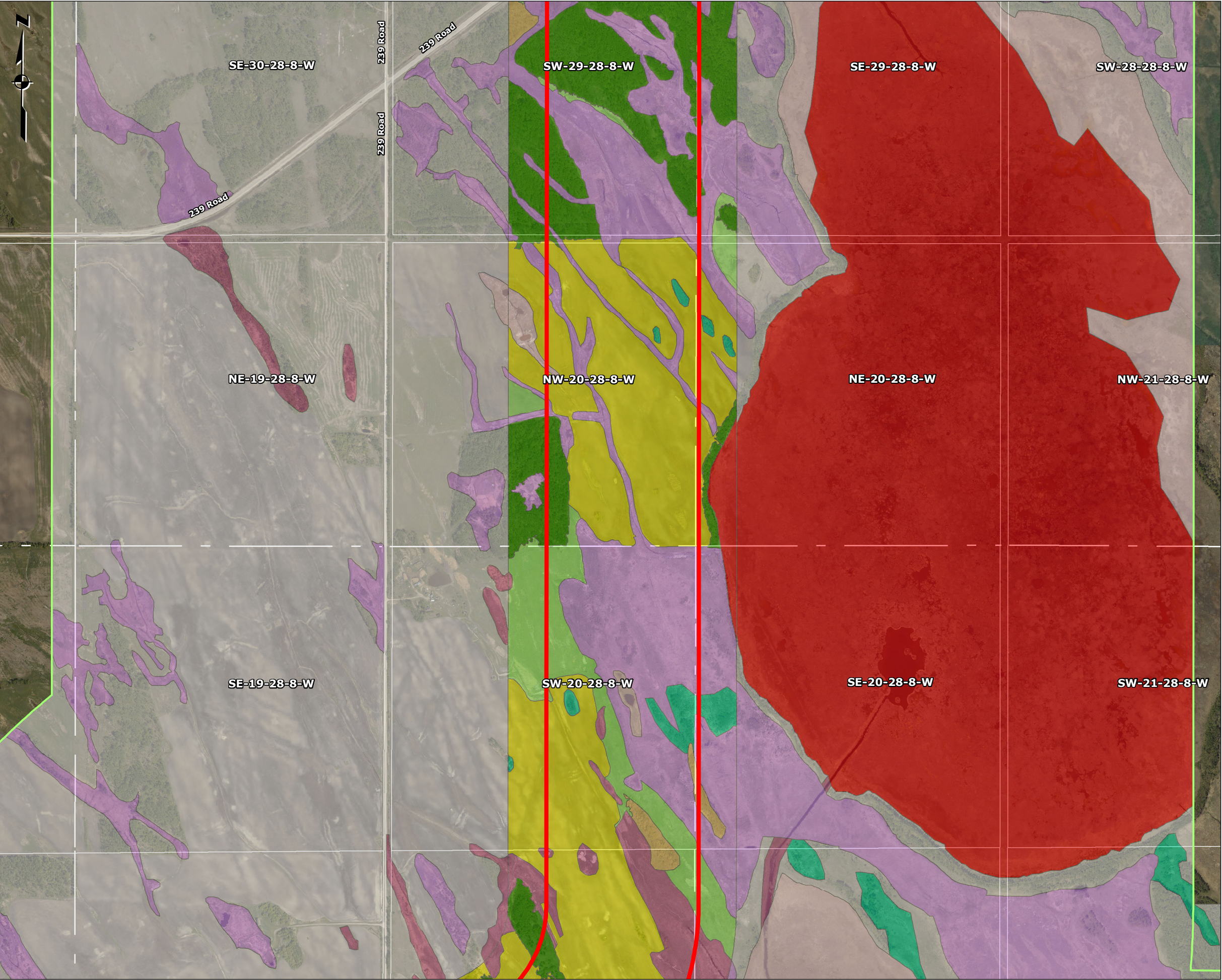


**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP WSP Job #: 20M-00910-00
 Drawn by: JH Date: September 10, 2020
 Reviewed By: DK Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure

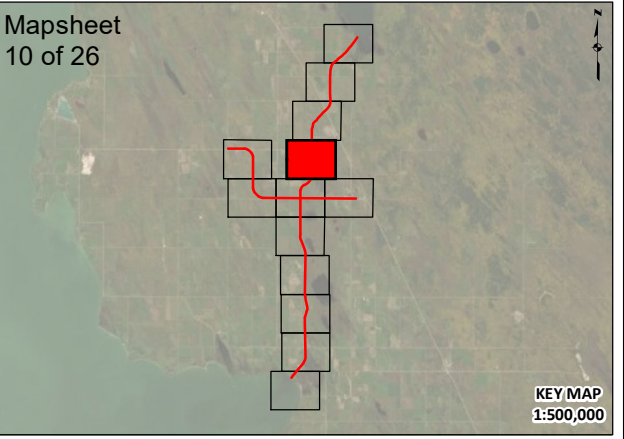


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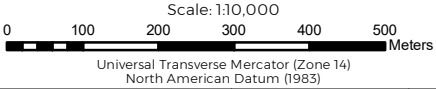
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)

Classification

- Agricultural Cropland
- Basin Swamp
- Class II Wetland
- Class III Wetland
- Class IV Wetland
- Class V Wetland
- Forage Crops
- V1 = Balsam Poplar Hardwood and Mixedwood
- V5 = Aspen Hardwood
- Undefined upland



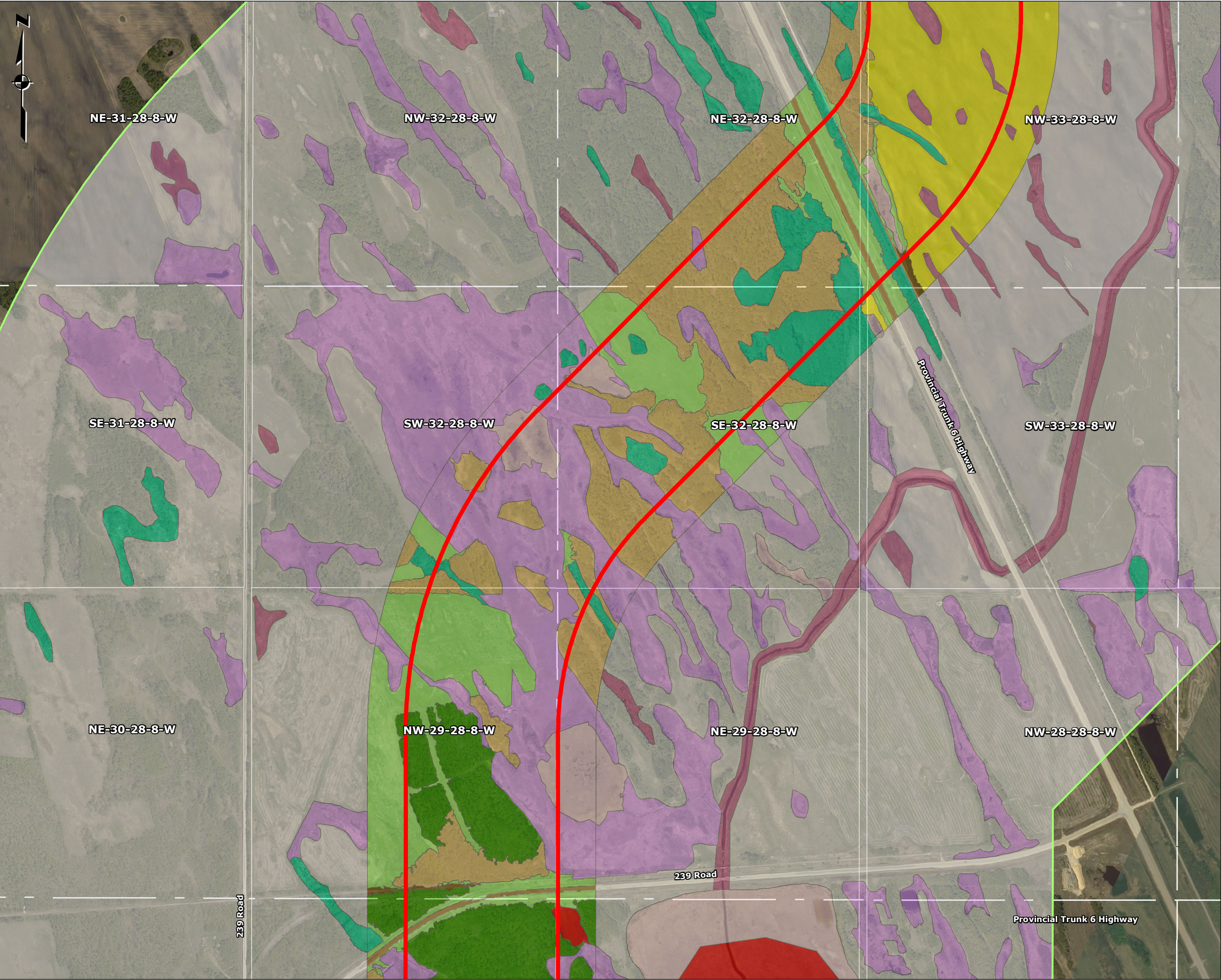
**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP
Drawn by: JH
Reviewed By: DK

WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure

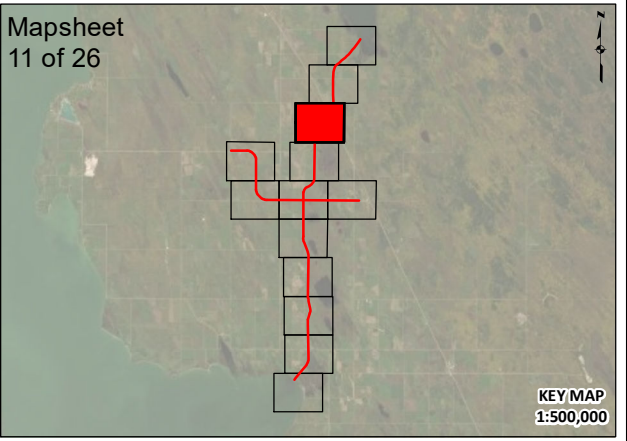


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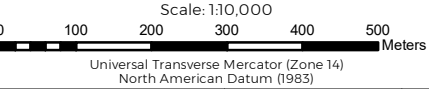
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)

Classification

- Agricultural Cropland
- Basin Swamp
- Class II Wetland
- Class III Wetland
- Class IV Wetland
- Class V Wetland
- Forage Crops
- Roads and Trails
- V1 = Balsam Poplar Hardwood and Mixedwood
- V5 = Aspen Hardwood
- Undefined upland



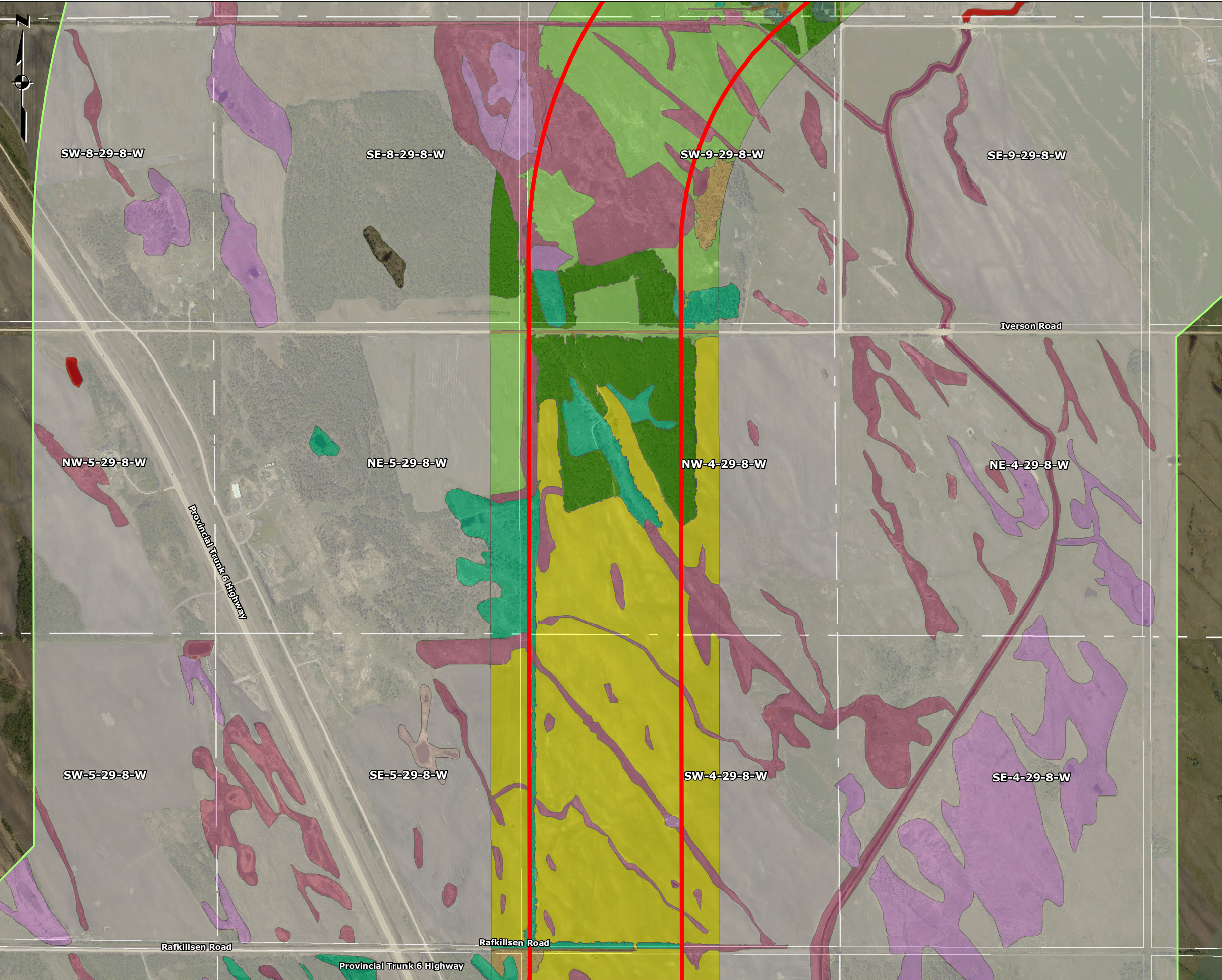
**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP
Drawn by: JH
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WSP Job #: 20M-00910-00
Date: September 10, 2020
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Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure

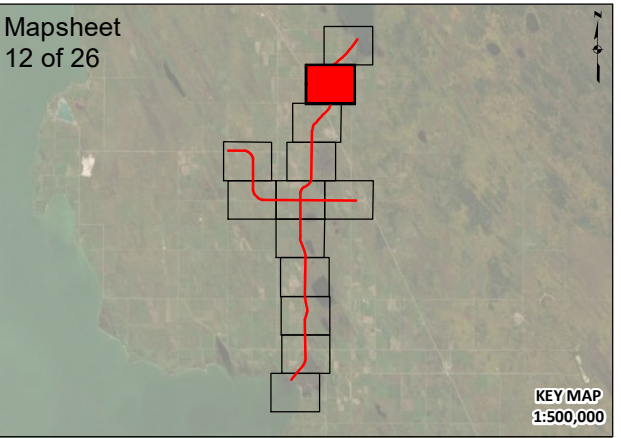


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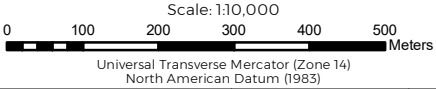
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)

Classification

- Agricultural Cropland
- Basin Swamp
- Class II Wetland
- Class III Wetland
- Class IV Wetland
- Class V Wetland
- Cultural Features
- Forage Crops
- Roads and Trails
- VI = Balsam Poplar Hardwood and Mixedwood
- V5 = Aspen Hardwood
- Undefined upland

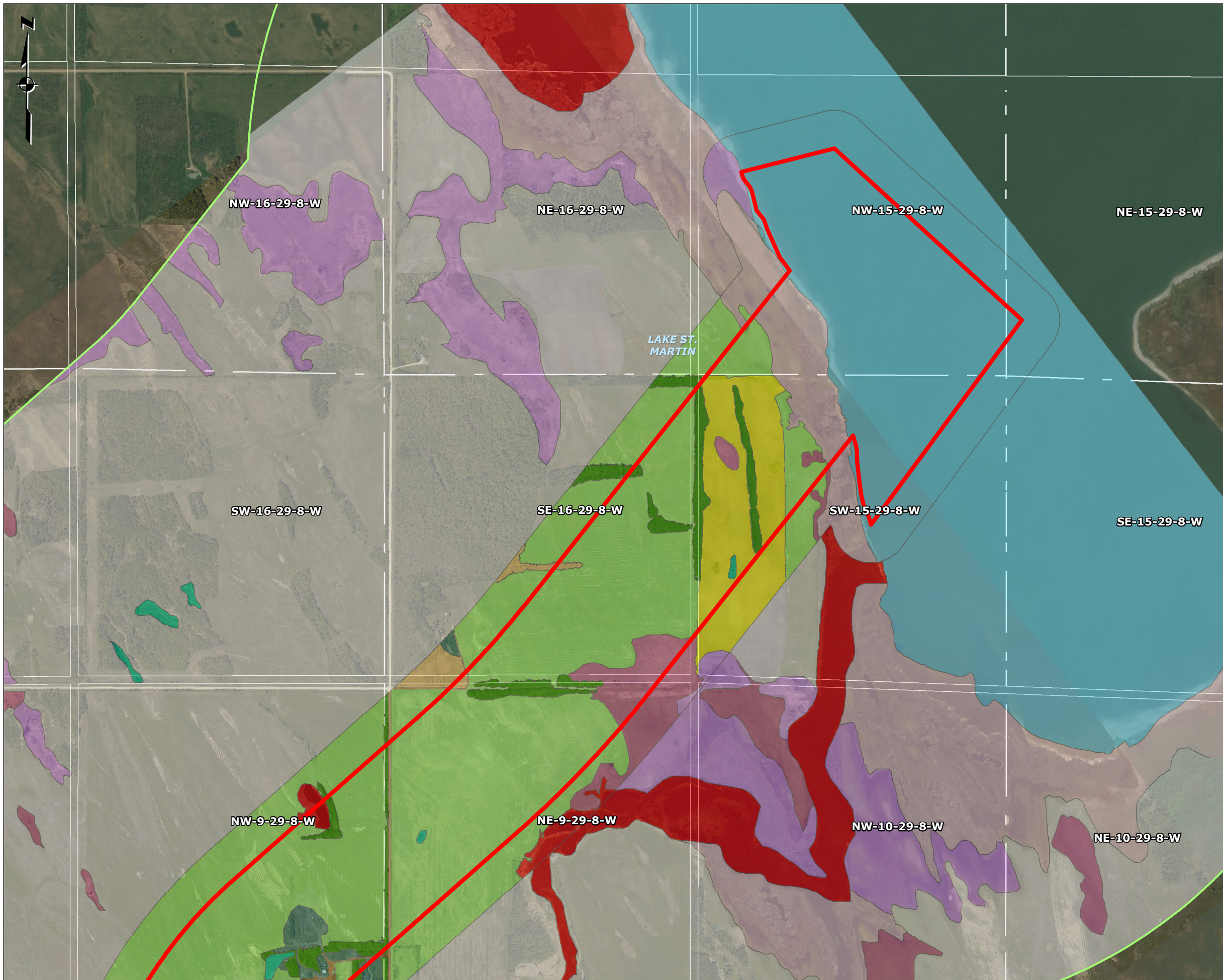


**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP WSP Job #: 20M-00910-00
 Drawn by: JH Date: September 10, 2020
 Reviewed By: DK Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure

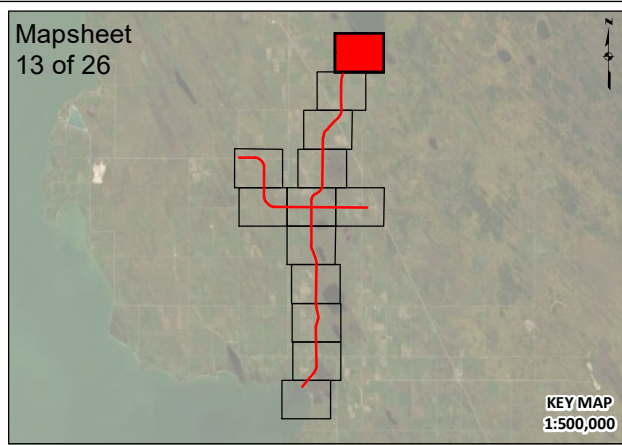


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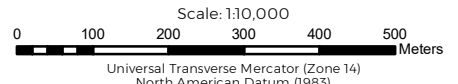
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)

Classification

- Agricultural Cropland
- Basin Swamp
- Class II Wetland
- Class III Wetland
- Class IV Wetland
- Class V Wetland
- Cultural Features
- Forage Crops
- Roads and Trails
- VI = Balsam Poplar Hardwood and Mixedwood
- V5 = Aspen Hardwood
- Undefined upland
- Water Bodies



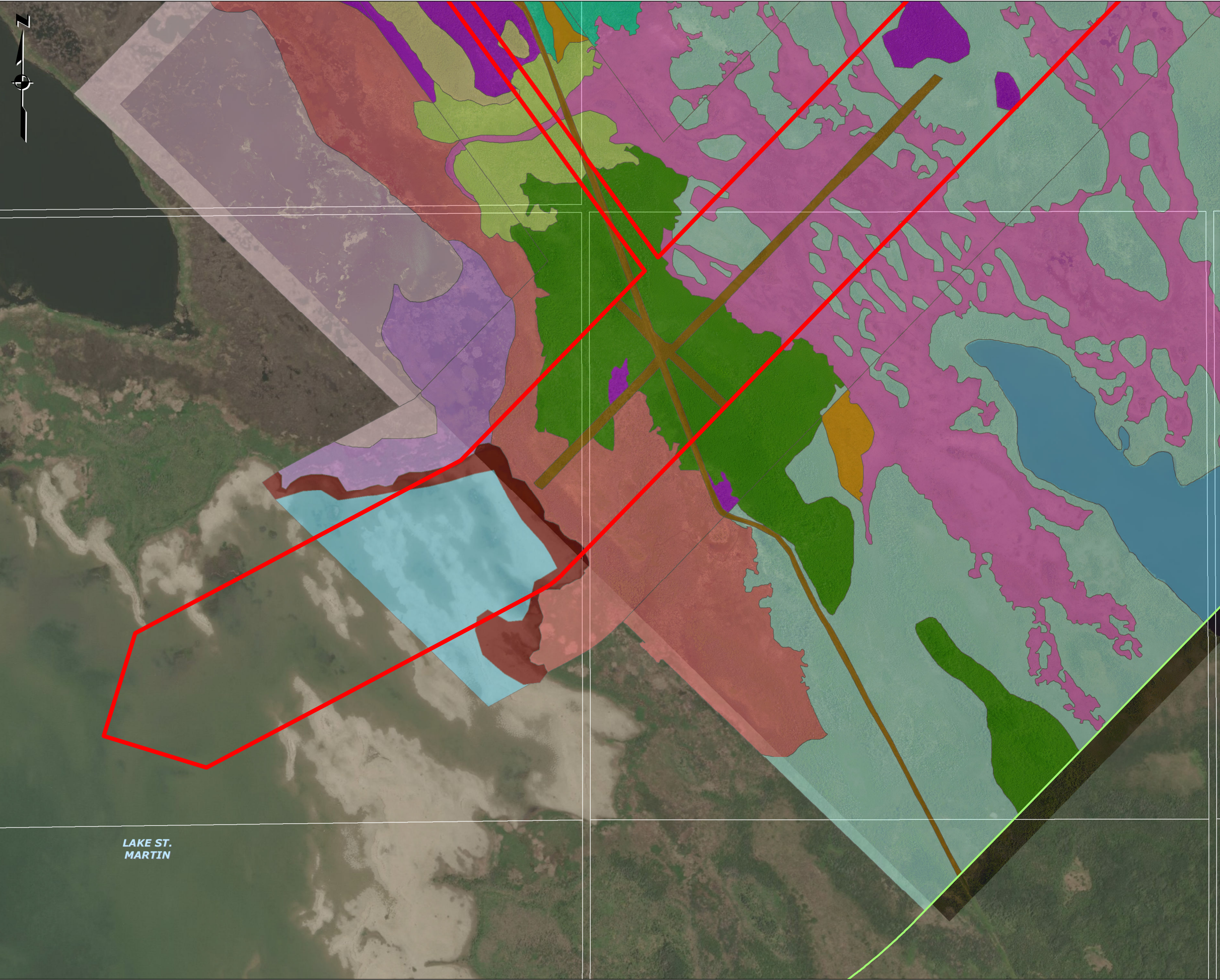
**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St. Martin
Manitoba, Canada**



Report By: DP
Drawn by: JH
Reviewed By: DK

WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



Legend

Project Development Area (PDA)

Modified Local Assessment Area (LAA)

Classification

Bare Rock, Gravel and Sand

Basin Fen

Class III_Wetland

Class IV Wetland

Horizontal Fen

Lacustrine Swamp

Lagg Swamp

Riverine Swamp

Roads and Trails

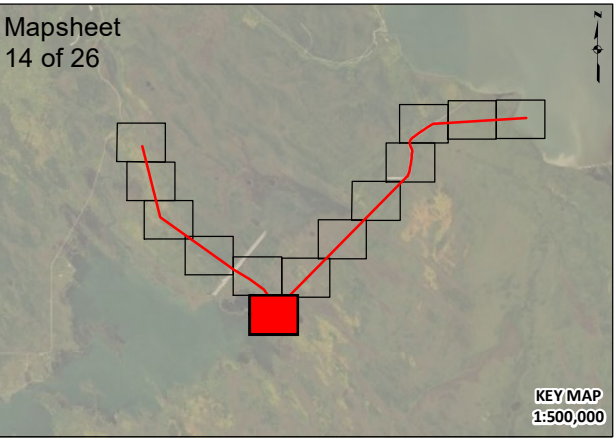
Stream Fen

Unconfined Flat Swamp

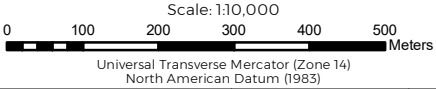
V1 = Balsam Poplar Hardwood and Mixedwood

V5 = Aspen Hardwood

Water Bodies

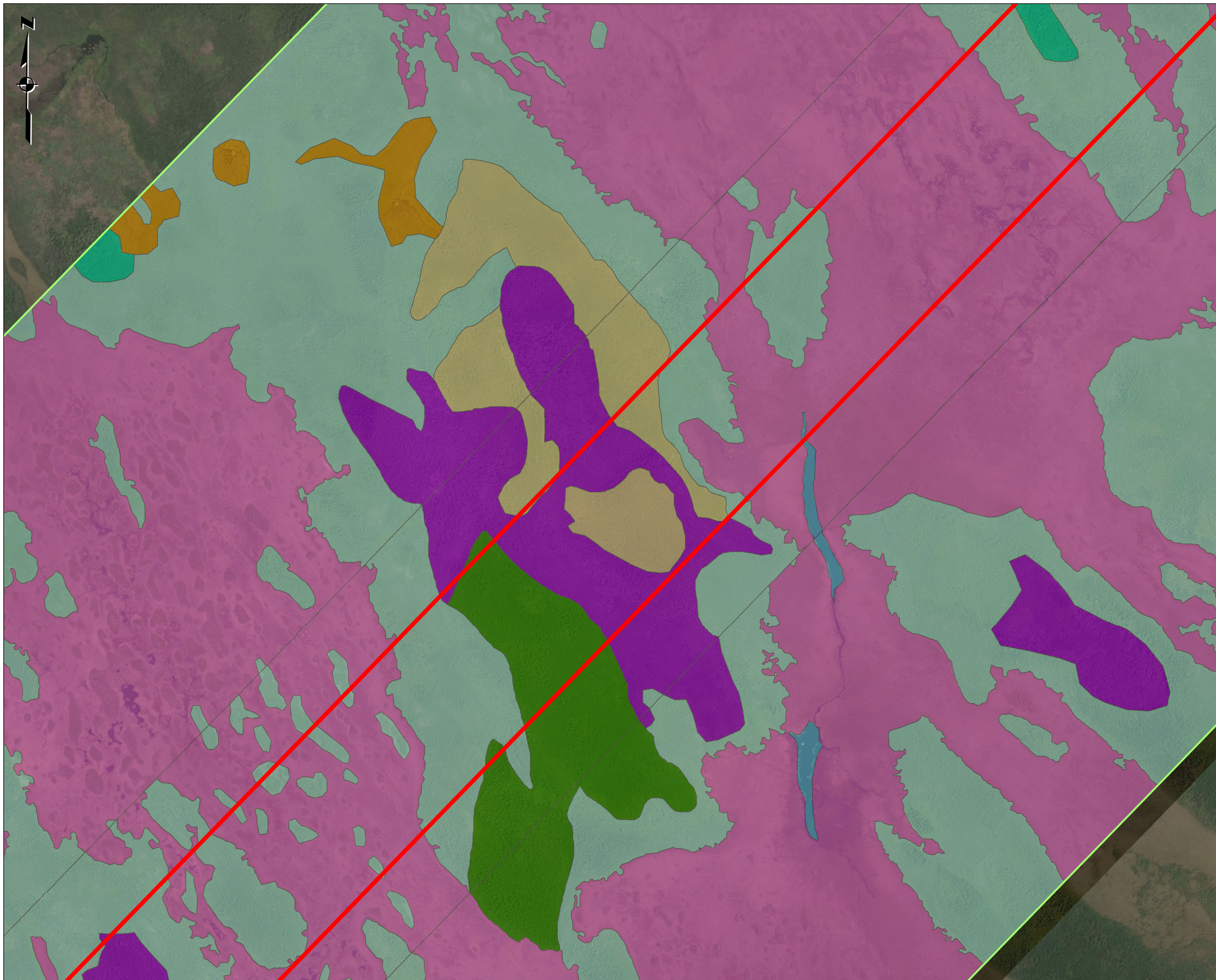


**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP WSP Job #: 20M-00910-00
Drawn by: JH Date: September 10, 2020
Reviewed By: DK Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



Legend

Project Development Area (PDA)
 Modified Local Assessment Area (LAA)
Classification

Basin Bog

Basin Fen

Horizontal Fen

Lagg Swamp

Stream Fen

Unconfined Flat Swamp

V1 = Balsam Poplar Hardwood and Mixedwood

V5 = Aspen Hardwood

Water Bodies

Mapsheet
15 of 26

KEY MAP
1:500,000

Manitoba
Infrastructure

**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**

Scale: 1:10,000

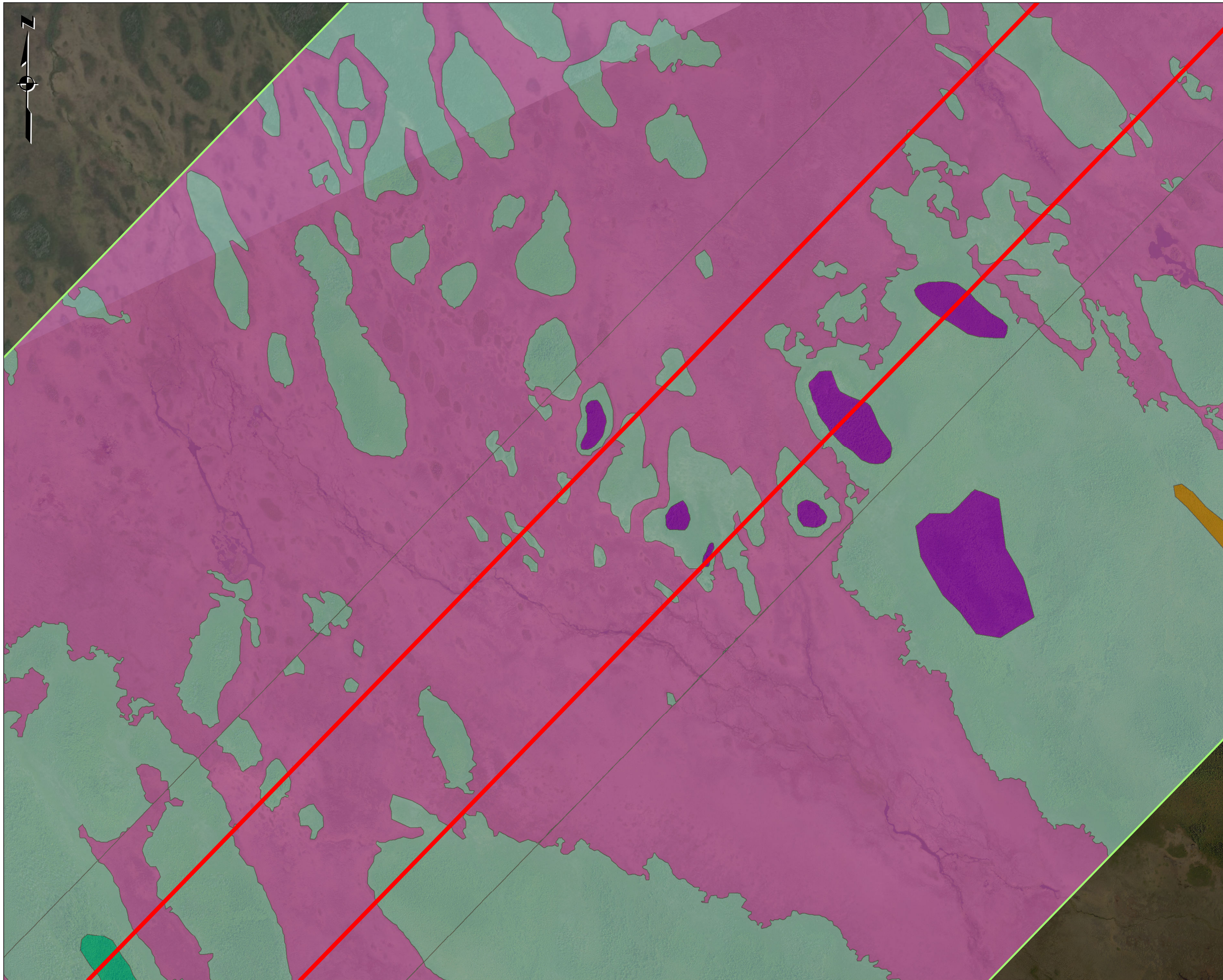
0 100 200 300 400 500 Meters

Universal Transverse Mercator (Zone 14)
North American Datum (1983)

Report By: DP
Drawn by: JH
Reviewed By: DK

WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



Legend

Project Development Area (PDA)

Modified Local Assessment Area (LAA)

Classification

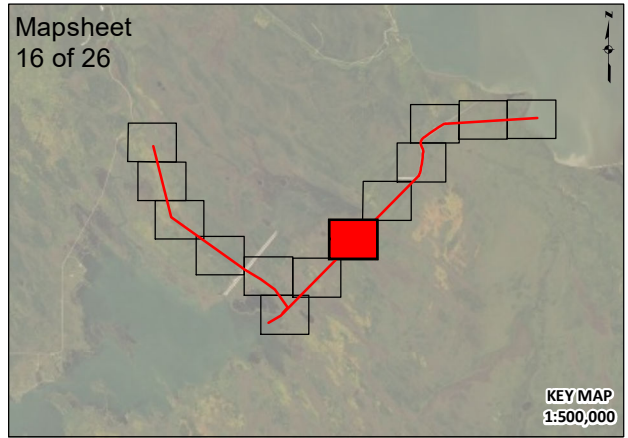
Basin Fen

Horizontal Fen

Lagg Swamp

Stream Fen

Unconfined Flat Swamp



**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**

Scale: 1:10,000
0 100 200 300 400 500 Meters
Universal Transverse Mercator (Zone 14)
North American Datum (1983)



Report By: DP
Drawn by: JH
Reviewed By: DK
WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



Legend

Project Development Area (PDA)

Modified Local Assessment Area (LAA)

Classification

Basin Bog

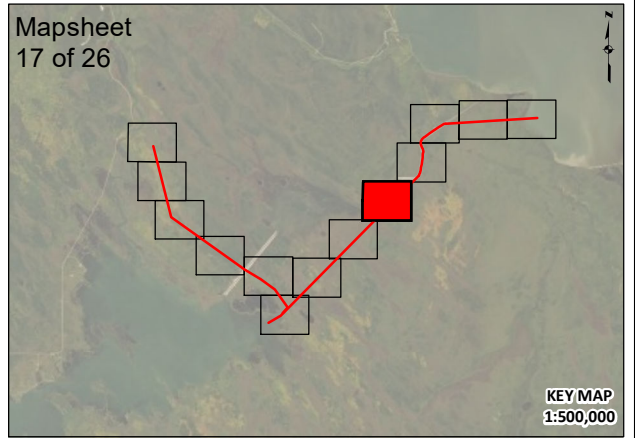
Horizontal Fen

Lagg Swamp

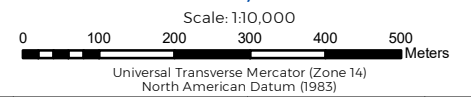
Roads and Trails

Stream Fen

VI = Balsam Poplar Hardwood and Mixedwood

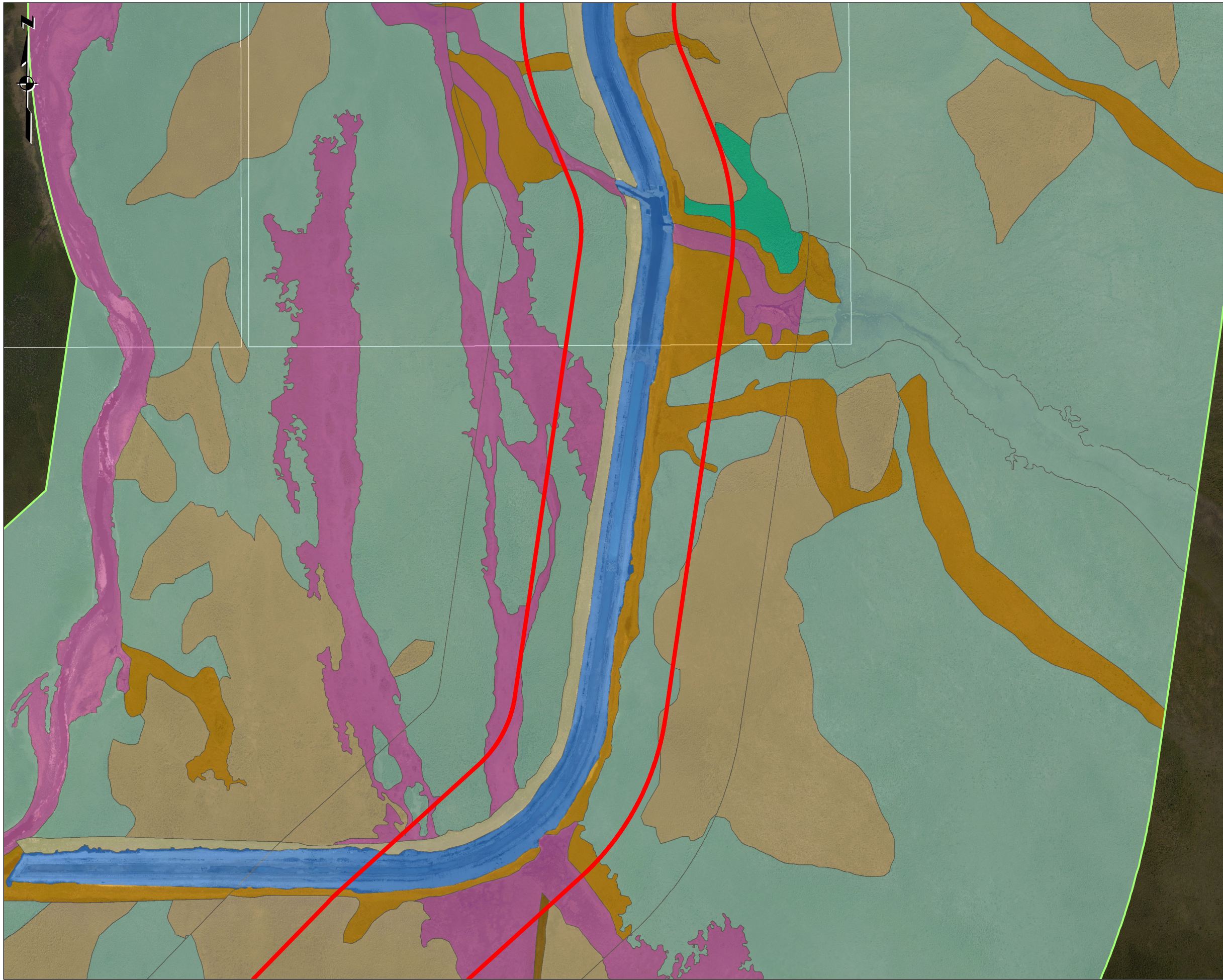


**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**

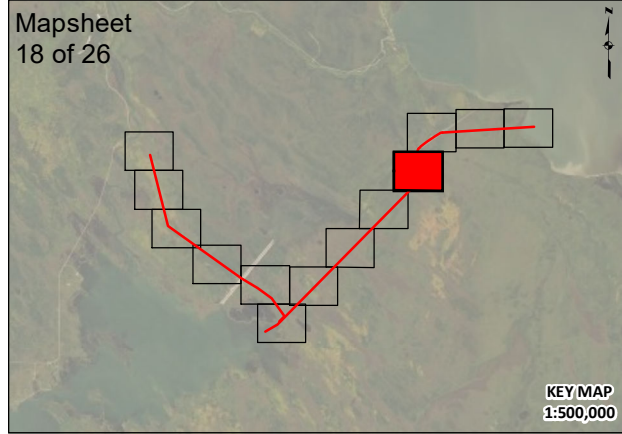


Report By: DP WSP Job #: 20M-00910-00
Drawn by: JH Date: September 10, 2020
Reviewed By: DK Office: Winnipeg

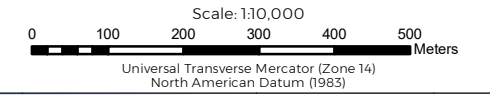
Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



- Legend**
- Project Development Area (PDA)
 - Modified Local Assessment Area (LAA)
- Classification**
- Basin Bog
 - Basin Fen
 - Channel
 - Forest Cutovers
 - Horizontal Fen
 - Lagg Swamp
 - Roads and Trails
 - Stream Fen



**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



wsp

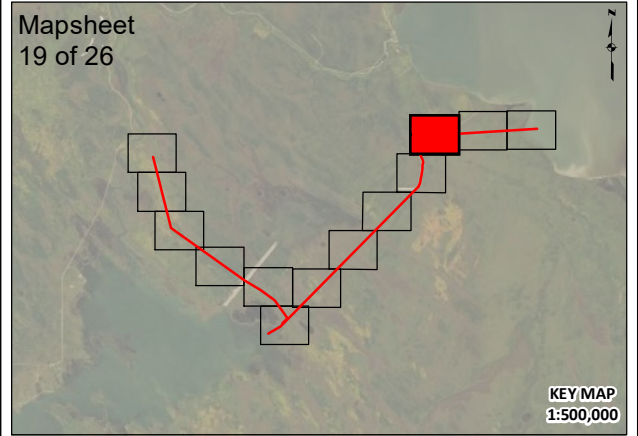
Report By: DP
Drawn by: JH
Reviewed By: DK

WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



- Legend**
- Project Development Area (PDA)
 - Modified Local Assessment Area (LAA)
- Classification**
- Basin Bog
 - Basin Fen
 - Basin Swamp
 - Channel
 - Forest Cutovers
 - Horizontal Fen
 - Lagg Swamp
 - Roads and Trails
 - Stream Fen



**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**

Scale: 1:10,000
0 100 200 300 400 500 Meters
Universal Transverse Mercator (Zone 14)
North American Datum (1983)

wsp
Report By: DP
Drawn by: JH
Reviewed By: DK
WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



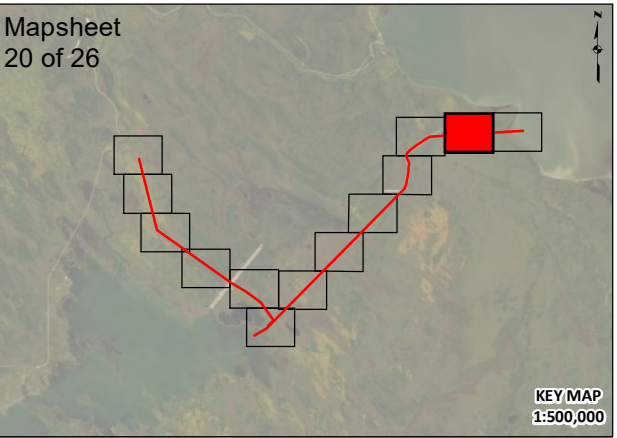
Legend

Project Development Area (PDA)

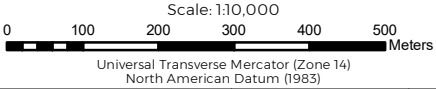
Modified Local Assessment Area (LAA)

Classification

- Basin Bog
- Basin Fen
- Channel
- Forest Cutovers
- Horizontal Fen
- Lagg Swamp
- Roads and Trails
- Shore Fen
- Stream Fen
- Water Bodies



**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP
Drawn by: JH
Reviewed By: DK

WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure

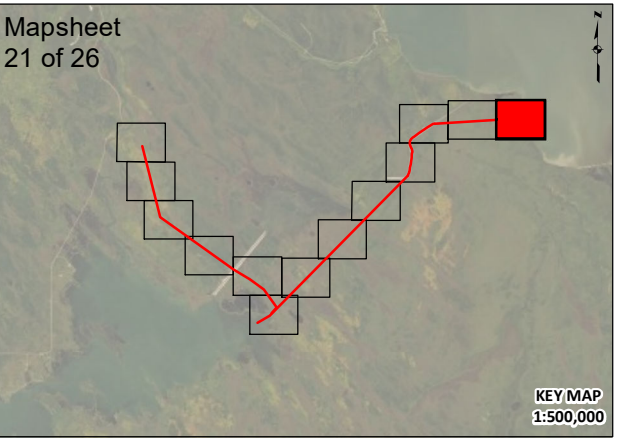


Legend

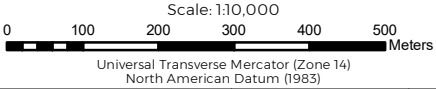
- Project Development Area (PDA)
- Modified Local Assessment Area (LAA)

Classification

- Bare Rock, Gravel and Sand
- Basin Fen
- Horizontal Fen
- Lacustrine Swamp
- Lagg Swamp
- Roads and Trails
- Shore Fen
- Water Bodies



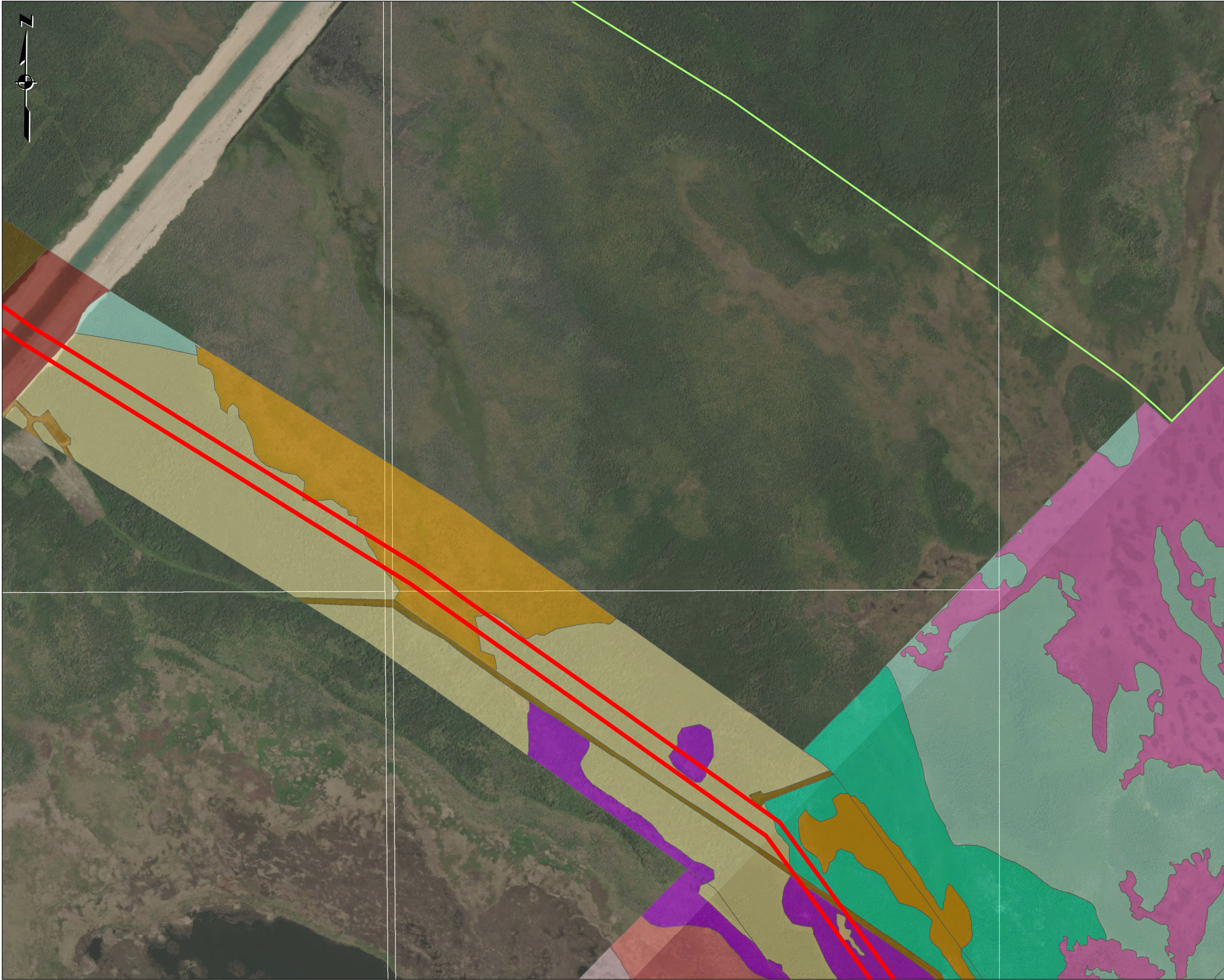
**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**




Report By: DP
Drawn by: JH
Reviewed By: DK


WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure





Legend


 Project Development Area (PDA)


 Modified Local Assessment Area (LAA)


Classification


 Bare Rock, Gravel and Sand


 Basin Bog


 Basin Fen


 Class IV Wetland


 Horizontal Fen


 Lacustrine Swamp


 Lagg Swamp

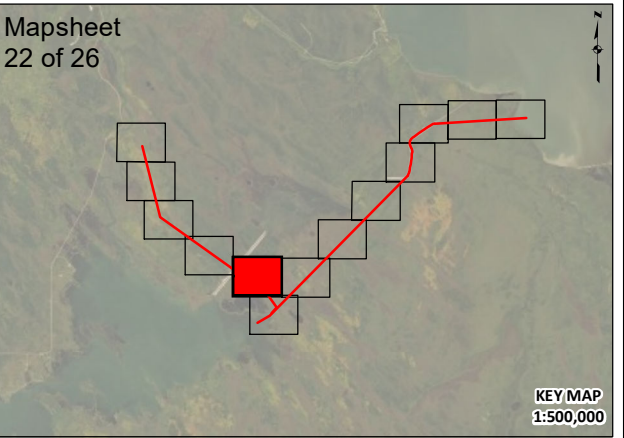
 Roads and Trails

 Stream Fen

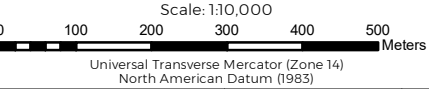
 Unconfined Flat Swamp

 V1 = Balsam Poplar Hardwood and Mixedwood

 V28 = Jack Pine-Black Spruce/Feather Moss



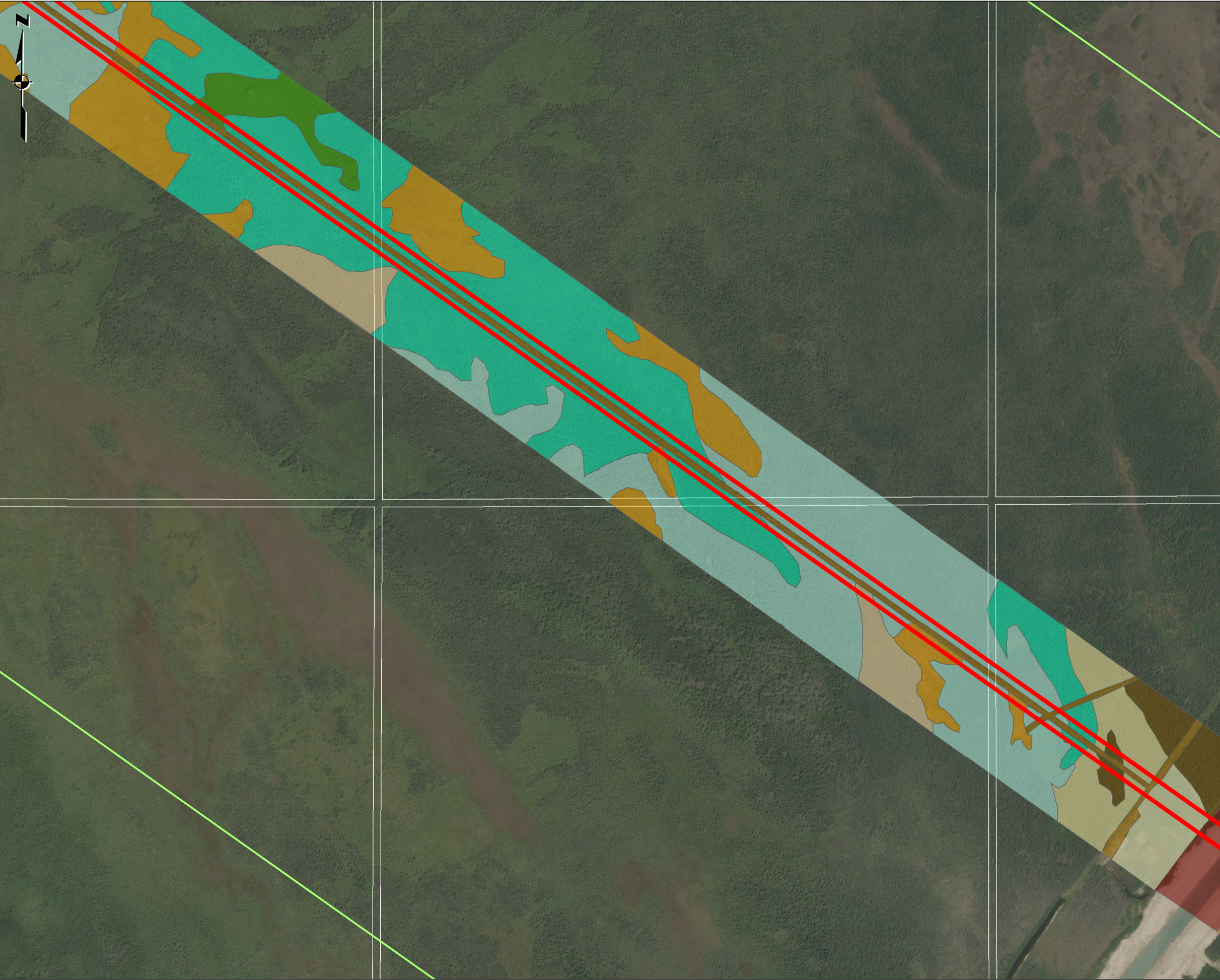
**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP
Drawn by: JH
Reviewed By: DK

WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



Legend

Project Development Area (PDA)

Modified Local Assessment Area (LAA)

Classification

Bare Rock, Gravel and Sand

Basin Bog

Basin Fen

Forest Cutovers

Horizontal Fen

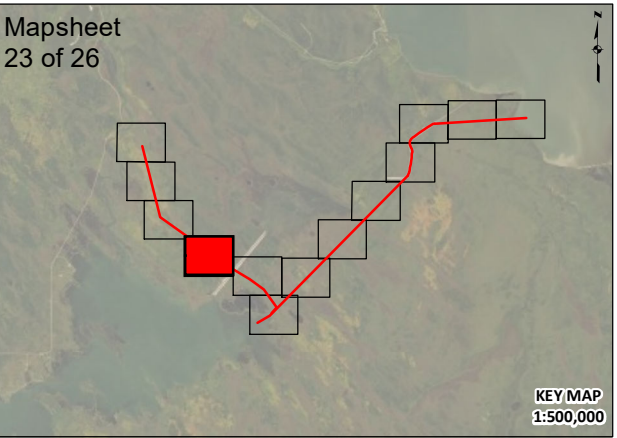
Lagg Swamp

Roads and Trails

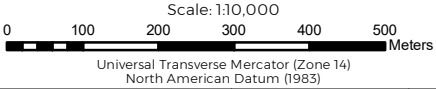
V1 = Balsam Poplar Hardwood and Mixedwood

V5 = Aspen Hardwood

V28 = Jack Pine-Black Spruce/Feather Moss

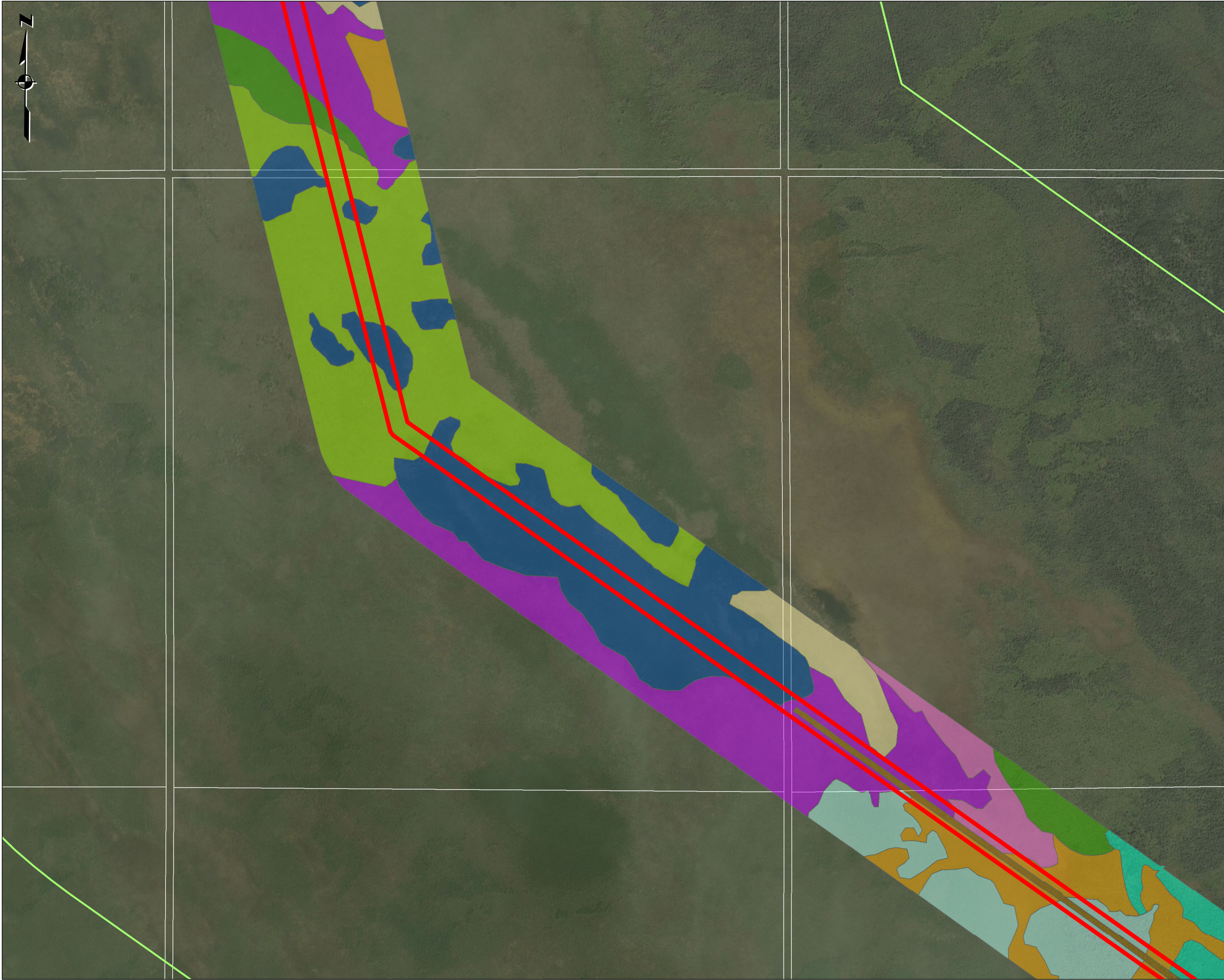


**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP WSP Job #: 20M-00910-00
Drawn by: JH Date: September 10, 2020
Reviewed By: DK Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



Legend

Project Development Area (PDA)

Modified Local Assessment Area (LAA)

Classification

Basin Fen

Horizontal Fen

Lagg Swamp

Roads and Trails

Stream Fen

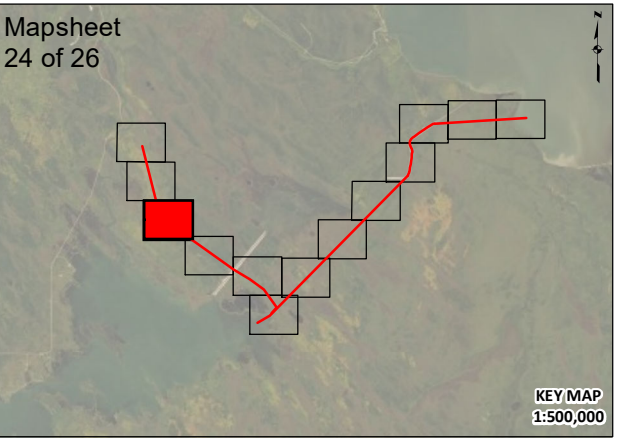
Unconfined Flat Swamp

V1 = Balsam Poplar Hardwood and Mixedwood

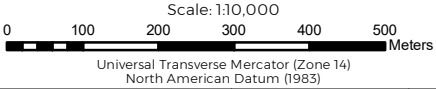
V4 = White Birch Hardwood and Mixedwood

V5 = Aspen Hardwood

V24 = Jack Pine Conifer

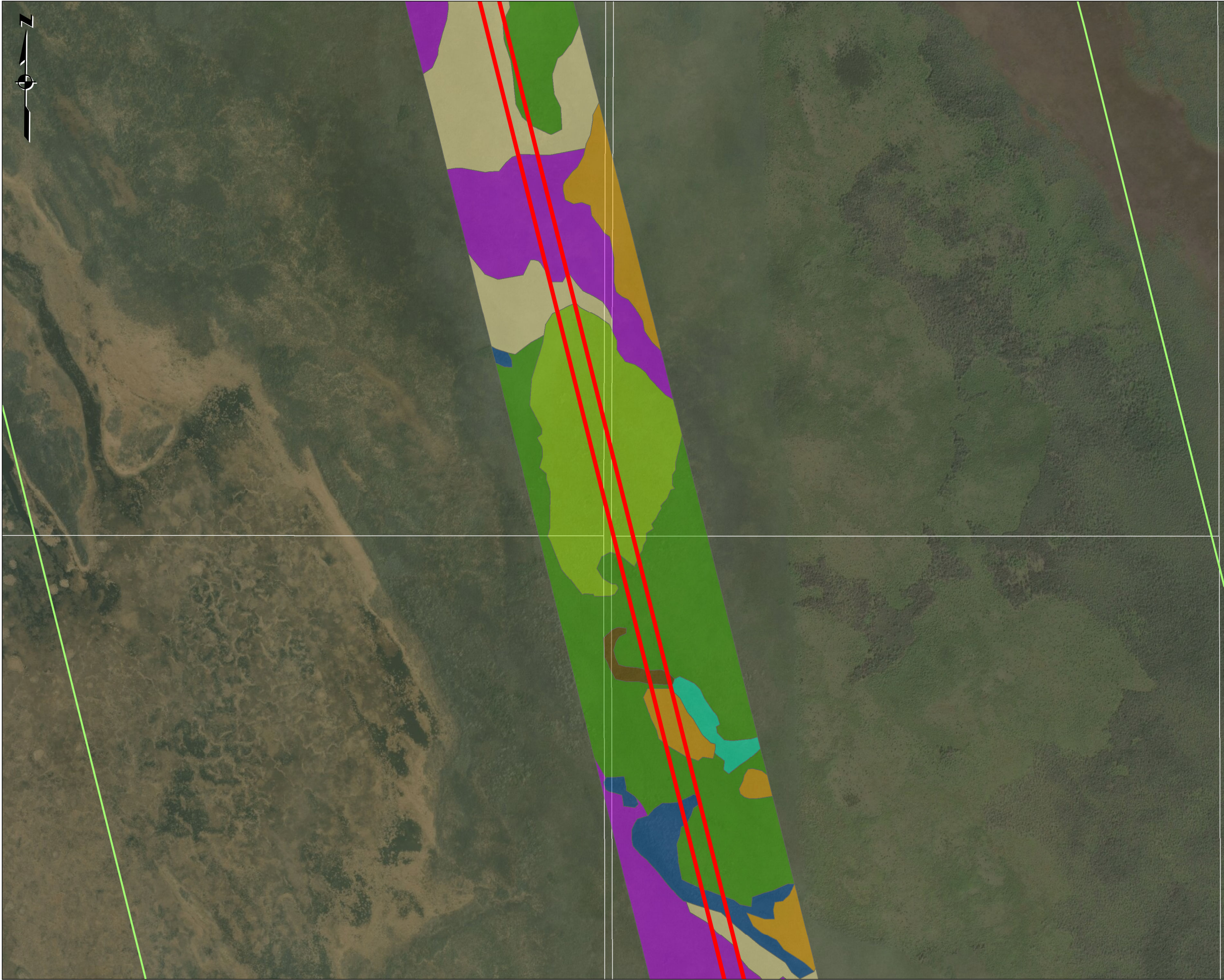


**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP WSP Job #: 20M-00910-00
Drawn by: JH Date: September 10, 2020
Reviewed By: DK Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



Legend

Project Development Area (PDA)

Modified Local Assessment Area (LAA)

Classification

Basin Fen

Lagg Swamp

Unconfined Flat Swamp

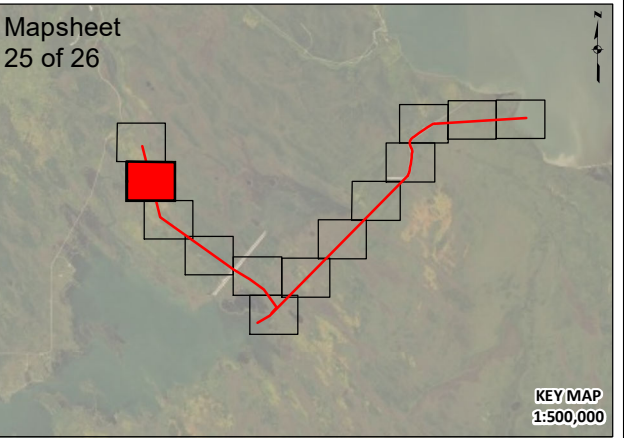
V1 = Balsam Poplar Hardwood and Mixedwood

V4 = White Birch Hardwood and Mixedwood

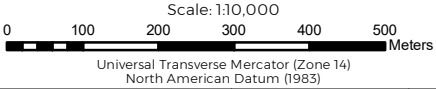
V5 = Aspen Hardwood

V24 = Jack Pine Conifer

V28 = Jack Pine-Black Spruce/Feather Moss



**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**



Report By: DP
Drawn by: JH
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WSP Job #: 20M-00910-00
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Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure



Legend

Project Development Area (PDA)

Modified Local Assessment Area (LAA)

Classification

Forest Cutovers

Horizontal Fen

Lagg Swamp

Roads and Trails

Stream Fen

Unconfined Flat Swamp

V1 = Balsam Poplar Hardwood and Mixedwood

V5 = Aspen Hardwood

Mapsheet
26 of 26

KEY MAP
1:500,000

Manitoba
Infrastructure

**Figure 2: Pre-construction Survey
Wetland Assessment Areas
Lake Manitoba & Lake St.Martin
Manitoba, Canada**

Scale: 1:10,000

0 100 200 300 400 500 Meters

Universal Transverse Mercator (Zone 14)
North American Datum (1983)

wsp

Report By: DP
Drawn by: JH
Reviewed By: DK

WSP Job #: 20M-00910-00
Date: September 10, 2020
Office: Winnipeg

Notes: Data Source: Imagery ESRI, Base Data: Manitoba Infrastructure

APPENDIX

B WETLAND DATA TABLES

APPENDIX

Table B1 Field Ground-truthing Sites by Project Component and Habitat Type

Survey Type, Cover Class, and Component*	LMOC	PR 239	LSMOC	Distribution Line	Grand Total
Early Summer SOCC Survey					
Forested					
V1		1	2	2	5
V28				1	1
V5	2	1		1	4
Forested Total	2	2	2	4	10
Wetland					
Bog					
Basin Bog			2		2
Bog Total			2		2
Fen					
Horizontal Fen			3		3
Stream Fen			5	1	6
Fen Total			8	1	9
Marsh					
Class II	3	1			4
Class III	2	1			3
Class IV	1				1
Class V	1				1
Marsh Total	7	2			9
Swamp					
Basin Swamp	1	1			2
Lacustrine Swamp			1		1
Riverine Swamp				1	1
Swamp Total	1	1	1	1	4
Wetland Total	8	3	11	2	24
Disturbance/Anthropogenic					
Bare Rock, Gravel and Sand			1		1
Disturbance/Anthropogenic Total			1		1

APPENDIX

Survey Type, Cover Class, and Component*	LMOC	PR 239	LSMOC	Distribution Line	Grand Total
Early Summer SOCC Survey Total	10	5	14	6	35
Late Summer SOCC Survey					
Forested					
V1				3	3
V24				2	2
V4				1	1
V5	1	2		2	5
Forested Total	1	2		8	11
Wetland					
Fen					
Basin Fen				1	1
Stream Fen			3		3
Fen Total			3	1	4
Marsh					
Class III	1				1
Marsh Total	1				1
Swamp					
Basin Swamp		2			2
Lagg swamp			1	3	4
Unconfined Flat Swamp				3	3
Swamp Total		2	1	6	9
Wetland Total	1	2	4	7	14
Disturbance/Anthropogenic					
Agricultural Cropland	1				1
Bare Rock, Gravel and Sand	1				1
Disturbance / Anthropogenic Total	2				2
Late Summer SOCC Survey Total	4	4	4	15	27
Wetland Check					
Wetland					
Fen					

APPENDIX

Survey Type, Cover Class, and Component*	LMOC	PR 239	LSMOC	Distribution Line	Grand Total
Horizontal Fen			1		1
Fen Total			1		1
Marsh					
Class II	2				2
Marsh Total	2				2
Swamp					
Lagg swamp				1	1
Swamp Total				1	1
Wetland Total	2		1	1	4
Disturbance/Anthropogenic					
Agricultural Cropland	4				4
Disturbance/Anthropogenic Total	4				4
Wetland Check Total	6		1	1	8
Visual Overflight Checks					
Wetland					
Marsh					
Class II	1				1
Marsh Total	1				1
Wetland Total	1				1
Visual					
Visual	2		6	42	50
Visual Total	2		6	42	50
Visual Total	3		6	42	51
Grand Total	23	9	25	64	121

*One sample site completed in the intersection of LMOC and Road 239 footprints, thus led to total of 121 survey sites.