APPENDIX J

Stantec

PROJECT NUMBER: 111477020

Agricultural Soil Productivity Monitoring for the Manitoba Minnesota Transmission Project: Pre-Construction (2019) and Post-Construction Year 1 (2020)

Final Report

For: Manitoba Hydro

Date: January 10,2022

Agricultural Soil Productivity Monitoring for the Manitoba-Minnesota Transmission Project: Pre-Construction (2019) and Post-Construction Year 1 (2020)

Final Report

January 10, 2022

Prepared for:

Manitoba Hydro

Prepared by:

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Project Number: 111477020

Revision: 1

Limitations and Sign-off

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Executive Summary

Manitoba Hydro retained Stantec Consulting Ltd. (Stantec) and AgriEarth Consulting Ltd. (AgriEarth) to conduct monitoring of soil productivity along the portion of the Manitoba-Minnesota Transmission Project (the "Project") under agricultural crop production. Monitoring of soil productivity during pre-construction and post-construction Project phases was a commitment made in the Project Environmental Monitoring Plan (EMP; Manitoba Hydro, 2019). This report represents the first annual report on this monitoring component and includes monitoring information on the pre-construction phase (2019) and the first year of the post-construction or operation phase (2020) of the Project. Construction was completed between the 2019 and 2020 growing seasons.

In agri-Manitoba the productivity of soils for arable agriculture is valued by agricultural producers as a primary source of income. Soil productivity on lands in the Project right of way (RoW) can be adversely affected by the use of construction machinery, including vehicles and heavy equipment, and disturbance of surface materials during grading and excavation for tower structure foundations. Effects on soil productivity are typically manifested in vegetation productivity. Therefore, a vegetation productivity indicator can be used as an effective proxy for soil productivity. As such, a vegetation productivity index, the Normalized Difference Vegetation Index (NDVI), was used as a screening tool to assess the effects on soil productivity in the Project RoW following construction activities in areas of agricultural production. The NDVI provides a relative measure of vegetation health or productivity and is calculated from remotely-sensed reflectance data captured from satellite imagery.

The objective of the monitoring program is to monitor soil productivity along portions of the Project RoW under agricultural land use to confirm the effectiveness of mitigation in the maintenance and rehabilitation of soil productivity. This objective is consistent with that presented for the soil productivity monitoring activity in the EMP.

As documented in the assessment of potential environmental effects on agriculture within the Project Environmental Impact Statement (EIS; Manitoba Hydro, 2015), physical degradation of soils from Project activities are expected, primarily due to compaction in work areas within the RoW, and those effects may result in reduced crop productivity. While effects are expected, the effects to agricultural capability class resulting in a reduced ability for the land to support crop production are expected to be minimal following mitigation. These residual effects are anticipated to be limited to localized areas within the RoW. Where degradation of land does occur due to soil compaction from construction activities, these effects are expected to extend beyond construction activities and could persist for a few years following remedial action.

Manitoba Hydro's landowner compensation program includes a structure impact compensation which considers reduced crop productivity in an area of overlap around each tower. Beyond these areas, in the event of damage to property, including to land, Manitoba Hydro is committed to working with landowners to repair damages. This may include construction damage compensation for residual effects to soil productivity in instances where remedial work requires farm machinery and the landowner's expertise.

To assess Project effects on soil productivity, differences in NDVI values were compared between areas within the RoW and adjacent, comparable off RoW areas within a defined agricultural evaluation area. The

agricultural evaluation area is comprised of areas of annual crop, forage (hay) and pasture (grassland, grazing) production traversed by the Project. Specific agricultural evaluation areas were delineated, including:

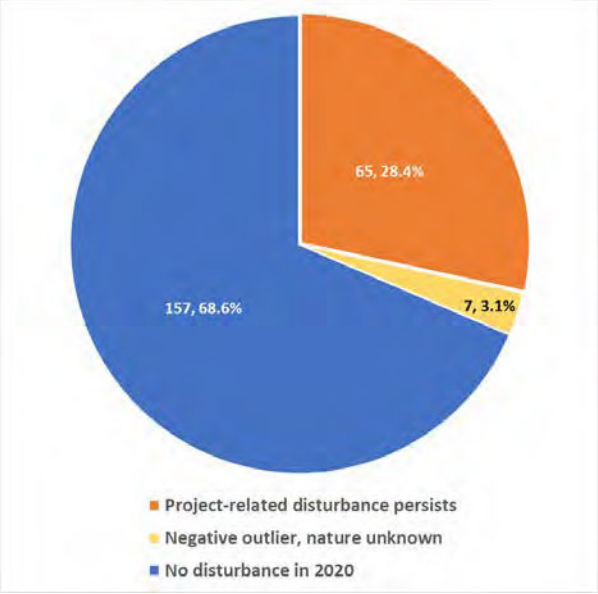
- Discrete agricultural field management units (FMUs) within a 20 m corridor centered along the transmission line (On RoW FMUs), to capture effects to soil productivity within the RoW between towers.
- Tower work areas (TWAs), or 80 m diameter buffer areas around tower structures, to capture effects to soil productivity from tower structure construction activities.

The Project includes a 213 km long transmission line and 499 tower structures. The transmission line originates at Dorsey station northwest of Winnipeg and terminates at the Manitoba to Minnesota border southeast of Piney, Manitoba. For the purposes of this evaluation:

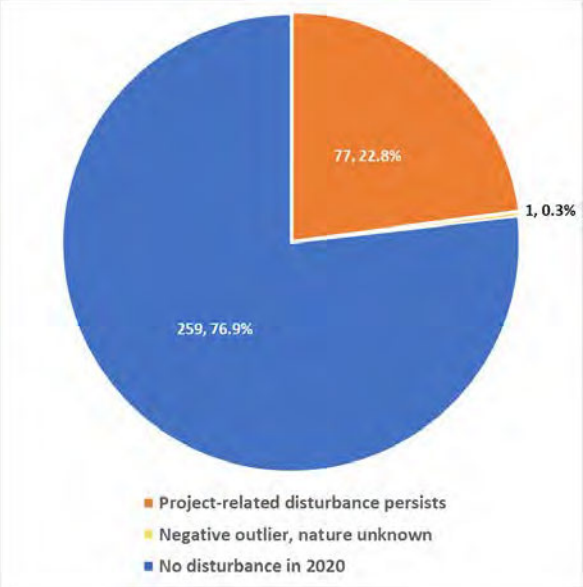
- Of the 213 km of transmission line, a total of 114 km (53.5% of total) were determined to be within the agricultural evaluation area and a total of 229 On RoW FMUs were delineated.
- Of the 499 total tower structures, 306 tower structures (61.3 % of total) were considered within the agricultural evaluation area and a total of 338 discrete TWAs were delineated (note: the higher TWA number relative to tower structures in the agricultural evaluation area is due to field management unit splits where towers straddle more than one field management unit).

An evaluation of NDVI differences was completed for 2019 and 2020 growing seasons using NDVI values captured in July to represent peak crop growth conditions. Threshold values were determined using baseline or pre-disturbance (pre-construction) conditions represented by the 2019 NDVI values, and were used to identify negative outliers for NDVI difference values in 2019 and 2020. Negative outliers for the 2020 growing season were visually reviewed to confirm whether they were likely the result of Project-related disturbance or if differences were attributable to other factors (e.g., natural variability in soil conditions).

A summary of counts and proportions of individual On RoW FMUs in each of the disturbance categories in 2020 is found in the figure on the right. A total of 65 of the 229 On RoW FMUs (28.4% of total) were considered to have lower soil productivity due to Project-related disturbances.



A summary of counts and proportions of individual TWAs in each of the disturbance categories is provided in the figure on the right.. A total of 77 of the 338 TWAs (22.8% of total) were considered to have lower soil productivity due to Project-related disturbances.



Therefore, Project activities have resulted in disturbance to soil and crop productivity within the RoW. Negative effects were found to persist following construction, which occurred between the 2019 and 2020 growing seasons. Effects were found to be limited to the RoW and associated with areas of construction activity (e.g., tower work areas, construction access and trails) within the RoW. As documented in the EIS, effects to soil productivity due to compaction from construction activities within the RoW were anticipated, and where effects from compaction occur, they could persist for a few years following construction. Results from the monitoring program are consistent with the predictions made in the EIS. Results suggest the mitigation program has been effective as over 70% of FMUs and over 75% of TWAs were considered to not have negative effects to soil productivity following post-construction year 1 (2020). No unexpected effects were determined through the monitoring program through the 2020 monitoring season. Future monitoring will be used to confirm that areas where effects have persisted are recovering or trending to recovery.

The evaluation will continue in 2021 to track the post-construction recovery of soil and crop productivity in areas of potential Project-related disturbances. Recommendations for monitoring and evaluation in 2021 include evaluating disturbance and recovery relative to soil properties (e.g., texture, drainage) and crop type to determine relationships to these factors, as well as integration of soil-related mitigation implemented on the Project to assess the effectiveness of mitigation. Beyond these recommendations, there are currently no recommendations for additional monitoring activities (e.g., field assessment), mitigation activities or alterations to the monitoring program. Additional mitigation and monitoring will be addressed following the completion of the post construction year 2 (2021) monitoring program.

Abbreviations

EMP	Environmental Monitoring Plan
FMU	Farm management unit
MMTP	Manitoba-Minnesota Transmission Project
NDVI	Normalized Difference Vegetation Index
NIR	Near-infrared
RoW	Right-of-way
TWA	Tower work area

Glossary

Normalized Difference Vegetation Index	A quantified measure of vegetation health or productivity determined using near-infrared and red light wavelengths.
Field management unit	An agricultural crop production area defined as being managed as a single field cropping management unit.
Off RoW Comparable Area	A discrete comparable area located off of the right-of-way (RoW) and considered not disturbed by the Project, and used to compare against potentially-disturbed areas including On RoW field management units (FMUs) and tower work areas (TWAs).
On RoW FMU	A discrete FMU located within the RoW, specifically within a 20 m corridor centered on the transmission line centreline.
Outlier (NDVI difference)	A value considered to be outside of the expected normal range of variation. For the purposes of this evaluation, outliers were determined for NDVI difference values between areas within the RoW that are potentially disturbed (i.e., On RoW FMUs and TWAs) and comparable areas outside of the RoW not disturbed by the Project.
Outlier, minor	An outlier between defined “inner fence” and “outer fence” limits using quartiles. Minor outliers are considered less extreme than major outliers. Negative outliers are of interest to this evaluation, and the negative inner fence is determined as: Q1 – (1.5 x IQR), where Q1 = first quartile (25th percentile) and IQR = interquartile range (Q3 [third quartile or 75th percentile] – Q1).
Outlier, major	An outlier beyond a defined “outer fence” limit using quartiles. Major outliers are considered more extreme than minor outliers. Negative outliers are of interest to this evaluation, and the negative outer fence limit is determined as: Q1 – (3 x IQR), where Q1 = first quartile (25th percentile) and IQR = interquartile range (Q3 [third quartile or 75th percentile] – Q1).
Threshold (NDVI difference)	Threshold values established to determine outliers in NDVI difference values between areas within the RoW that are potentially disturbed by the Project (i.e., On RoW FMUs and TWAs) and comparable areas outside of the RoW not disturbed by the Project. Negative thresholds are of interest to this evaluation to identify where soil and crop productivity within the RoW is lower than comparable areas outside of the RoW. Thresholds for minor negative outliers and major negative outliers were established using “inner fences” and “outer fences”.

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1.0 INTRODUCTION

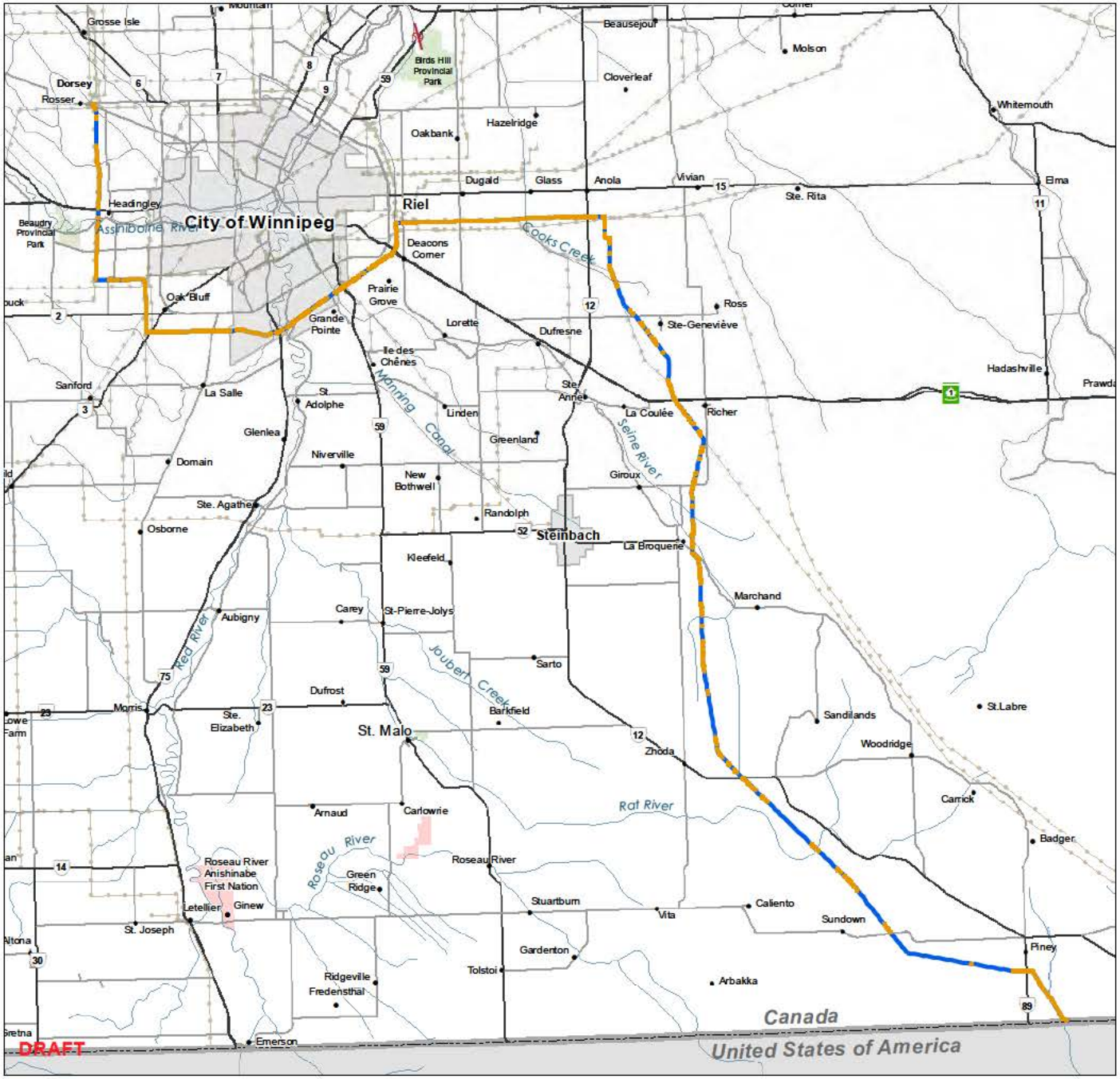
Manitoba Hydro retained Stantec Consulting Ltd. (Stantec) and AgriEarth Consulting Ltd. (AgriEarth) to conduct monitoring of soil productivity along the portion of the Manitoba-Minnesota Transmission Project (the "Project") under agricultural crop production. Monitoring of soil productivity during pre-construction and post-construction Project phases is a commitment made in the Project Environmental Monitoring Plan (EMP; Manitoba Hydro, 2019). This report represents the first annual report on this monitoring component and includes monitoring information on the pre-construction phase (2019) and the first year of the post-construction or operation phase (2020) of the Project.

In agri-Manitoba the productivity of soils for arable agriculture is valued by agricultural producers as a primary source of income. Agricultural production is also of general benefit to society. Soil productivity on lands in the Project right of way (RoW) can be affected by the use of construction machinery, including vehicles and heavy equipment, and disturbance of surface materials during grading and excavation for tower foundations. The effects mechanisms for construction activities on soil productivity are primarily physical, but secondary or indirect effects to productivity may occur through chemical and biological changes as a result of physical disturbances. Soil productivity is a result of numerous soil environmental factors and conditions and is difficult to measure or assess. However, these direct effects on soil properties are typically manifested in vegetation productivity. Therefore, a vegetation productivity indicator can be used as an effective proxy for soil productivity. As such, vegetation productivity was used as a screening tool to assess the effectiveness of prescribed mitigation in the maintenance and reclamation of soil productivity in the Project RoW following construction activities in areas of agricultural production.

For the purposes of this evaluation, the Project consists of a transmission line 213 km in length with 499 tower structures. The transmission line originates at Dorsey station northwest of Winnipeg and terminates at the Manitoba to Minnesota border southeast of Piney, Manitoba. An overview of the Project is provided in **Map 1.1**.

As documented in the assessment of potential environmental effects on agriculture within the Project Environmental Impact Statement (EIS; Manitoba Hydro, 2015), physical degradation of soils from Project activities are expected, primarily due to compaction in work areas within the RoW, and those effects may result in reduced crop productivity. While effects are expected, the effects to agricultural capability class resulting in a reduced ability for the land to support crop production are expected to be minimal following mitigation. These residual effects are anticipated to be limited to localized areas within the RoW. Where degradation of land does occur due to soil compaction from construction activities, these effects are expected to extend beyond the construction and could persist for a few years following remedial action.

Manitoba Hydro's landowner compensation includes a structure impact compensation which considers reduced crop productivity in an area of overlap around each tower. Beyond these areas, in the event of damage to property, including to land, Manitoba Hydro is committed to working with landowners to repair damages. This may include construction damage compensation for residual effects where remedial work requires farm machinery and the landowner's expertise. More information can be found in the Manitoba-



Stantec

Legend

- Manitoba-Minnesota Transmission Line
- Agricultural Land Use Along the Transmission Line
- Provincial Highway
- Provincial Road
- Existing Transmission Lines
- Community
- First Nation Lands
- Provincial Park
- City

N

0 10 20 km

(At original document size of 8.5x11)
1:700,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Government of Canada, Manitoba Hydro
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Project Location
Winnipeg,
Manitoba

Prepared by JH on 2021-05-15
TR by DW on 2021-05-15
IR Review by ABC on 2021-05-15

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Performance & Crop Performance Monitoring

111477020-003 REVB

Figure No.
1.1

Title
Manitoba Minnesota Transmission Line - Project Overview

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Minnesota Project Landowner Compensation Information brochure included in the EIS (Appendix 15C; Manitoba Hydro 2015).

The Project soil productivity monitoring program relies primarily on the use of the Normalized Difference Vegetation Index (NDVI), a relative measure of vegetation health or productivity. NDVI is calculated from remotely-sensed reflectance data collected through satellite imagery, and assessment is based on the difference between NDVI values on the RoW and adjacent, comparable off RoW areas.

1.1 OBJECTIVE

The objective of the monitoring program is to monitor soil productivity along portions of the Project RoW under agricultural land use to confirm the effectiveness of mitigation in the maintenance and rehabilitation of soil productivity. This objective is consistent with that presented for the soil productivity monitoring activity in the EMP (Section 4.7.1, p. 64).

To achieve the commitment made in the EMP, the soil productivity monitoring program has been structured to:

- use crop performance as the parameter for evaluating soil productivity along the RoW, access roads, and other temporary project footprints within areas of agricultural land use, including annual crop, forage (hay) and grassland (grazing) production.
- include monitoring for one year prior to construction (2019), and up to two-years post-construction (2020 and 2021) or until suitable knowledge is acquired.

The monitoring approach relies on desktop-based activities, namely remote sensing of vegetative productivity based on computed NDVI values.

As identified in the EMP (Table 4-21), field assessments by resource specialists may be completed, as required. Field assessments would be completed on a site-specific basis if warranted due to residual effects to soil productivity determined through monitoring activities or as identified by landowners, and as directed by Manitoba Hydro.

2.0 METHODOLOGY

The methods used to conduct the 2019 and 2020 soil productivity monitoring program are consistent with those presented in the EMP (Section 7.7) and are summarized below.

2.1 IMAGE ACQUISITION AND PROCESSING

Imagery was collected from the PlanetScope satellite constellation to support the evaluation. The PlanetScope sensors provide sufficient radiometric and spatial resolution to capture crop conditions across a broad landscape, such as the agricultural portion of the Project, in a cost-effective manner.

The PlanetScope satellites collect multispectral data, including blue (455-515 µm), green (500-590 µm), red (590-670 µm) and near infrared (NIR) (780-860 µm) wavelengths at 3 m by 3.5 m resolution. The sensors are affected by atmospheric interference such as clouds, fog, rain or smoke and requires cloud-free conditions to collect reliable surface spectral reflectance information.

Satellite image acquisition for the Project RoW required multiple orbital paths due to the extent of the area of interest. Due to cloud cover, a long repeat coverage period and a high level of orbital overlap, multiple orbital tracks were required over varying dates to compile a single, cloud-free imagery mosaic for the RoW. Acquisition dates for 2019 and 2020 were all within the month of July.

All satellite imagery was atmospherically corrected by PlanetScope's parent company Planet Labs Inc. Haze removal was performed as part of the atmospheric correction allowing for precise vegetation measurements. Planet normalized solar illumination conditions at different time periods allowing for accurate change detection analysis. Individual images were clipped and combined, creating continuous coverages of agricultural land use areas across the entire RoW.

2.2 NORMALIZED DIFFERENCE VEGETATION INDEX

Imagery was processed to quantify agricultural crop health by implementing the NDVI formula. NDVI is a measure of vegetative vigor or plant health using the Red and Near-Infrared (NIR) channels of the electromagnetic spectrum. NIR energy is highly reflected by healthy vegetation while Red wavelengths are highly absorbed by vibrant vegetation (**Figure 2.1**). This relationship is not as strong in stressed vegetation and is non-existent in dead vegetation. This unique vegetative property provides detail on vegetation health and is exemplified in the NDVI formula:

(NIR – RED) / (NIR + RED) = NDVI

NDVI values range from 1 (healthy vegetation) to -1 (non-vegetation). Results of the NDVI formula can vary from one landscape to another but typically areas of water, sand, or infrastructure show very low NDVI values (for example, -0.5 or less). For instance, bare soil usually scores near 0.0 on the NDVI scale range; sparse vegetation such as shrubs and grasslands or senescing crops may result in moderate

NDVI values (approximately 0.1 to 0.4); and high NDVI values (approximately 0.5 to 0.9) correspond to dense vegetation such as that found in temperate and tropical forests or crops at their peak growth stage.

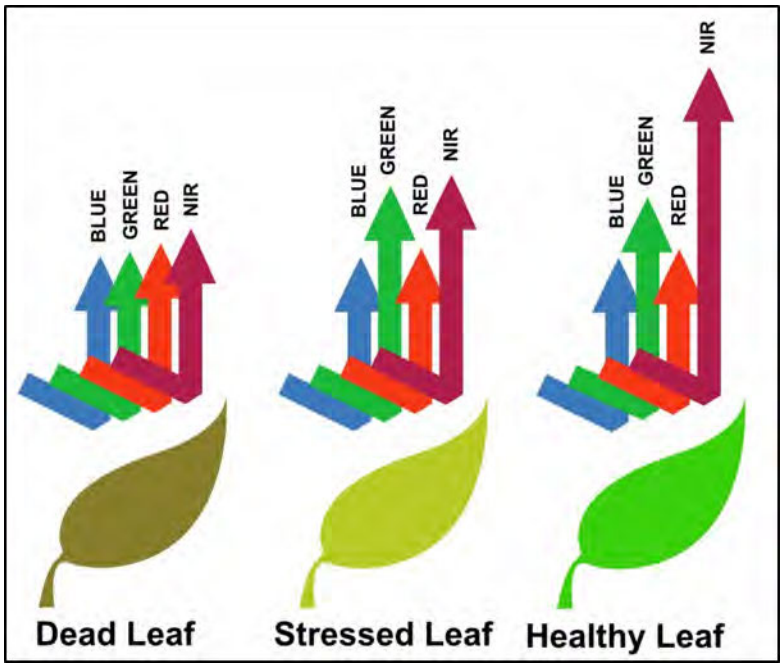


Figure 2.1 Spectral Reflectance Amount Variations for Blue, Green, Red and NIR Energy of Dead, Stressed and Healthy Crop Leaves

2.3 EVALUATION AREAS DEFINITION

2.3.1 On RoW, Tower Work Area and Off RoW Study Area Delineation

Construction activities within and along the transmission RoW vary in nature and intensity around tower structure installations and between towers. Generally, a higher degree of impact occurs around tower structures than between towers. Around tower work structures, there is a relatively high level of construction vehicle and heavy equipment activity, resulting in a potential disturbance area extending across the RoW around each tower location. Between towers, much of the activity is construction machinery (vehicles and heavy equipment) traversing from one tower to the next, hence the potential disturbance in areas between towers typically occurs in a more confined area of the RoW along a centreline or near-centerline travel corridor.

Recognizing these differences, and based on a similar evaluation conducted on a previous transmission project (Stantec, 2019)[1], two evaluation areas within the RoW were established: 1) an On RoW construction corridor, and 2) tower work areas (TWAs).

Delineation of these features was completed in the ArcGIS environment using known locations of existing project components including the current transmission centreline, tower locations and Project RoW extents. The On RoW construction corridor was delineated by generating a 20 m wide corridor along the current transmission line, and TWAs were delineated by generating 80 m buffers around tower locations.

Off RoW evaluation areas were delineated by generating an 80 m buffer from the outer extents of the current Project RoW. A width of 80 m for these Off RoW evaluation areas was selected to approximate the average RoW width.

The study areas are displayed in a conceptual diagram in **Figure 2.2**.

[1] Stantec completed a similar evaluation the Bipole III Transmission Project. Through this evaluation, it was determined that a 20 m corridor centered on the transmission line provided a more reliable means of identifying potential effects between towers when compared with evaluating the entire RoW area.

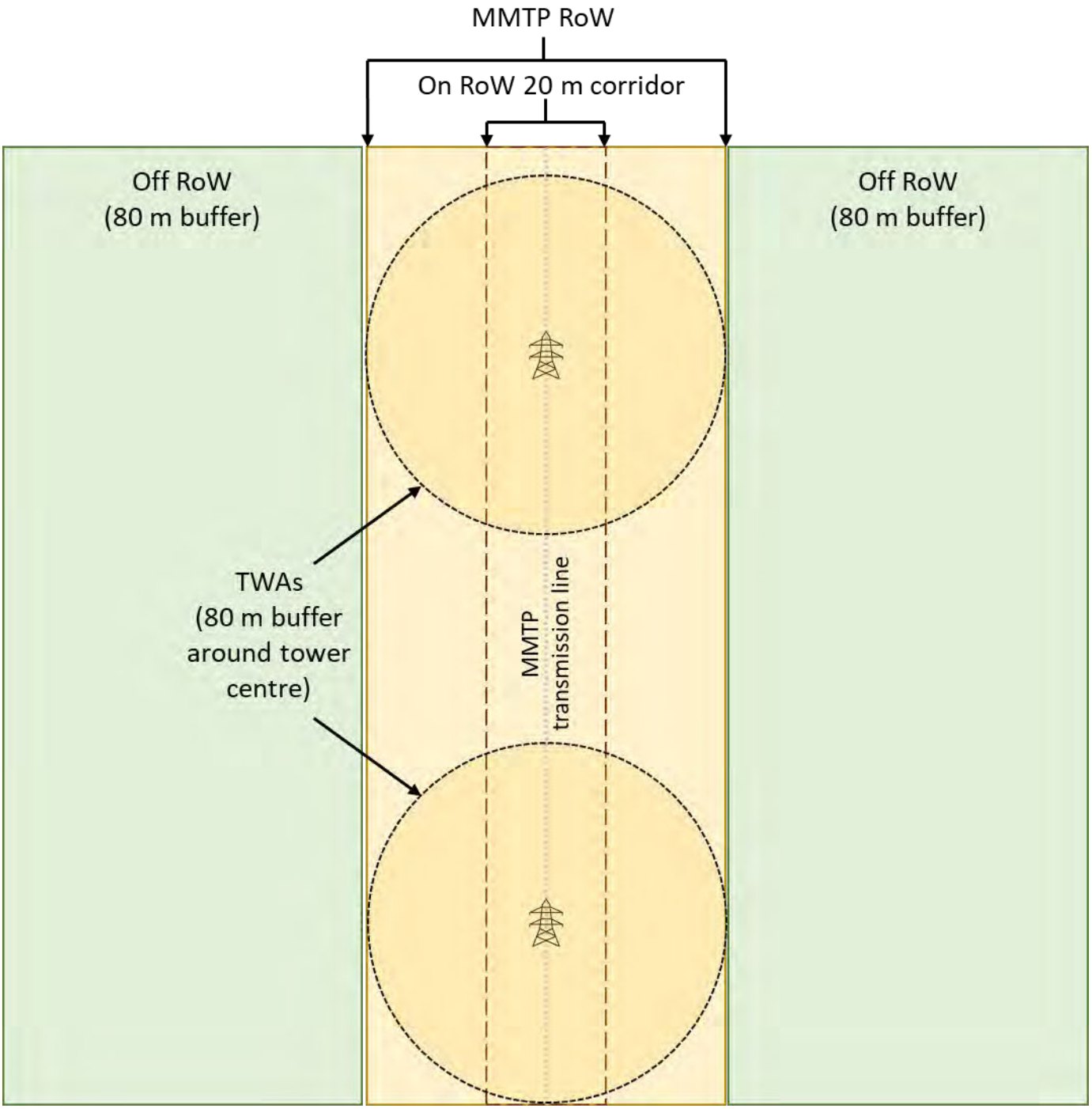


Figure 2.2 Conceptual Drawing of On RoW, TWA and Off RoW Study Areas

2.3.2 Agricultural Evaluation Area Delineation

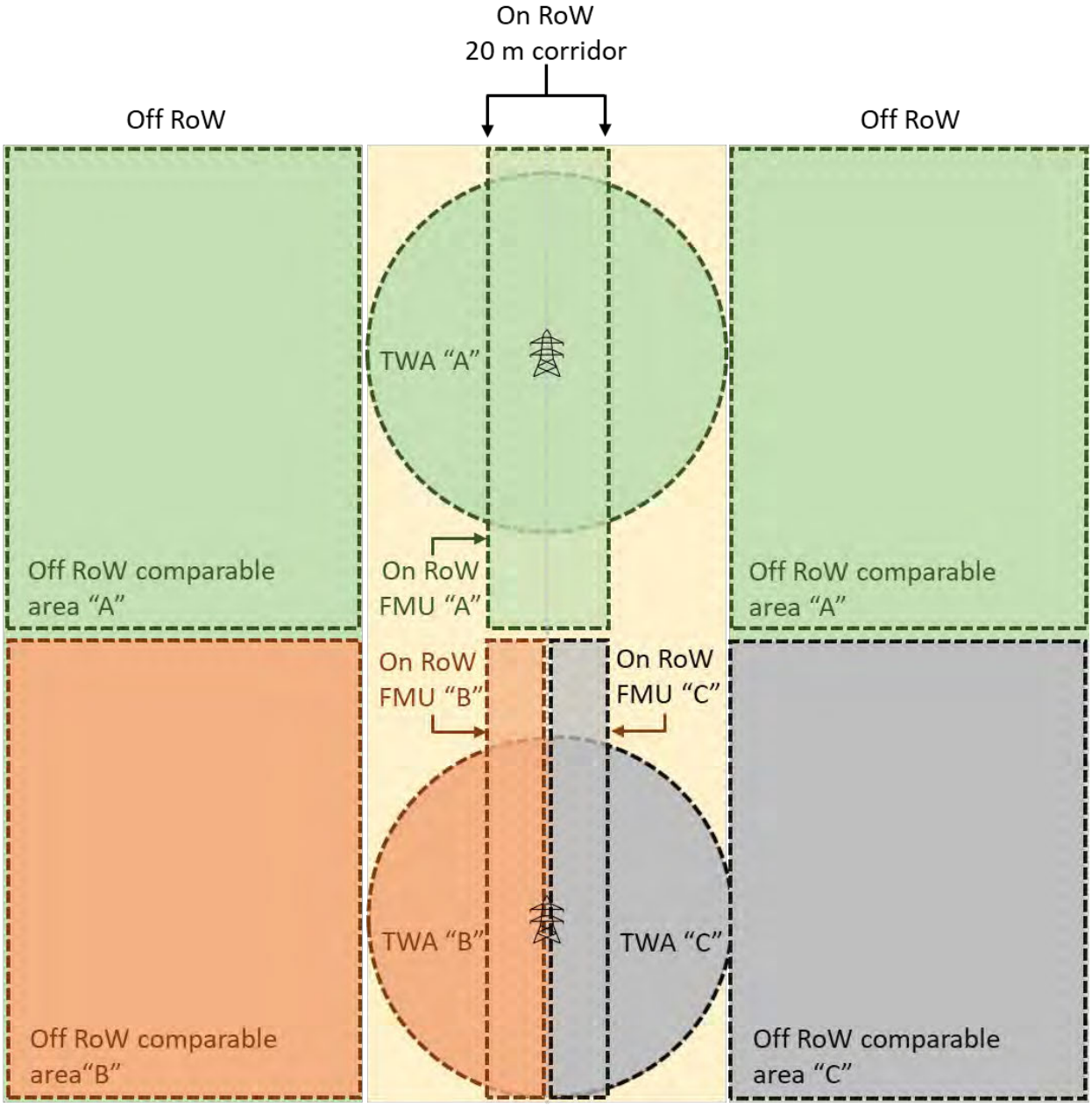
In order to analyze data and evaluate potential for effects to soil productivity within the RoW from construction activities, On RoW, TWA and Off RoW agricultural evaluation areas were established within portions of the Project traversing agricultural land. This was accomplished within the ArcGIS software environment as follows:

1. Delineating areas of agricultural land use using agricultural crop inventory data (AAFC, 2021), specifically areas of land under annual crop, forage (hay) or grassland (pasture). This resulted in the elimination of non-agricultural land uses (e.g., infrastructure such as roads, rail and other transmission lines, tree/forest/bush cover, wetlands, abandoned land, etc.).
2. Eliminating portions of On Row, TWA and Off RoW study areas in areas of non-agricultural land uses.
3. Dividing the resulting agricultural evaluation area according to discrete agricultural field management units (FMUs) using the land ownership grid (i.e., quarter section, river lots, etc.) as a basis combined with heads-up digitizing, supported with orthoimagery and agricultural crop inventory data (AAFC, 2021). This resulted in the delineation of discrete On RoW FMUs (i.e., portions of the 20 m corridor within a discrete FMU) and TWAs paired with comparable Off RoW evaluation areas within the discrete FMU area.
4. Identifying and labeling individual On RoW FMUs and TWAs, and comparable Off RoW evaluation area counterparts. In cases where multiple FMU areas were delineated within a given quarter section, these evaluation areas were labelled successively with “A”, “B”, “C”, etc. to yield unique identifiers for data management and for comparative evaluation purposes.

The establishment of On RoW FMUs, TWAs, and comparable Off RoW evaluation areas provided the basis for comparison of soil productivity within agricultural areas potentially disturbed by the Project against comparable agricultural areas not disturbed by the Project.

A conceptual drawing of On ROW FMUs, TWAs and Off RoW comparable areas is displayed in **Figure 2.3**.

An example of these evaluation areas for a select quarter section is presented in **Figure 2.4**.



Within FMU "A" (dark green outline), the On RoW FMU "A" area is compared against the Off RoW comparable area "A" to determine the NDVI difference. Within FMU B (dark orange outline), the On RoW FMU "B" area is compared against the Off RoW comparable area "B" to determine the NDVI difference. Within FMU C (black outline), the On RoW FMU "C" area is compared against the Off RoW comparable area "C" to determine the NDVI difference. For TWAs, TWA "A" is compared against Off RoW comparable area "A", TWA "B" is compared against Off RoW comparable area "B" and TWA "C" is compared against Off RoW comparable area "C".

Figure 2.3 Conceptual Drawing of On RoW FMUs, TWAs and Off RoW Comparable Areas

On RoW FMUs shown in solid gray and blue outlines; TWAs shown in solid gray and blue circular outlines; Off RoW FMUs shown in dashed gray outlines. Note SW-17-1-12-E has two, discrete On RoW FMUs (i.e., "A" and "B"), and On RoW FMUs and TWAs have corresponding Off RoW comparable areas denoted as "A" and "B".

Figure 2.4 Screen Capture from ArcGIS showing On RoW FMUs, TWAs and Off RoW Comparable Areas within a Select Quarter Section

2.4 DATA ANALYSIS

2.4.1 NDVI Evaluation

NDVI evaluation was completed for the entire agricultural portion of the Project RoW in order to develop an understanding of the differences in NDVI values between individual On RoW FMUs and TWAs, and their corresponding Off RoW comparable areas. This understanding was then used to:

- identify areas within the Project RoW where Project-related disturbances may be negatively affecting soil productivity; and
- track the post-construction recovery of soil productivity in these areas of potential Project-related disturbances.

Difference values were determined for each individual On RoW FMU and TWA as follows:

- On RoW FMU NDVI mean value – Off RoW comparable area NDVI mean value = FMU NDVI difference value
- TWA NDVI mean value – TWA comparable area mean value = TWA NDVI difference value

Statistical analyses were completed on NDVI mean values and NDVI difference values to characterize the NDVI data. The use of threshold values for NDVI differences was employed to identify potential practically-meaningful NDVI differences within individual On RoW FMUs and TWAs. Statistical analyses approaches and NDVI difference thresholds are discussed further in the sections below.

In addition, a visual assessment of imagery data was completed, as discussed below.

A total of 229 On RoW FMUs and 337 TWAs were evaluated in 2019 and 2020.

2.4.2 Statistical Analyses

Basic statistical analyses were conducted on NDVI mean values for On RoW FMUs and TWAs, and Off RoW comparable areas, and NDVI difference values. Statistical analyses included frequency histograms and quartile analyses to understand the character and distribution of mean values for On RoW FMUs, TWAs and Off RoW comparable areas. For difference values, values were plotted against the expected normal distribution, quartiles were determined, and percentiles were examined to characterize the data distributions.

2.4.3 NDVI Difference Thresholds

To support the remotely-sensed NDVI approach to identify potential Project-related disturbances to soil productivity within the RoW, thresholds for NDVI difference values were established. Difference value thresholds were used to identify individual On RoW FMUs and TWAs whose NDVI difference values were

considered outliers relative to the normal variation in NDVI difference values expected if there were no disturbances to soil productivity.

The threshold values were established in both the positive and negative difference directions; therefore, were used to identify both positive and negative outliers in the NDVI difference values. In other words, the thresholds were established such that NDVI difference values between the positive and negative thresholds were considered to be within the normal variation of differences between On RoW and Off RoW areas. NDVI difference values for individual On RoW FMUs and TWAs exceeding the positive threshold were considered positive outliers (i.e., soil and crop productivity was higher in the On RoW area vs. Off RoW area) and values below the negative threshold were considered negative outliers (i.e., soil and crop productivity was lower in the ON RoW area vs. Off RoW area). Negative outliers are of more interest to this evaluation as they are indicative of potential Project-related disturbances resulting in reduced soil productivity On RoW relative to comparable Off RoW areas.

Threshold values were established using quartile data, specifically inter-quartile ranges. Quartiles were used to divide the NDVI difference value data into four segments according to where the values fall in relation to the overall range of values. Quartiles are defined as follows:

- Q1 (25th percentile) – 25% of values fall below this quartile value
- Q2 (50th percentile or the median value) – 50% of values are above this quartile value and 50% are below
- Q3 (75th percentile) – 25% of values fall above this quartile value

The interquartile range (IQR) is defined as Q3 – Q1, and provides an indication of the spread of the middle 50% of values, as well as a means to identify outliers (below).

Quartiles were used to identify what's called inner and outer fences for NDVI difference values, as an indicator of minor and major outliers, respectively. These inner and outer fences were determined in the negative (lower) and positive (upper) directions as follows:

- Inner lower fence (minor negative outlier threshold): Q1 – (1.5 x IQR)
- Outer lower fence (major negative outlier threshold): Q1 – (3 x IQR)
- Inner upper fence (minor positive outlier threshold): Q3 + (1.5 x IQR)
- Outer upper fence (major positive outlier threshold): Q3 + (3 x IQR)

A conceptual diagram illustrating the inner fences (minor outlier thresholds) and outer fences (major outlier thresholds) is presented in **Figure 2.5**.

Thresholds were developed based on the 2019 NDVI difference values for On RoW FMUs and TWAs. These 2019 threshold values were used to evaluate 2019 and 2020 difference values, as the 2019 values present the baseline or pre-disturbance (i.e., pre-construction) conditions.

NDVI threshold values are presented in **Table 2.1** and are visualized in **Figure 2.6**.

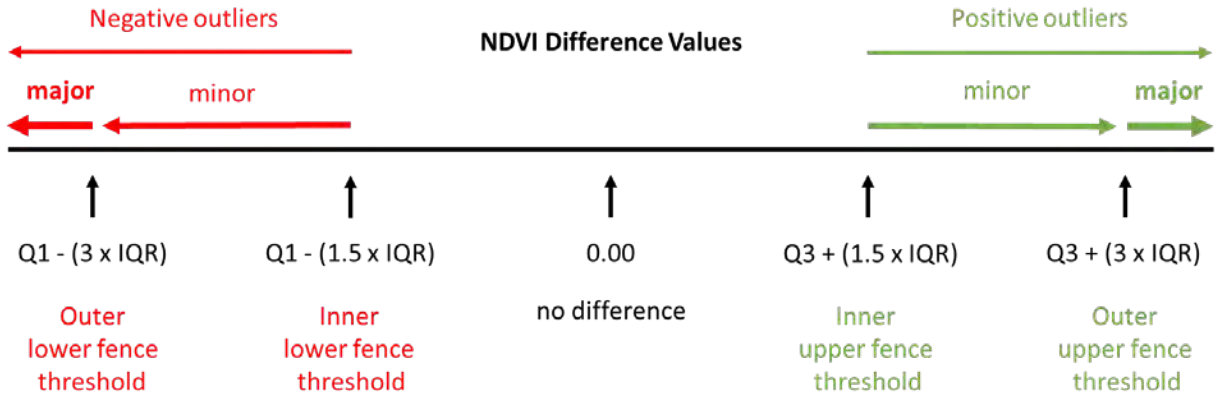


Figure 2.5 Conceptual Drawing of NDVI Difference Thresholds

Table 2.1 NDVI Difference Threshold Values for On RoW FMUs and TWAs Determined Using 2019 Results

Evaluation Component	Positive threshold		Negative threshold	
	Outer Upper Fence	Inner Upper Fence	Inner Lower Fence	Outer Lower Fence
	Major positive difference threshold	Minor positive difference threshold	Minor negative difference threshold	Major negative difference threshold
On RoW FMUs	0.090	0.052	-0.052	-0.090
TWAs	0.14	0.079	-0.084	-0.145

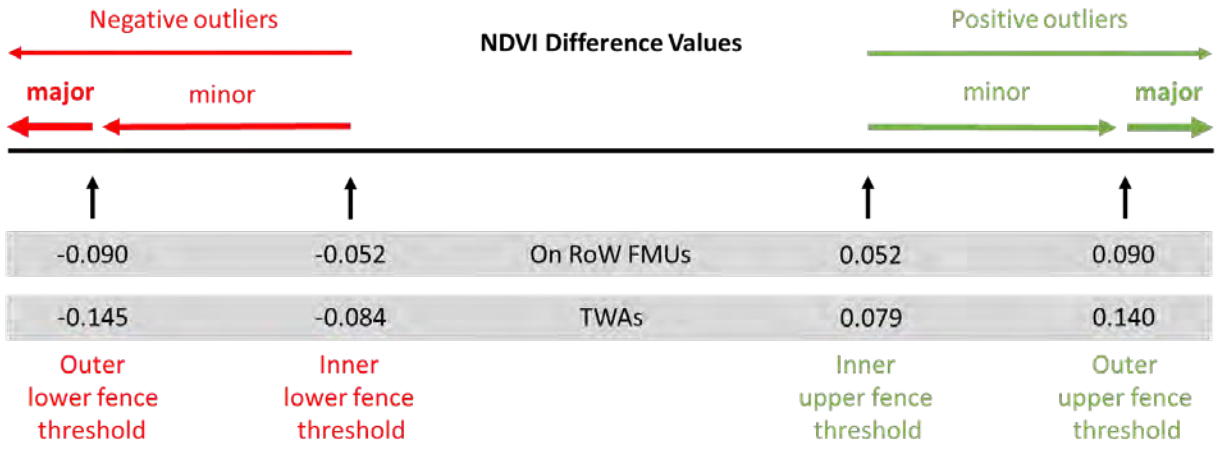


Figure 2.6 NDVI Difference Threshold Values for On RoW FMUs and TWAs Determined Using 2019 Results

2.4.4 Visual Assessment

A manual visual imagery review of all On RoW FMUs and TWAs considered to be negative outliers in 2019 and 2020 was conducted to characterize the nature of the NDVI differences and confirm visual evidence of potential construction effects to soil productivity along the agricultural portions of the Project RoW. This visual assessment was used to confirm that negative outliers were considered to be the result of Project-related disturbances to soil productivity. In some cases, the visual assessment indicated that negative outliers were the result of factors not related to Project activities, for example in cases where it was apparent that differences were due to variable status of agricultural field management within an FMU [e.g., crop partially harvested], or natural variability in soil capability or productivity [e.g., soil drainage, fertility or salinity]).

2.5 FIELD ASSESSMENT

No field assessments were conducted during the 2020 post-construction monitoring season, as these were not deemed necessary to support the monitoring program.

Methods for field assessments would be developed as necessitated by the site-specific assessment requirements.

3.0 RESULTS AND DISCUSSION

Summaries and discussions of NDVI soil productivity analyses are presented for On RoW FMUs in Section 3.1 and TWAs in Section 3.2. For the purposes of this evaluation:

- Of the total transmission line length of 213 km, 114 km (53.5%) were determined to be within the agricultural evaluation area and a total of 229 On RoW FMUs were delineated.
- Of the 499 total tower structures, 306 tower structures (61.3 %) were considered within the agricultural evaluation area and a total of 338 discrete TWAs were delineated (note: the higher TWA number relative to tower structures in the agricultural evaluation area is due to field management unit splits where towers straddle management units).

NDVI values for individual agricultural evaluation areas for pre-construction (2019) and post-construction year 1 (2020) monitoring seasons are located in Tables A.1 and Table A. (Appendix A). Statistical analyses are presented in the sections below and in Appendix B.

Tabular summaries, figures and discussions of results are supplemented with a mapbook displaying NDVI values and On RoW FMU and TWA outliers for the 2019 and 2020 monitoring seasons (Appendix C).

3.1 SOIL PRODUCTIVITY WITHIN ON RoW FMUs

3.1.1 Pre-Construction (2019) Monitoring Season

A summary of basic statistics for On RoW FMUs, Off RoW comparable areas and difference values is provided in **Table 3.1**. The mean values were found to be very close and the median values identical between On RoW FMUs and Off RoW comparable areas, which resulted in difference values close to and at zero, respectively. Of the 229 On RoW FMUs, differences were found to be negative in 113 (49%) FMUs and positive in 116 (51%) FMUs.

These data indicate that soil productivity, as represented by NDVI, was similar in On RoW and Off RoW areas within the 20 m corridor along the transmission centreline in the pre-construction (2019) monitoring season. This confirms that agricultural evaluation areas including On RoW FMUs and Off RoW comparable areas were delineated well.

Further statistical support that NDVI values are similar between On RoW FMUs and comparable Off RoW comparable areas is provided in Figures B.1.1 to B.1.4 (Appendix B.1).

Table 3.1 Basic Statistics for 2019 NDVI Results for On RoW FMUs

Parameter	On RoW FMU	Off RoW Comparable Areas	Difference (On RoW - Off RoW)
Count	229	229	229
Mean	0.438	0.434	0.004
Minimum	0.090	0.121	-0.117
Median	0.457	0.447	0.000
Maximum	0.688	0.681	0.181
Range	0.598	0.560	0.298
Count of Negatives	N/A	N/A	113
% Negatives	N/A	N/A	49%
Count of Positives	N/A	N/A	116
% Positives	N/A	N/A	51%

Outliers were identified using the thresholds presented in Section 2.4.3. A summary of outliers in 2019 is presented in **Table 3.2** as follows:

- there was a total of 19 positive outliers (8.3% of total), 8 of which were considered minor positive outliers (3.5% of total) and 11 of which were considered major positive outliers (4.8% of total).
- there was a total of 9 negative outliers (3.9% of total), 6 of which were considered minor negative outliers (2.6% of total) and 3 of which were considered major negative outliers (1.3% of total).

It is reasonable to expect some outliers in data, even in a pre-disturbance situation. However, it is good to understand the nature of NDVI data in the outlying On RoW FMUs. These outlying On RoW FMUs were reviewed visually, which allowed the nature of the differences in NDVI values to be evaluated. The outcome of this visual review is presented in Section 3.1.3.

Table 3.2 Summary of NDVI Difference Outliers for 2019 NDVI for On RoW FMUs

Outlier Direction	Outlier Category	Threshold Value	Count	% of Total	Count	% of Total
Positive	Major positive outlier	>0.091	11	4.8	19	8.3
	Minor positive outlier	>0.052 to 0.091	8	3.5		
Negative	Minor negative outlier	<-0.052 to -0.091	6	2.6	9	3.9
	Major negative outlier	<-0.091	3	1.3		

3.1.2 Post-Construction Year 1 (2020) Monitoring Season

A summary of basic statistics for On RoW FMUs, Off RoW comparable areas and difference values is provided in **Table 3.3**. The mean and median values were found to be lower for On RoW FMUs relative to Off RoW comparable areas, resulting in negative difference values. Of the 229 On RoW FMUs, differences were found to be negative in 182 (79.5%) and positive in 47 (20.5%). These results demonstrate a negative "skewness" in the data, in other words, the NDVI values have shifted in a negative direction relative to the pre-construction monitoring season.

These data indicate that soil productivity, as represented by NDVI, is lower in On RoW areas relative to Off RoW areas within the 20 m corridor along the transmission centreline in the post-construction year 1 (2020) monitoring season. This suggests that Project-related disturbances have resulted in reduced soil productivity in portions of the RoW.

Further statistical support that NDVI values are lower in On RoW FMUs relative to Off RoW comparable areas is provided in Figures B.1.5 to B.1.8 (Appendix B.1).

Table 3.3 Basic Statistics for 2020 NDVI Results for On RoW FMUs

Parameter	On RoW FMU	Off RoW Comparable Areas	Difference (On RoW - Off RoW)
Count	229	229	229
Mean	0.447	0.482	-0.034
Minimum	0.141	0.138	-0.242
Median	0.450	0.505	-0.031
Maximum	0.692	0.746	0.193
Range	0.551	0.608	0.435
Count of Negatives	N/A	N/A	182
% Negatives	N/A	N/A	79.5%
Count of Positives	N/A	N/A	47
% Positives	N/A	N/A	20.5%

Outliers were identified using the thresholds presented in Section 2.4.3. A summary of outliers in 2020 is presented in **Table 3.4** as follows:

- there was a total of 13 positive outliers (5.7% of total), 5 of which were considered minor positive outliers (2.2% of total) and 8 of which were considered major positive outliers (3.5% of total).
- there was a total of 72 negative outliers (31.4% of total), 36 of which were considered minor negative outliers (15.7% of total) and 36 of which were considered major negative outliers (15.7% of total).

The count of positive outliers was found to be slightly lower in 2020 relative to 2019 (i.e.,13 in 2020 vs. 19 in 2019); however, these results are not expected to be Project-related. The much higher negative outlier count in 2020 relative to 2019 (i.e., 72 in 2020 vs. 9 in 2019) suggests Project-related disturbance has persisted into the 2020 growing season within a significant portion of On RoW FMUs within the 20 m corridor along the transmission centreline.

Table 3.4 Summary of NDVI Difference Outliers for 2020 NDVI for On RoW FMUs

Outlier Direction	Outlier Category	Threshold Value	Count	% of Total	Count	% of Total
Positive	Major positive outlier	>0.091	8	3.5	13	5.7
	Minor positive outlier	>0.052 to 0.091	5	2.2		
Negative	Minor negative outlier	<-0.052 to -0.091	36	15.7	72	31.4
	Major negative outlier	<-0.091	36	15.7		

An example of an On RoW FMU that is considered a minor negative outlier in 2020 is presented in **Figure 3.1**. The relatively low NDVI values (orange) are indicative of disturbance within the 20 m corridor in 2020, particularly between Brady Road and tower D604I_106.

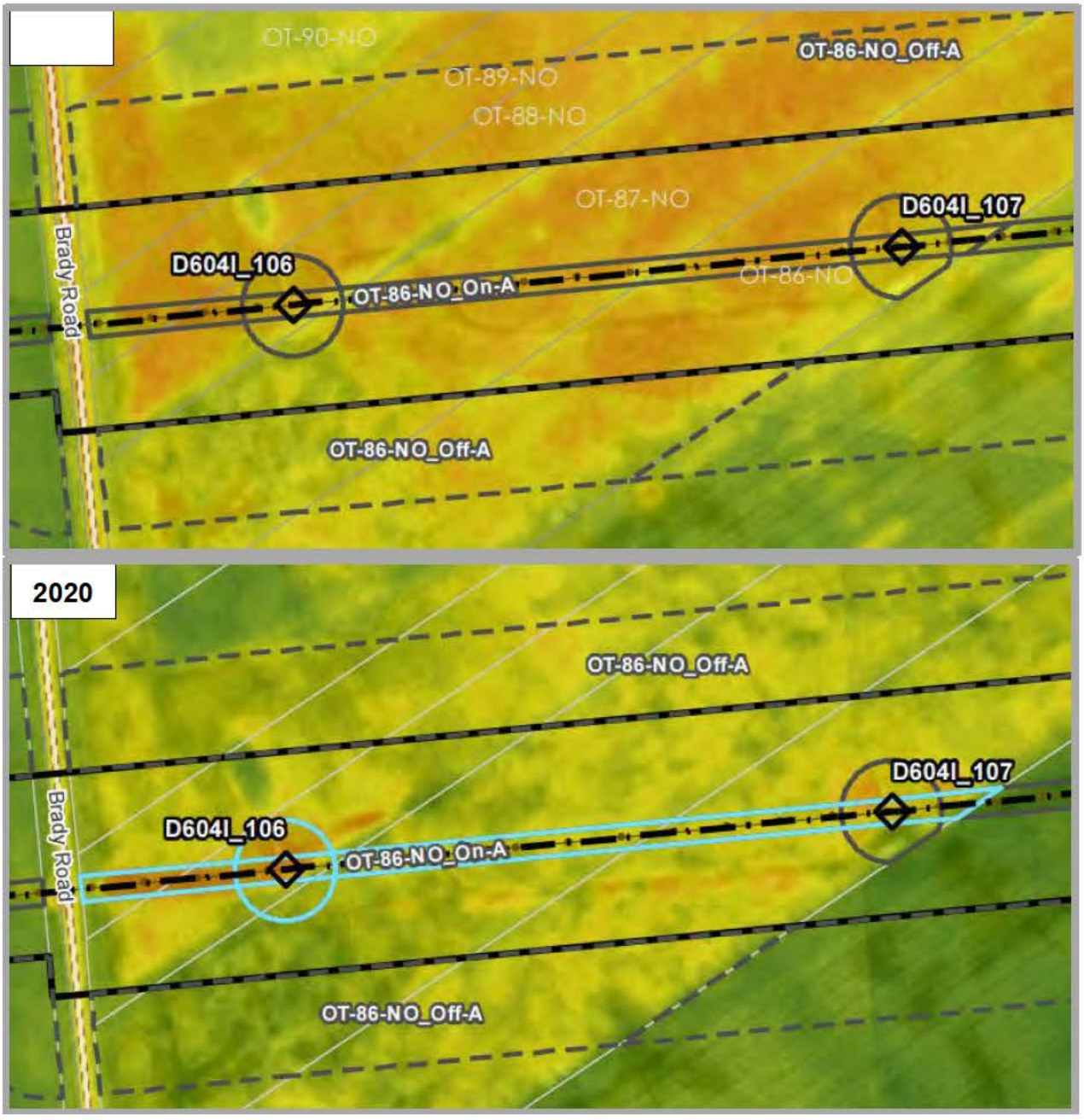


Figure 3.1 **Example of On RoW FMU (OT-86-NO-On-A) Considered a Minor Negative Outlier in 2020**

An example of an On RoW FMU that is considered a major negative outlier in 2020 is presented in **Figure 3.2**. The relatively low NDVI values (yellow and orange) are indicative of disturbance within the 20 m corridor in 2020, and are apparent across the entire On RoW FMU.

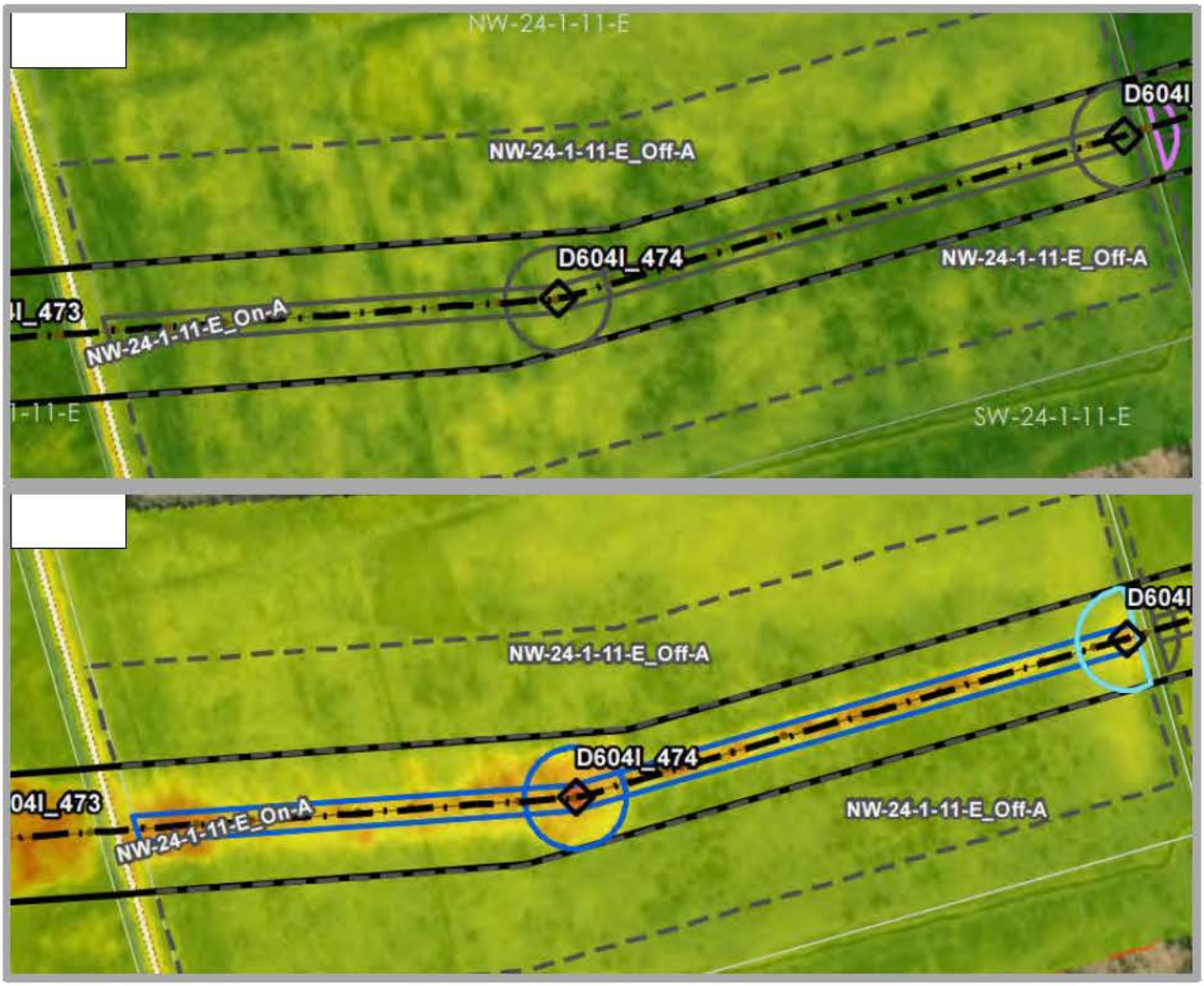


Figure 3.2 **Example of On RoW FMU (NW-24-1-11-E_On-A) considered a major negative outlier in 2020**

3.1.3 Trend Analysis

As noted in Section 2.4, NDVI difference values that exceed the positive threshold are considered positive outliers and are likely the result of factors not related to Project activities. For example, they may be due to incorrect FMU delineation or natural variability in soil capability or productivity, such as differing soil drainage, fertility, or salinity conditions in the On RoW and Off RoW evaluation areas. These positive outliers are of little interest to this evaluation and are not discussed further.

NDVI difference values for individual FMUs that are below the negative threshold are likely the result of a Project-related disturbance within the RoW reducing soil productivity. However, it is possible that even the negative outliers may be the result of other factors, hence the need for further evaluation of data for individual FMUs where NDVI difference values are below the negative threshold.

Applying the negative threshold values yielded 72 negative outlier values (31.4% of FMUs), including 36 (15.7%) considered minor outliers and 36 (15.7%) considered major outliers (**Table 3.5**). Notably but as expected, there was an increase in On RoW FMUs with NDVI differences below the negative threshold from the pre-disturbance monitoring (2019; 9 On RoW FMUs) to post-construction year 1 (2020; 72 On RoW FMUs). A summary of counts of On RoW FMUs with NDVI differences considered negative outliers is presented in **Figure 3.3** and **Figure 3.4**.

These data suggest that Project disturbances have affected soil productivity On RoW and have persisted through the post-construction year 1 monitoring season. However, review of individual On RoW FMUs was required to confirm the nature of disturbances, specifically if negative outliers are the result of Project-related disturbances.

Table 3.5 On RoW FMUs with NDVI Difference Below Negative Thresholds in 2019 and 2020

Year	Total count	Negatives		Total Negative Outliers		Minor Negative Outliers		Major Negative Outliers	
		Count	%	Count	%	Count	%	Count	%
2019	229	113	49.3	9	3.9	6	2.6	3	1.3
2020	229	599	261.6	72	31.4	36	15.7	36	15.7

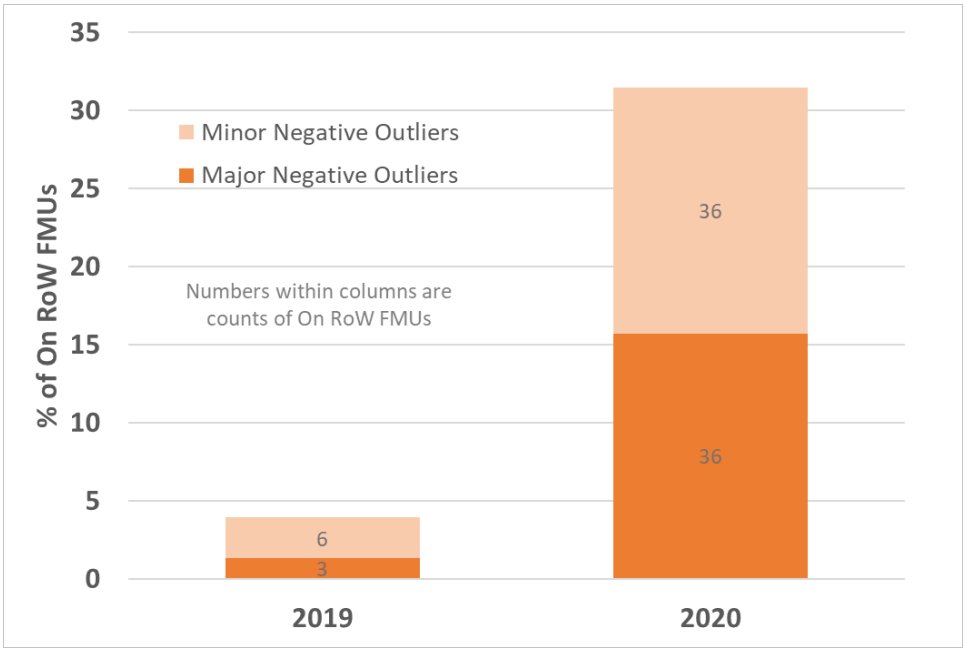


Figure 3.3 On RoW FMUs below the Negative Thresholds in 2019 and 2020

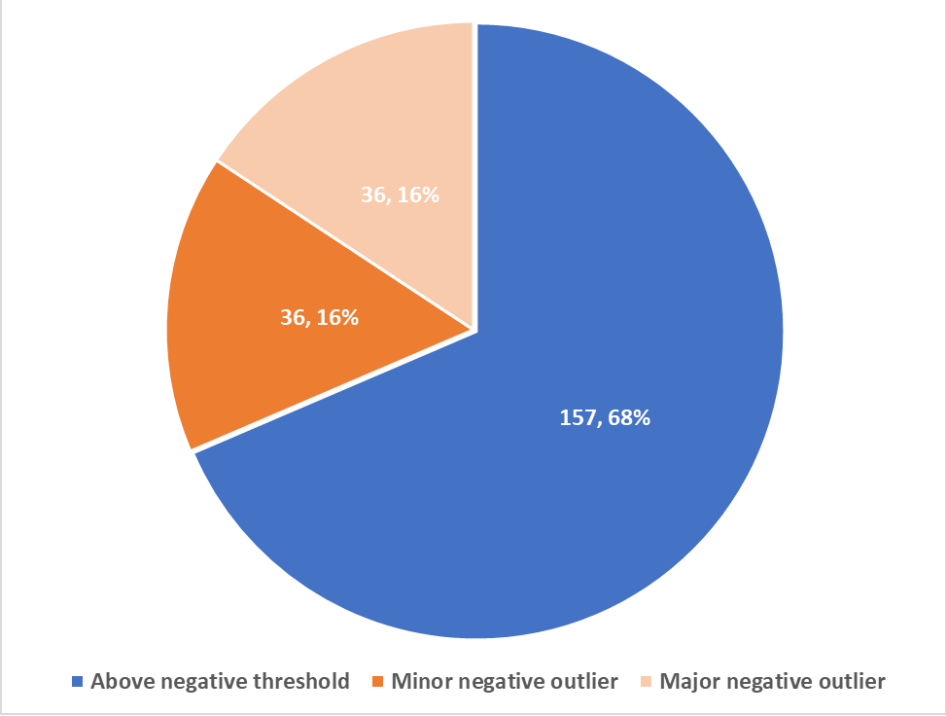


Figure 3.4 On RoW FMUs Considered Negative Outliers in 2020

A visual review and evaluation of negative outliers in 2020 was completed to classify On RoW in the following negative outlier categories:

- **Project-related disturbance persists** – Project-related disturbance has resulted in a difference below negative threshold in 2020, in the minor negative outlier category or major negative outlier category; or
- **Negative outlier, nature unknown** – difference below negative threshold in 2020, but does not appear to be a result of the Project (i.e., related to other factors, such as variable status of agricultural field management with the FMU [e.g., crop partially harvested], or natural variability in soil capability or productivity [e.g., soil drainage, fertility or salinity]).

A summary of counts and proportions of individual On RoW FMUs in each of the disturbance categories is found in **Table 3.6** and **Figure 3.5**. Following visual review and evaluation of negative outliers, 7 On RoW FMUs (3.1%) were found to have been negative outliers in 2019, and therefore are not considered to have lower productivity On RoW due to the Project (i.e., negative outlier, nature unknown). A total of 65 On RoW FMUs (28.4%) are considered to have lower soil productivity due to Project-related disturbances, 36 of which (15.7%) are considered major negative outliers and 29 of which (12.7%) are considered minor negative outliers.

Table 3.6 Summary of Disturbance Status for On RoW FMUs

Disturbance Category	On RoW FMU Count	% of Total FMUs
Project disturbance persists	**65**	**28.4**
Disturbed (minor negative outlier)	29	12.7
Disturbed (major negative outlier)	36	15.7
No disturbance	**164**	**71.6**
Negative outlier, nature unknown	7	3.1
No disturbance	157	68.6
Total	**229**	**100.0**

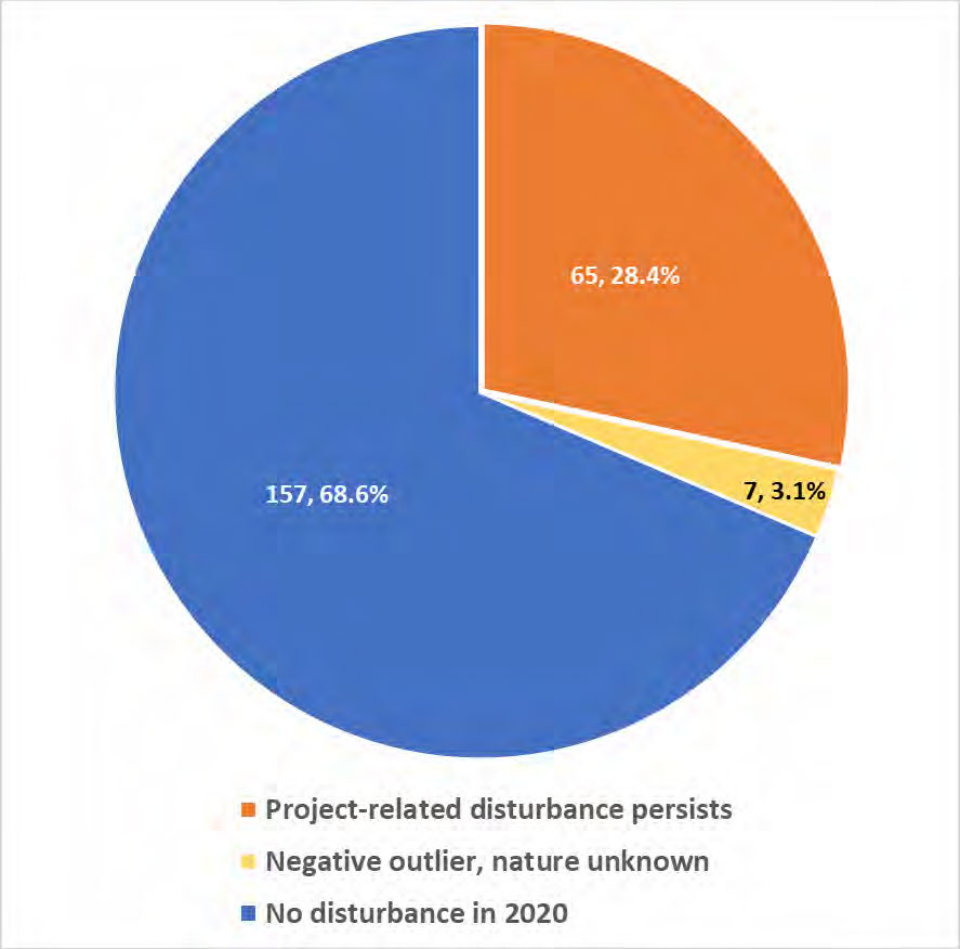


Figure 3.5 Proportion of On RoW FMUs by Recovery Category

3.2 SOIL PRODUCTIVITY WITHIN TWAs

3.2.1 Pre-Construction (2019) Monitoring Season

A summary of basic statistics for TWAs, Off RoW comparable areas and difference values is provided in **Table 3.6**. The mean and median values were found to be very close between TWAs and Off RoW comparable areas resulting in difference values close to zero. Of the 337 TWAs, differences were found to be negative in 165 (49%) and positive in 172 (51%).

These data indicate soil productivity, as represented by NDVI, is similar in TWA and Off RoW areas in the pre-construction (2019) monitoring season. This confirms that agricultural evaluation areas including TWAs and Off RoW comparable areas were delineated well.

Further statistical support that NDVI values are similar between TWAs and comparable Off RoW comparable areas is provided in Figures B.2.1 to B.2.4 (Appendix B).

Table 3.6 Basic Statistics for 2019 NDVI Results for TWAs

Parameter	TWAs	Off RoW Comparable Areas	Difference (On RoW - Off RoW)
Count	337	337	337
Mean	0.424	0.427	-0.003
Minimum	0.107	0.121	-0.252
Median	0.442	0.450	0.001
Maximum	0.698	0.681	0.211
Range	0.591	0.560	0.463
Count of Negatives	N/A	N/A	165
% Negatives	N/A	N/A	49.0%
Count of Positives	N/A	N/A	172
% Positives	N/A	N/A	51.0%

Outliers were identified using the thresholds presented in Section 2.4.3. A summary of outliers in 2019 is presented in **Table 3.7** as follows:

- there was a total of 13 positive outliers (3.9% of total), 11 of which were considered minor positive outliers (3.3% of total) and 2 of which were considered major positive outliers (0.6% of total).
- there was a total of 16 negative outliers (4.8% of total), 14 of which were considered minor negative outliers (4.2% of total) and 2 of which were considered major negative outliers (0.6% of total).

It is reasonable to expect some outliers in data, even in a pre-disturbance situation, as discussed for On RoW FMUs, above. Outlying TWAs were reviewed visually, which allowed the nature of the differences in NDVI values to be evaluated. The outcome of this visual review is presented in Section 3.2.3.

Table 3.7 Summary of NDVI Difference Outliers for 2019 NDVI for TWAs

Outlier Direction	Outlier Category	Threshold Value	Count	% of Total	Count	% of Total
Positive	Major positive outlier	>0.140	2	0.6	13	3.9
	Minor positive outlier	>0.079 to 0.140	11	3.3		
Negative	Minor negative outlier	<-0.084 to -0.145	14	4.2	16	4.8
	Major negative outlier	<-0.145	2	0.6		

3.2.2 Post-Construction Year 1 (2020) Monitoring Season

A summary of basic statistics for TWAs, Off RoW comparable areas and difference values is provided in **Table 3.8**. The mean and median values were found to be lower for TWAs relative to Off RoW comparable areas resulting in negative difference values. Of the 337 TWAs, differences were found to be negative in 273 (81.0%) and positive in 64 (19.0%). These results demonstrate a negative "skewness" in the data, in other words, the NDVI values have shifted in a negative direction relative to the pre-construction monitoring season.

These data indicate soil productivity, as represented by NDVI, is lower in areas represented by TWAs relative to Off RoW areas in the post-construction year 1 (2020) monitoring season. This suggests that Project-related disturbances have resulted in reduced soil productivity across TWAs.

Further statistical support that NDVI values are lower in TWAs relative to Off RoW comparable areas is provided in Figures B.2.5 to B.2.8 (Appendix B.2).

Table 3.8 Basic Statistics for 2020 NDVI Results for TWAs

Parameter	TWAs	Off RoW Comparable Areas	Difference (On RoW - Off RoW)
Count	337	337	337
Mean	0.449	0.496	-0.048
Minimum	0.102	0.138	-0.409
Median	0.475	0.521	-0.041
Maximum	0.737	0.755	0.213
Range	0.634	0.617	0.623
Count of Negatives	N/A	N/A	273
% Negatives	N/A	N/A	81.0%
Count of Positives	N/A	N/A	64
% Positives	N/A	N/A	19.0%

Outliers were identified using the thresholds presented in Section 2.4.3. A summary of outliers in 2020 is presented in **Table 3.9** as follows:

- there was a total of 11 positive outliers (3.3% of total), 8 of which were considered minor positive outliers (2.4% of total) and 3 of which were considered major positive outliers (0.9% of total).
- there was a total of 78 negative outliers (23.1% of total), 47 of which were considered minor negative outliers (13.9% of total) and 31 of which were considered major negative outliers (9.2% of total).

The count of positive outliers was found to be slightly lower in 2020 relative to 2019 (i.e.,13 in 2020 vs. 11 in 2019); however, these results are not expected to be Project-related. The much higher negative outlier

count in 2020 relative to 2019 (i.e., 78 in 2020 vs. 16 in 2019) suggests Project-related disturbance has persisted into the 2020 growing season within a significant portion of TWAs.

Table 3.9 Summary of NDVI Difference Outliers for 2020 NDVI for TWAs

Outlier Direction	Outlier Category	Threshold Value	Count	% of Total	Count	% of Total
Positive	Major positive outlier	>0.140	3	0.9	11	3.3
	Minor positive outlier	>0.079 to 0.140	8	2.4		
Negative	Minor negative outlier	<-0.084 to -0.145	47	13.9	78	23.1
	Major negative outlier	<-0.145	31	9.2		

An example of TWA that is considered a minor negative outlier in 2020 is presented in **Figure 3.6**. The relatively low NDVI values (yellow, orange and red) around the angle tower structure are indicative of a higher degree of disturbance from tower construction activities relative to along the corridor between towers.

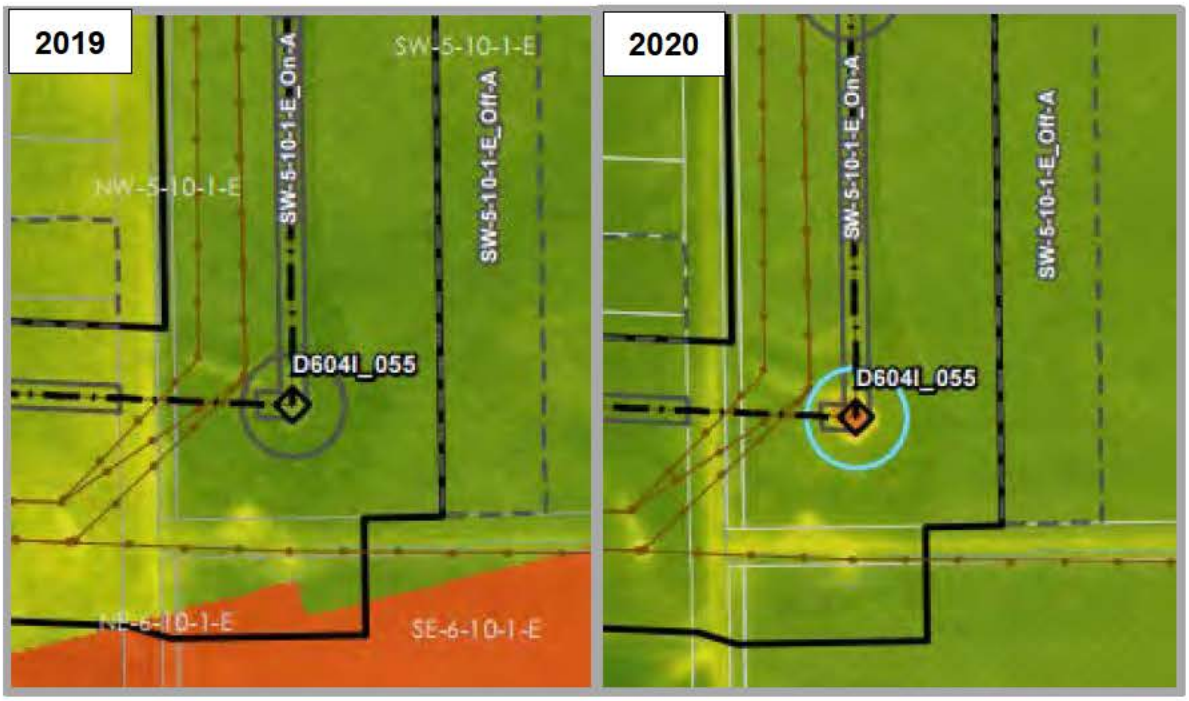


Figure 3.6 Example of TWA (D604I_055) Considered a Minor Negative Outlier in 2020

An example of TWA that is considered a major negative outlier in 2020 is presented in **Figure 3.7**. The relatively low NDVI values (orange and red) are indicative of a large area of disturbance around the tower structure, suggesting intensive tower construction activity and potentially a laydown area or other construction activity beyond the TWA.

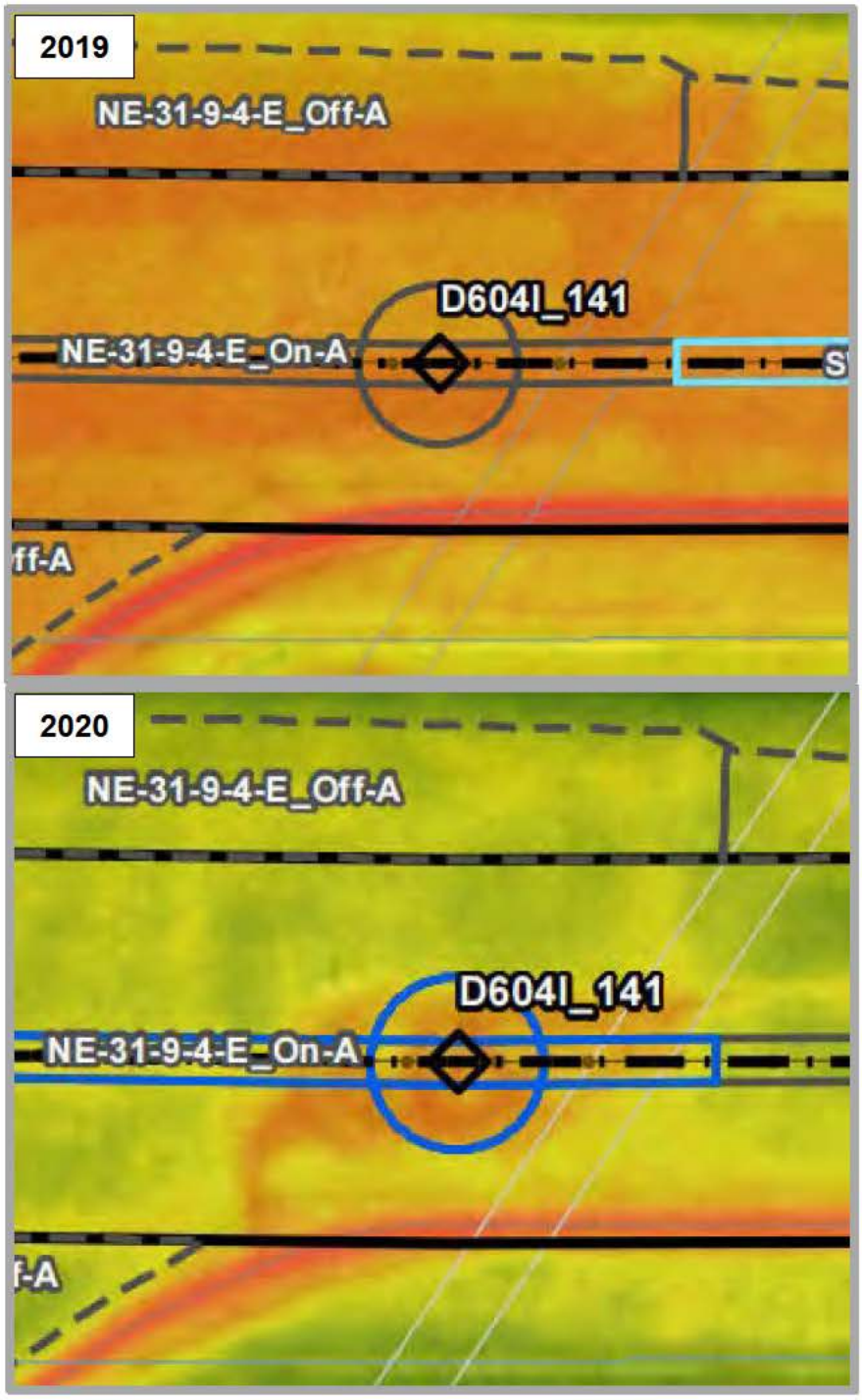


Figure 3.7 Example of TWA (D604I_141) Considered a Major Negative Outlier in 2020

3.2.3 Trend Analysis

As noted in Section 2.4, NDVI difference values that exceed the positive threshold are considered positive outliers and are likely the result of factors not related to Project activities. For example, they may be due to incorrect delineation of Off RoW comparable areas relative to TWAs, variable management of the land within the TWA and corresponding Off RoW comparable area, or natural variability in soil capability or productivity, such as differing soil drainage, fertility, or salinity conditions in the On RoW and Off RoW evaluation areas. These positive outliers are not of interest to this evaluation and are not discussed further.

NDVI difference values for individual TWAs that are below the negative threshold are likely the result of a Project-related disturbance within TWAs reducing soil productivity. However, it is possible that even the negative outliers may be the result of other factors, hence the need for further evaluation of data for individual TWAs where NDVI difference values are below the negative threshold.

Applying the negative threshold values yielded 78 negative outlier values (23.1% of TWAs), including 47 (13.9%) considered minor outliers and 31 (9.2%) considered major outliers (**Table 3.10**). Notably, but as expected, there was a significant increase in TWAs with NDVI differences below the negative threshold from the pre-disturbance monitoring (2019; 16 TWAs) to post-construction year 1 (2020; 78 TWAs). A summary of counts of TWAs with NDVI differences considered negative outliers is presented in **Figure 3.8** and **Figure 3.9**.

These data suggest that Project disturbances have affected soil productivity within TWAs and have persisted through the post-construction year 1 monitoring season. However, review of individual TWAs was conducted to confirm the nature of disturbances, specifically if negative outliers are a result of Project-related disturbances.

Table 3.10 TWAs with NDVI Difference Below Negative Thresholds in 2019 and 2020

Year	Total Count	Negatives		Total Negative Outliers		Minor Negative Outliers		Major Negative Outliers	
		Count	%	Count	%	Count	%	Count	%
2019	337	165	49.0	16	4.7	14	4.2	2	0.6
2020	337	273	81.0	78	23.1	47	13.9	31	9.2

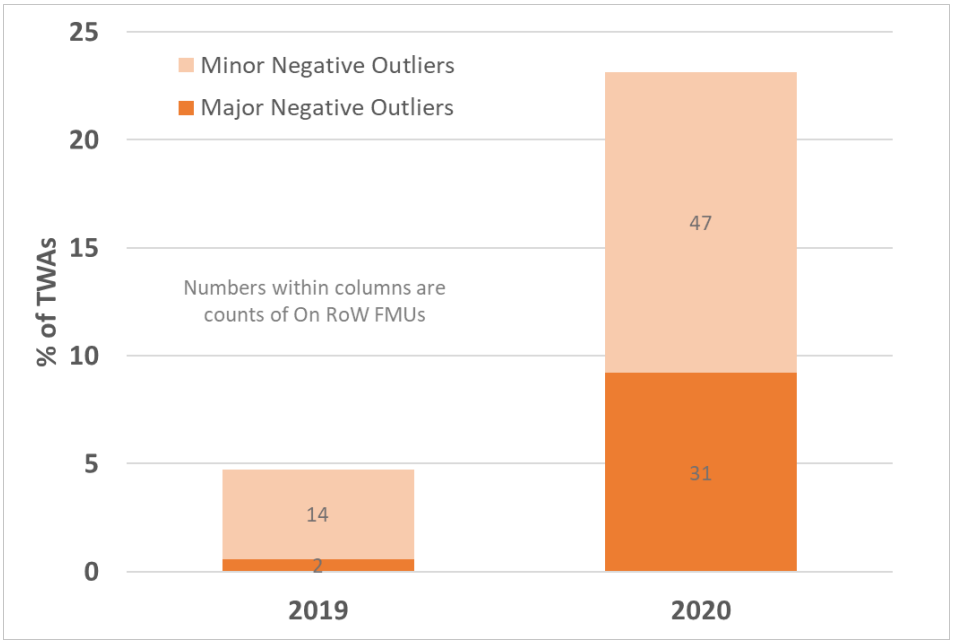


Figure 3.8 TWAs Below the Negative Thresholds in 2019 and 2020

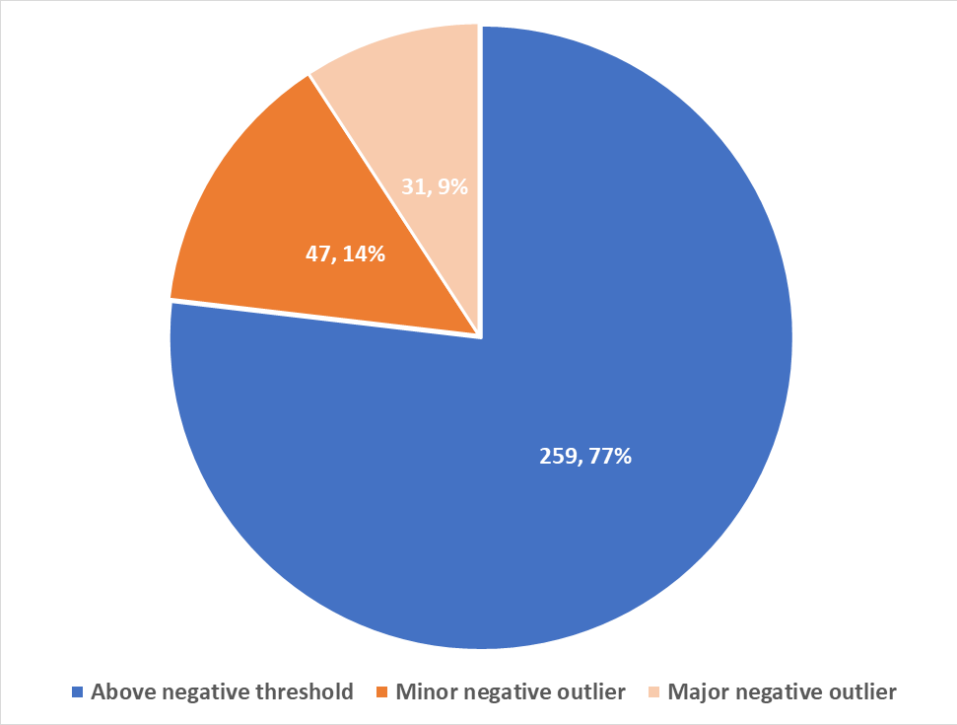


Figure 3.9 TWAs Considered Negative Outliers in 2020

A visual review and evaluation of negative outliers in 2020 was completed to classify TWAs in the following negative outlier categories:

- **Project-related disturbance persists** – Project-related disturbance has resulted in a difference below negative threshold in 2020; or
- **Not Project-related** – difference below negative threshold in 2020 but does not appear to be the result of the Project (i.e., related to other factors, such as variable status of agricultural field management with the TWA and corresponding Off RoW comparable area [e.g., crop partially harvested], or natural variability in soil capability or productivity [e.g., soil drainage, fertility or salinity]).

A summary of counts and proportions of individual TWAs in each of the disturbance categories is provided in **Table 3.11** and **Figure 3.10**. Following visual review and evaluation of negative outliers, only 1 TWA (0.3%) was determined to be not disturbed by the Project (i.e., negative outlier, nature unknown). A total of 77 TWAs (22.8%) are considered to have lower soil productivity due to Project-related disturbances, 47 of which (13.9%) are considered minor negative outliers and 30 of which (8.9%) are considered major negative outliers.

Table 3.11 Summary of Disturbance Status for TWAs

Disturbance Category	On RoW FMU Count	% of Total FMUs
Project disturbance persists	**77**	**22.8**
Disturbed (minor negative outlier)	47	13.9
Disturbed (major negative outlier)	30	8.9
No disturbance	**260**	**77.2**
Negative outlier, nature unknown	1	0.3
No disturbance	259	76.9
Total	**337**	**100.0**

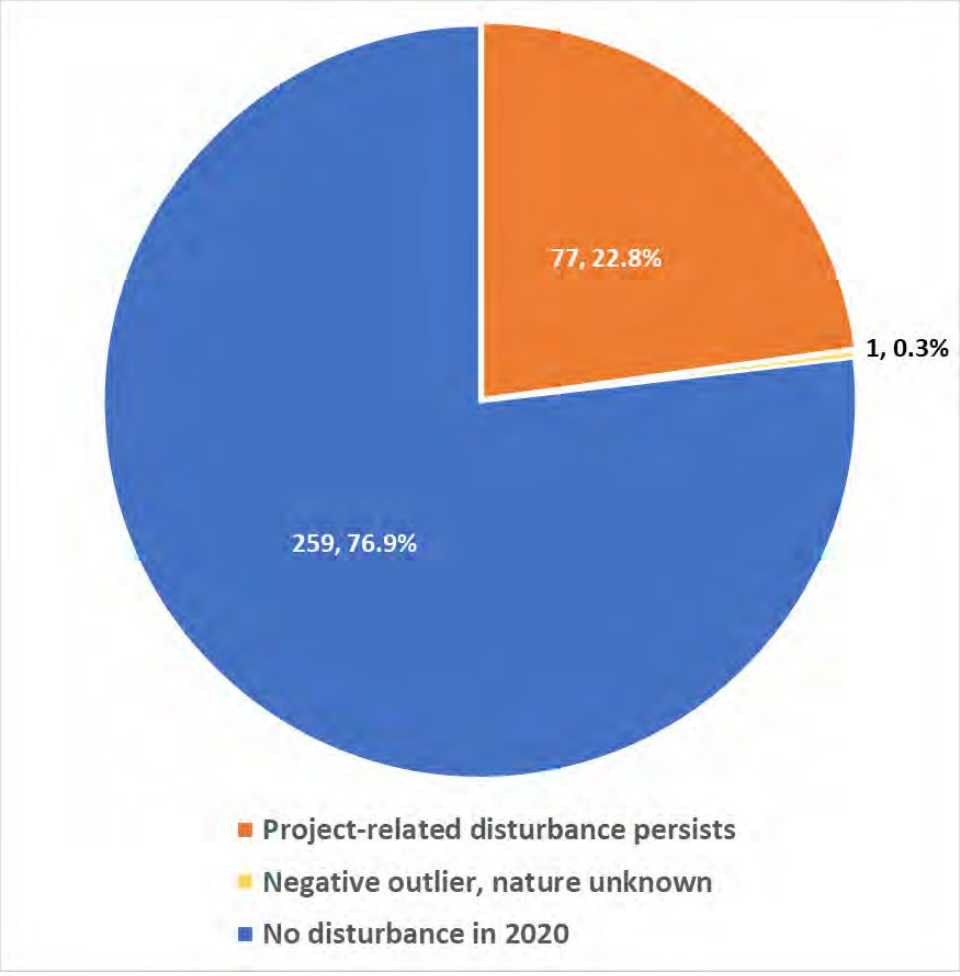


Figure 3.10 Proportion of TWAs by Disturbance Category

4.0 SUMMARY AND CONCLUSIONS

The analysis and evaluation of NDVI values have demonstrated reductions in soil productivity in On RoW areas in the first year, post-construction. Reductions were found in NDVI in On RoW FMUs, as measured within a 20 m corridor along the transmission centreline, and in TWAs, relative to comparable areas Off RoW.

Thresholds were established from pre-construction (2019) NDVI analysis to be used to identify negative outliers in differences between On RoW FMUs and TWAs, and Off RoW comparable areas.

A total of 229 On RoW FMUs were evaluated and 72 (31.4%) were considered to be negative outliers as follows:

- 36 On RoW FMUs (15.7%) were considered minor negative outliers.
- 36 On RoW FMUs (15.7%) were considered major negative outliers.

A total of 337 TWAs were evaluated and 78 (23.1%) were considered to be negative outliers as follows:

- 47 TWAs (13.9%) were considered minor negative outliers.
- 31 TWAs (9.2%) were considered major negative outliers.

While these results strongly suggest that Project-related disturbances have negatively affected soil and crop productivity in areas within the RoW, further evaluation was completed to confirm the nature of differences in NDVI values to confirm that results were Project-related. Individual On RoW FMUs and TWAs were visually evaluated to provide this confirmation.

Following confirmation, the following conclusions are presented on Project-related disturbances to On RoW FMUs and TWAs in the post-construction year 1 (2020) monitoring season:

- 65 On RoW FMUs (28.4%) were considered to have persisting Project disturbances, including:
  - 29 On RoW FMUs (12.7%) in the minor negative outlier category
  - 36 On RoW FMUs (15.7%) in the major negative outlier category
- 77 TWAs (22.8%) were considered to have persisting Project disturbances, including:
  - 47 TWAs (13.9%) in the minor negative outlier category
  - 30 TWAs (8.9%) in the major negative outlier category

Therefore, Project activities have resulted in disturbance to crop productivity and soil productivity within the RoW. Negative effects were found to persist following construction, which occurred between monitoring conducted during the 2019 and 2020 growing seasons.

Effects were found to be limited to the RoW and associated with areas of construction activity (e.g., tower work areas, construction access and trails) within the RoW. As documented in the EIS, effects to soil productivity due to compaction from construction activities within the RoW were anticipated, and where effects from compaction occur, they could persist for a few years following construction. Results from the monitoring program are consistent with the predictions made in the EIS. Results suggest the mitigation program has been effective as over 70% of FMUs and over 75% of TWAs were considered to not have negative effects to soil productivity following post-construction year 1 (2020). No unexpected effects were determined through the monitoring program through the 2020 monitoring season. Future monitoring will be used to confirm that areas where effects have persisted are recovering or trending to recovery.

No field assessments were conducted during the 2020 post-construction monitoring season, as these were not deemed necessary to support the monitoring program.

5.0 RECOMMENDATIONS

The following recommendations are presented for the post-construction year 2 (2021) soil productivity monitoring program:

- Continue to review and revise On RoW FMUs, TWAs and Off RoW comparable areas using NDVI data and up-to-date orthoimagery, as available. Delineations that are kept current relative to agricultural field management units will provide more reliable soil productivity evaluation results.
- Evaluate NDVI values in 2021 relative to 2020 to confirm that soil productivity in On RoW FMUs and TWAs is trending towards recovery (i.e., pre-construction levels).
- Review disturbance and recovery relative to soil properties (e.g., texture, drainage) and crop type (e.g., annual crop, forage, pasture/grassland) during evaluation of 2021 soil productivity data.
- Integrate information on soil-related mitigation implemented on the Project relative to 2020 and 2021 soil productivity evaluation results to assess effectiveness of mitigation.
- Implement object-based image analysis of individual NDVI pixels to identify and delineate areas within On RoW FMUs and TWAs that are considered disturbed by the Project. These delineated areas could be monitored over time to track recovery and return to pre-disturbance crop and soil productivity levels.

There are currently no recommendations for additional monitoring activities (e.g., field assessment), mitigation activities or alterations to the monitoring program, except for those items noted above. Additional mitigation and monitoring will be addressed following the completion of the post construction year 2 (2021) monitoring program.

6.0 REFERENCES

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Appendix A TABLES

Appendix A Tables
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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
E-8-1-12-E-A	0.580	0.584	-0.004	0.618	0.638	-0.021		No disturbance in 2020
N-17-5-8-E-A	0.434	0.361	0.073	0.414	0.252	0.162		No disturbance in 2020
NE-10-9-7-E-A	0.384	0.400	-0.016	0.446	0.464	-0.018		No disturbance in 2020
NE-13-9-1-E-A	0.548	0.515	0.033	0.579	0.583	-0.003		No disturbance in 2020
NE-13-9-1-E-B	0.360	0.344	0.016	0.556	0.595	-0.040		No disturbance in 2020
NE-14-9-1-E-A	0.497	0.496	0.001	0.550	0.579	-0.029		No disturbance in 2020
NE-14-9-1-E-B	0.555	0.559	-0.004	0.530	0.589	-0.058	twa and corridor dist	Project related disturbance persists
NE-14-9-1-E-C	0.321	0.328	-0.007	0.566	0.619	-0.053	twa and access dist	Project related disturbance persists
NE-15-9-2-E-A	0.332	0.329	0.004	0.606	0.634	-0.028		No disturbance in 2020
NE-15-9-7-E-A	0.420	0.395	0.025	0.344	0.388	-0.044		No disturbance in 2020
NE-16-9-2-E-A	0.556	0.557	-0.001	0.500	0.533	-0.033		No disturbance in 2020
NE-17-9-2-E-A	0.328	0.327	0.001	0.543	0.566	-0.023		No disturbance in 2020
NE-17-9-2-E-B	0.331	0.331	0.000	0.536	0.566	-0.029		No disturbance in 2020
NE-18-1-12-E-A	0.535	0.548	-0.013	0.286	0.298	-0.011		No disturbance in 2020
NE-18-1-12-E-B	0.494	0.490	0.004	0.360	0.421	-0.061	corridor and twa disturbance	Project related disturbance persists
NE-18-7-8-E-A	0.361	0.478	-0.117	0.581	0.603	-0.022		No disturbance in 2020
NE-18-7-8-E-B	0.488	0.508	-0.020	0.643	0.679	-0.036		No disturbance in 2020
NE-18-9-2-E-A	0.321	0.321	-0.001	0.552	0.596	-0.043		No disturbance in 2020
NE-18-9-2-E-B	0.346	0.345	0.002	0.567	0.613	-0.046		No disturbance in 2020
NE-20-5-8-E-A	0.523	0.481	0.042	0.443	0.318	0.125		No disturbance in 2020
NE-23-9-1-E-A	0.506	0.506	0.001	0.351	0.362	-0.010		No disturbance in 2020
NE-24-1-11-E-A	0.564	0.538	0.026	0.456	0.492	-0.036		No disturbance in 2020
NE-24-8-7-E-A	0.444	0.446	-0.001	0.450	0.481	-0.031		No disturbance in 2020
NE-26-9-1-E-A	0.506	0.505	0.002	0.349	0.380	-0.032		No disturbance in 2020

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
NE-3-10-1-E-A	0.392	0.397	-0.006	0.537	0.557	-0.020		No disturbance in 2020
NE-31-9-4-E-A	0.090	0.135	-0.045	0.308	0.414	**-0.106**	marshalling yard (?) and twa	Project related disturbance persists
NE-31-9-4-E-B	0.286	0.236	0.049	0.426	0.396	0.030		No disturbance in 2020
NE-32-4-8-E-A	0.539	0.570	-0.031	0.409	0.558	**-0.149**	corridor dist	Project related disturbance persists
NE-32-5-8-E-A	0.481	0.503	-0.022	0.386	0.226	**0.160**		No disturbance in 2020
NE-32-5-8-E-B	0.366	0.371	-0.006	0.169	0.284	**-0.115**	corridor and twa dist	Project related disturbance persists
NE-32-5-8-E-C	0.544	0.517	0.028	0.483	0.512	-0.028		No disturbance in 2020
NE-32-9-7-E-A	0.529	0.515	0.014	0.479	0.519	-0.040		No disturbance in 2020
NE-34-3-8-E-A	0.466	0.421	0.045	0.249	0.333	-0.084	small fmu corner of field; corridor dist	Project related disturbance persists
NE-35-9-1-E-A	0.488	0.496	-0.008	0.514	0.538	-0.025		No disturbance in 2020
NE-4-3-9-E-A	0.525	0.535	-0.010	0.373	0.444	-0.071	doesn't appear project related	Negative outlier, nature unknown
NE-4-3-9-E-B	0.667	0.658	0.008	0.483	0.515	-0.033		No disturbance in 2020
NE-5-1-12-E-A	0.605	0.647	-0.042	0.537	0.576	-0.039		No disturbance in 2020
NE-5-6-8-E-A	0.549	0.625	-0.076	0.421	0.309	**0.113**		No disturbance in 2020
NE-5-6-8-E-B	0.474	0.358	**0.116**	0.438	0.539	**-0.102**	sliver fmu adjacent to bush clearing	Project related disturbance persists
NE-6-7-8-E-B	0.512	0.550	-0.038	0.592	0.660	-0.068	some corridor and twa dist	Project related disturbance persists
NE-7-7-8-E-A	0.507	0.495	0.012	0.578	0.610	-0.032		No disturbance in 2020
NE-7-7-8-E-B	0.614	0.619	-0.005	0.322	0.368	-0.046		No disturbance in 2020
NE-7-8-8-E-A	0.464	0.472	-0.008	0.313	0.308	0.005		No disturbance in 2020
NE-8-5-8-E-A	0.549	0.367	**0.181**	0.446	0.426	0.020		No disturbance in 2020
NE-8-5-8-E-B	0.380	0.384	-0.004	0.473	0.461	0.012		No disturbance in 2020
NE-8-6-8-E-A	0.418	0.324	**0.093**	0.390	0.511	**-0.121**	twa and corridor dist adjacent to bush clearing	Project related disturbance persists

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
NE-9-4-8-E-A	0.555	0.554	0.001	0.247	0.253	-0.006		No disturbance in 2020
NW-13-9-1-E-A	0.581	0.586	-0.004	0.561	0.574	-0.012		No disturbance in 2020
NW-13-9-1-E-B	0.572	0.573	-0.001	0.522	0.571	-0.049		No disturbance in 2020
NW-14-10-4-E-A	0.275	0.266	0.009	0.284	0.264	0.020		No disturbance in 2020
NW-14-9-2-E-A	0.555	0.549	0.005	0.617	0.643	-0.026		No disturbance in 2020
NW-15-9-2-E-A	0.555	0.554	0.001	0.531	0.558	-0.028		No disturbance in 2020
NW-15-9-2-E-B	0.446	0.447	-0.001	0.341	0.344	-0.003		No disturbance in 2020
NW-16-9-2-E-A	0.435	0.432	0.004	0.506	0.535	-0.029		No disturbance in 2020
NW-17-10-7-E-A	0.439	0.465	-0.026	0.344	0.488	-0.144	corridor dist and twa dist	Project related disturbance persists
NW-17-11-1-E-A	0.544	0.399	0.144	0.558	0.555	0.003		No disturbance in 2020
NW-17-11-1-E-B	0.512	0.478	0.033	0.503	0.521	-0.017		No disturbance in 2020
NW-17-11-1-E-C	0.361	0.333	0.028	0.399	0.516	-0.117	small FMU centered on TWA	Project related disturbance persists
NW-17-6-8-E-A	0.443	0.443	0.000	0.587	0.632	-0.046		No disturbance in 2020
NW-17-9-2-E-A	0.334	0.348	-0.013	0.526	0.440	0.086		No disturbance in 2020
NW-18-9-2-E-A	0.541	0.539	0.002	0.367	0.407	-0.039		No disturbance in 2020
NW-20-10-7-E-A	0.333	0.324	0.009	0.202	0.352	-0.150	large TWA and wide ROW dist	Project related disturbance persists
NW-20-10-7-E-B	0.402	0.408	-0.006	0.308	0.395	-0.087	corridor dist	Project related disturbance persists
NW-20-11-1-E-A	0.490	0.477	0.013	0.512	0.608	-0.096	dist along FMU	Project related disturbance persists
NW-20-6-8-E-A	0.483	0.441	0.042	0.692	0.631	0.060		No disturbance in 2020
NW-20-6-8-E-B	0.345	0.335	0.011	0.572	0.615	-0.043		No disturbance in 2020
NW-23-10-4-E-A	0.170	0.121	0.049	0.272	0.285	-0.013		No disturbance in 2020
NW-23-9-1-E-A	0.510	0.520	-0.010	0.411	0.366	0.045		No disturbance in 2020
NW-24-1-11-E-A	0.513	0.499	0.013	0.268	0.510	-0.242	corridor dist and TWA; bush clearing in pasture	Project related disturbance persists

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
NW-26-9-1-E-A	0.443	0.491	-0.048	0.412	0.394	0.018		No disturbance in 2020
NW-29-11-1-E-A	0.561	0.562	-0.001	0.539	0.578	-0.038		No disturbance in 2020
NW-29-6-8-E-A	0.334	0.221	0.113	0.337	0.316	0.021		No disturbance in 2020
NW-3-10-1-E-A	0.374	0.374	0.000	0.531	0.562	-0.031		No disturbance in 2020
NW-3-10-1-E-B	0.362	0.377	-0.014	0.534	0.555	-0.022		No disturbance in 2020
NW-31-9-4-E-A	0.296	0.256	0.041	0.357	0.397	-0.040		No disturbance in 2020
NW-32-11-1-E-B	0.536	0.537	-0.001	0.649	0.661	-0.012		No disturbance in 2020
NW-32-11-1-E-C	0.545	0.542	0.004	0.641	0.657	-0.016		No disturbance in 2020
NW-32-11-1-E-D	0.540	0.543	-0.004	0.659	0.669	-0.010		No disturbance in 2020
NW-32-5-8-E-A	0.383	0.370	0.013	0.203	0.309	-0.106	corridor and twa dist	Project related disturbance persists
NW-32-6-8-E-A	0.329	0.346	-0.017	0.422	0.478	-0.056	doesn't appear project related	Negative outlier, nature unknown
NW-3-3-9-E-A	0.585	0.591	-0.006	0.384	0.374	0.010		No disturbance in 2020
NW-35-3-8-E-A	0.525	0.528	-0.003	0.397	0.442	-0.045		No disturbance in 2020
NW-4-1-12-E-A	0.559	0.554	0.005	0.606	0.643	-0.037		No disturbance in 2020
NW-4-2-10-E-A	0.531	0.568	-0.037	0.371	0.505	-0.134	twa dist in small FMU	Project related disturbance persists
NW-5-10-7-E-A	0.479	0.424	0.054	0.309	0.257	0.052		No disturbance in 2020
NW-5-12-1-E-A	0.234	0.241	-0.007	0.333	0.451	-0.118	dist adjacent to dorsey incl tower	Project related disturbance persists
NW-5-12-1-E-B	0.575	0.572	0.003	0.506	0.607	-0.102	dist along entire corridor	Project related disturbance persists
NW-5-12-1-E-C	0.448	0.398	0.050	0.235	0.220	0.016		No disturbance in 2020
NW-5-6-8-E-A	0.573	0.594	-0.021	0.531	0.570	-0.039		No disturbance in 2020
NW-8-10-7-E-A	0.605	0.530	0.075	0.411	0.482	-0.072	small fmu; corridor dist	Project related disturbance persists
NW-8-10-7-E-B	0.558	0.553	0.005	0.438	0.483	-0.046		No disturbance in 2020
NW-8-1-12-E-A	0.688	0.681	0.007	0.539	0.521	0.018		No disturbance in 2020

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
NW-8-1-12-E-B	0.619	0.643	-0.024	0.416	0.526	-0.110	small FMU, shallow angle TWA dist	Project related disturbance persists
NW-8-6-8-E-A	0.477	0.373	0.104	0.417	0.618	-0.201	corrid dist adjacent to bush clearing	Project related disturbance persists
NW-9-4-8-E-A	0.569	0.607	-0.038	0.440	0.390	0.050		No disturbance in 2020
OT-172-NO A	0.234	0.319	-0.085	0.321	0.478	-0.157	twa and constr trail (not all captured in corr)	Project related disturbance persists
OT-174-NO-A	0.293	0.230	0.063	0.297	0.376	-0.080	construction trail	Project related disturbance persists
OT-26-HE-A	0.524	0.521	0.003	0.561	0.584	-0.023		No disturbance in 2020
OT-27-HE-A	0.427	0.432	-0.005	0.563	0.587	-0.025		No disturbance in 2020
OT-80-NO-A	0.162	0.148	0.015	0.581	0.585	-0.004		No disturbance in 2020
OT-81-NO-A	0.389	0.367	0.022	0.616	0.637	-0.021		No disturbance in 2020
OT-83-NO-A	0.334	0.361	-0.027	0.594	0.555	0.039		No disturbance in 2020
OT-85-NO-A	0.427	0.408	0.019	0.615	0.617	-0.002		No disturbance in 2020
OT-86-NO-A	0.231	0.254	-0.023	0.342	0.430	-0.088	access and twa dist	Project related disturbance persists
RL-174-NO A	0.264	0.255	0.008	0.376	0.415	-0.039		No disturbance in 2020
RL-174-NO B	0.234	0.264	-0.030	0.298	0.415	-0.117	twa and uncertain corridor dist	Project related disturbance persists
RL-177-NO-A	0.300	0.285	0.015	0.453	0.460	-0.007		No disturbance in 2020
RL-178-NO-B	0.304	0.308	-0.004	0.356	0.370	-0.014		No disturbance in 2020
RL-179-NO-A	0.167	0.174	-0.007	0.413	0.427	-0.014		No disturbance in 2020
RL-179-NO-B	0.220	0.221	-0.001	0.478	0.427	0.051		No disturbance in 2020
RL-179-NO-C	0.387	0.379	0.008	0.575	0.577	-0.002		No disturbance in 2020
RL-27-HE-A	0.485	0.478	0.007	0.538	0.553	-0.015		No disturbance in 2020
RL-27-HE-B	0.543	0.544	-0.001	0.577	0.612	-0.035		No disturbance in 2020
RL-38-HE-A	0.533	0.536	-0.003	0.443	0.538	-0.096	tower and corridor dist	Project related disturbance persists

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
RL-39-HE-A	0.506	0.481	0.025	0.518	0.532	-0.014		No disturbance in 2020
RL-39-HE-B	0.461	0.447	0.015	0.618	0.666	-0.048		No disturbance in 2020
RL-39-HE-C	0.471	0.462	0.009	0.610	0.654	-0.043		No disturbance in 2020
RL-73-NO-A	0.214	0.215	-0.002	0.302	0.328	-0.026		No disturbance in 2020
RL-74-NO-A	0.401	0.488	-0.087	0.465	0.602	**-0.137**	twa and otther irregular dist patters	Project related disturbance persists
RL-80-NO-A	0.435	0.448	-0.013	0.473	0.463	0.010		No disturbance in 2020
S-17-5-8-E-A	0.451	0.451	0.000	0.404	0.484	-0.080	corridor and twa dist	Project related disturbance persists
SE-15-9-7-E-A	0.354	0.386	-0.033	0.342	0.447	**-0.104**	TWA and some corridor dist	Project related disturbance persists
SE-17-6-8-E-A	0.438	0.450	-0.011	0.501	0.668	**-0.167**	long sliver fmu; twa and corridor dist	Project related disturbance persists
SE-18-7-8-E-A	0.426	0.416	0.010	0.608	0.597	0.011		No disturbance in 2020
SE-19-1-12-E-A	0.629	0.628	0.001	0.466	0.481	-0.015		No disturbance in 2020
SE-19-7-8-E-A	0.556	0.568	-0.013	0.664	0.718	-0.054	ltd twa and corridor dist adj to bush clearing	Project related disturbance persists
SE-20-5-8-E-A	0.488	0.376	**0.112**	0.391	0.238	**0.153**		No disturbance in 2020
SE-20-5-8-E-B	0.472	0.375	**0.097**	0.304	0.291	0.013		No disturbance in 2020
SE-23-9-1-E-A	0.477	0.474	0.003	0.497	0.528	-0.031		No disturbance in 2020
SE-24-8-7-E-A	0.313	0.316	-0.003	0.451	0.477	-0.026		No disturbance in 2020
SE-24-8-7-E-B	0.361	0.347	0.014	0.502	0.514	-0.013		No disturbance in 2020
SE-24-8-7-E-C	0.392	0.362	0.030	0.501	0.549	-0.048		No disturbance in 2020
SE-25-10-6-E-A	0.376	0.349	0.028	0.347	0.304	0.043		No disturbance in 2020
SE-25-2-9-E-A	0.535	0.518	0.017	0.293	0.400	**-0.107**	corridor and twa dist	Project related disturbance persists
SE-26-10-4-E-A	0.214	0.153	0.062	0.316	0.266	0.050		No disturbance in 2020
SE-26-10-6-E-A	0.586	0.581	0.005	0.496	0.532	-0.036		No disturbance in 2020
SE-26-9-1-E-A	0.385	0.396	-0.011	0.499	0.516	-0.017		No disturbance in 2020

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
SE-26-9-1-E-B	0.340	0.368	-0.028	0.420	0.437	-0.018		No disturbance in 2020
SE-27-10-5-E-A	0.449	0.452	-0.003	0.527	0.551	-0.023		No disturbance in 2020
SE-27-10-6-E-A	0.420	0.454	-0.033	0.255	0.293	-0.037		No disturbance in 2020
SE-28-10-5-E-A	0.179	0.196	-0.017	0.387	0.305	0.082		No disturbance in 2020
SE-28-10-6-E-A	0.447	0.459	-0.011	0.526	0.519	0.007		No disturbance in 2020
SE-29-10-6-E-A	0.235	0.260	-0.025	0.518	0.548	-0.031		No disturbance in 2020
SE-30-10-5-E-B	0.353	0.381	-0.028	0.569	0.605	-0.037		No disturbance in 2020
SE-30-10-6-E-A	0.408	0.515	**-0.107**	0.167	0.188	-0.021		No disturbance in 2020
SE-30-10-7-E-A	0.444	0.432	0.012	0.396	0.384	0.011		No disturbance in 2020
SE-30-10-7-E-B	0.369	0.371	-0.001	0.300	0.264	0.036		No disturbance in 2020
SE-3-4-8-E-A	0.359	0.360	-0.001	0.310	0.335	-0.025		No disturbance in 2020
SE-35-3-8-E-A	0.444	0.432	0.012	0.305	0.362	-0.058	corridor const trail dist	Project related disturbance persists
SE-35-3-8-E-B	0.428	0.517	-0.089	0.294	0.388	**-0.095**	access, twa and corridor dist	Project related disturbance persists
SE-35-9-1-E-B	0.547	0.559	-0.012	0.612	0.638	-0.026		No disturbance in 2020
SE-4-10-1-E-A	0.424	0.430	-0.006	0.542	0.560	-0.018		No disturbance in 2020
SE-4-10-1-E-B	0.536	0.524	0.012	0.552	0.571	-0.019		No disturbance in 2020
SE-5-10-1-E-A	0.506	0.510	-0.004	0.524	0.563	-0.038		No disturbance in 2020
SE-5-10-7-E-A	0.382	0.396	-0.014	0.263	0.384	**-0.122**	major corridor dist	Project related disturbance persists
SE-5-5-8-E-A	0.621	0.621	0.000	0.395	0.554	**-0.159**	access and twa dist	Project related disturbance persists
SE-5-6-8-E-A	0.586	0.430	**0.156**	0.360	0.276	0.085		No disturbance in 2020
SE-5-6-8-E-B	0.508	0.485	0.024	0.356	0.511	**-0.156**	sliver fmu; may be pr adjacent to clearing	Project related disturbance persists
SE-6-7-8-E-A	0.454	0.464	-0.011	0.524	0.605	-0.081	TWA and corridor dist	Project related disturbance persists

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
SE-6-7-8-E-B	0.504	0.493	0.011	0.566	0.624	-0.058	shelterbelt removal; other corridor and TWA dist	Project related disturbance persists
SE-7-7-8-E-A	0.624	0.634	-0.010	0.141	0.138	0.003		No disturbance in 2020
SE-7-7-8-E-B	0.502	0.410	0.092	0.429	0.409	0.019		No disturbance in 2020
SE-7-7-8-E-D	0.506	0.445	0.062	0.459	0.519	-0.060	doesn't appear project related	Negative outlier, nature unknown
SE-8-1-12-E-A	0.524	0.520	0.004	0.360	0.406	-0.046		No disturbance in 2020
SE-8-6-8-E-A	0.507	0.529	-0.022	0.447	0.510	-0.064	twa and corridor dist	Project related disturbance persists
SE-8-6-8-E-B	0.532	0.507	0.025	0.424	0.507	-0.082	corrid dist	Project related disturbance persists
SE-8-6-8-E-D	0.572	0.453	0.118	0.677	0.746	-0.068	sliver fmu no obvious dist	Project related disturbance persists
SE-8-6-8-E-E	0.522	0.545	-0.023	0.599	0.721	-0.122	twa dist primarily	Project related disturbance persists
SE-8-6-8-E-F	0.525	0.509	0.016	0.601	0.688	-0.086	twa dist	Project related disturbance persists
SE-9-10-4-E-A	0.224	0.238	-0.013	0.294	0.462	-0.168	TWAs and centreline trail	Project related disturbance persists
SE-9-4-8-E-A	0.511	0.429	0.082	0.150	0.308	-0.158	small fmu, corr dist adjacent to bush clearing	Project related disturbance persists
SE-9-4-8-E-B	0.557	0.601	-0.044	0.372	0.500	-0.128	small fmu, corr dist adjacent bush clearing	Project related disturbance persists
SW-10-10-4-E-A	0.276	0.255	0.021	0.352	0.429	-0.077	TWAs; MISSED CONSTRUCTION TRAIL	Project related disturbance persists
SW-10-10-4-E-B	0.314	0.312	0.002	0.326	0.389	-0.062	MISSED CONST TRAIL; some TWA; some not PR	Project related disturbance persists
SW-10-4-8-E-A	0.557	0.566	-0.009	0.426	0.498	-0.072	dist bush clearing in portion of corridor	Project related disturbance persists
SW-11-9-7-E-B	0.412	0.402	0.011	0.433	0.458	-0.025		No disturbance in 2020
SW-11-9-7-E-C	0.378	0.392	-0.014	0.507	0.492	0.016		No disturbance in 2020
SW-14-10-4-E-A	0.285	0.281	0.003	0.319	0.431	-0.112	small FMU with TWA dist	Project related disturbance persists

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
SW-17-1-12-E-A	0.553	0.548	0.005	0.298	0.323	-0.025		No disturbance in 2020
SW-17-1-12-E-B	0.573	0.574	-0.001	0.323	0.384	-0.061	twa and some corridor dist	Project related disturbance persists
SW-17-6-8-E-A	0.506	0.526	-0.019	0.551	0.627	-0.077	limited corridor dist related to bush clearing	Negative outlier, nature unknown
SW-17-6-8-E-B	0.479	0.443	0.036	0.529	0.545	-0.016		No disturbance in 2020
SW-18-8-8-E-A	0.346	0.348	-0.002	0.275	0.305	-0.031		No disturbance in 2020
SW-20-10-7-E-A	0.495	0.486	0.008	0.409	0.486	-0.077	small FMU corridor dist	Project related disturbance persists
SW-20-11-1-E-A	0.470	0.476	-0.006	0.598	0.635	-0.037		No disturbance in 2020
SW-20-6-8-E-A	0.523	0.593	-0.069	0.485	0.543	-0.058	not project related dist	Negative outlier, nature unknown
SW-20-6-8-E-B	0.587	0.561	0.026	0.510	0.535	-0.024		No disturbance in 2020
SW-2-10-1-E-A	0.404	0.403	0.000	0.512	0.612	**-0.099**	twa and corridor dist	Project related disturbance persists
SW-23-10-4-E-A	0.277	0.319	-0.042	0.358	0.165	**0.193**		No disturbance in 2020
SW-25-10-4-E-A	0.281	0.289	-0.008	0.565	0.681	**-0.116**	TWAs and corridor dist	Project related disturbance persists
SW-25-10-5-E-A	0.369	0.401	-0.032	0.489	0.503	-0.015		No disturbance in 2020
SW-25-10-6-E-A	0.380	0.471	**-0.091**	0.396	0.485	-0.090	neg outlier in 2019; no obvious dist beyond tower	Negative outlier, nature unknown
SW-26-10-5-E-A	0.476	0.488	-0.013	0.369	0.409	-0.041		No disturbance in 2020
SW-26-10-6-E-A	0.354	0.370	-0.015	0.332	0.349	-0.017		No disturbance in 2020
SW-27-10-5-E-A	0.236	0.276	-0.040	0.551	0.568	-0.017		No disturbance in 2020
SW-27-10-5-E-B	0.237	0.259	-0.022	0.327	0.343	-0.017		No disturbance in 2020
SW-27-10-6-E-A	0.230	0.269	-0.039	0.431	0.445	-0.014		No disturbance in 2020
SW-28-10-5-E-A	0.366	0.348	0.018	0.532	0.519	0.013		No disturbance in 2020
SW-28-10-6-E-A	0.470	0.495	-0.024	0.508	0.519	-0.011		No disturbance in 2020
SW-29-10-5-E-A	0.487	0.491	-0.005	0.621	0.640	-0.019		No disturbance in 2020

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
SW-29-10-6-E-A	0.170	0.187	-0.017	0.512	0.525	-0.013		No disturbance in 2020
SW-29-10-7-E-A	0.378	0.398	-0.020	0.207	0.296	-0.089	small fmu; unknown dist	Project related disturbance persists
SW-29-10-7-E-B	0.393	0.392	0.001	0.267	0.409	**-0.142**	large TWA dist and large access (laydown?) area	Project related disturbance persists
SW-29-6-8-E-A	0.394	0.390	0.003	0.445	0.428	0.017		No disturbance in 2020
SW-29-6-8-E-B	0.325	0.316	0.009	0.395	0.388	0.008		No disturbance in 2020
SW-29-6-8-E-C	0.458	0.463	-0.005	0.420	0.287	**0.132**		No disturbance in 2020
SW-30-10-5-E-A	0.398	0.433	-0.035	0.517	0.535	-0.019		No disturbance in 2020
SW-30-10-6-E-A	0.560	0.551	0.008	0.149	0.158	-0.009		No disturbance in 2020
SW-30-10-7-E-A	0.618	0.615	0.003	0.248	0.231	0.016		No disturbance in 2020
SW-31-9-4-E A	0.255	0.222	0.033	0.308	0.361	-0.053	twa and corridor dist	Project related disturbance persists
SW-31-9-4-E B	0.329	0.344	-0.015	0.456	0.465	-0.009		No disturbance in 2020
SW-31-9-4-E C	0.273	0.229	0.044	0.417	0.405	0.011		No disturbance in 2020
SW-32-11-1-E-A	0.538	0.534	0.004	0.551	0.580	-0.028		No disturbance in 2020
SW-32-6-8-E-A	0.515	0.528	-0.013	0.601	0.620	-0.019		No disturbance in 2020
SW-32-6-8-E-B	0.362	0.397	-0.035	0.446	0.590	**-0.144**	TWA and corridor dist	Project related disturbance persists
SW-32-6-8-E-C	0.412	0.424	-0.012	0.442	0.499	-0.057	not obvious project-related dist	Negative outlier, nature unknown
SW-32-6-8-E-D	0.457	0.397	0.060	0.412	0.418	-0.006		No disturbance in 2020
SW-4-10-1-E-A	0.542	0.545	-0.004	0.508	0.521	-0.014		No disturbance in 2020
SW-4-10-1-E-B	0.522	0.521	0.001	0.502	0.565	-0.063	appears mainly twa dist	Project related disturbance persists
SW-4-1-12-E-A	0.586	0.578	0.009	0.621	0.663	-0.041		No disturbance in 2020
SW-4-1-12-E-B	0.553	0.551	0.001	0.558	0.624	-0.065	small fmu, corridor dist adjacent to bush removal?	Project related disturbance persists
SW-5-10-1-E-A	0.515	0.509	0.006	0.523	0.568	-0.045		No disturbance in 2020

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Table A.1 On RoW FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

On ROW FMU Label	2019 ON NDVI MEAN	2019 OFF NDVI MEAN	2019 Diff OnROW - OffROW	2020 ON NDVI MEAN	2020 OFF NDVI MEAN	2020 Diff OnROW-OffROW	2020 Difference Evaluation Comment	2020 Disturbance Category
SW-5-10-4-E-A	0.115	0.181	-0.065	0.455	0.410	0.045		No disturbance in 2020
SW-5-10-4-E-B	0.136	0.184	-0.048	0.346	0.421	-0.075	TWAs, access and some centreline	Project related disturbance persists
SW-5-12-1-E-A	0.331	0.310	0.021	0.561	0.604	-0.043		No disturbance in 2020
SW-5-12-1-E-B	0.482	0.520	-0.038	0.504	0.572	-0.069	small sliver FMU; dist assoc with TWAs	Project related disturbance persists
SW-8-6-8-E-B	0.550	0.546	0.004	0.596	0.487	0.109		No disturbance in 2020
SW-8-6-8-E-C	0.382	0.364	0.018	0.636	0.632	0.004		No disturbance in 2020
W-19-1-12-E-A	0.639	0.617	0.023	0.420	0.396	0.024		No disturbance in 2020

Notes:
NDVI difference outliers are indicated as follows:

Major negative outlier	Minor negative outlier	Minor positive outlier	Major positive outlier

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 001--NW-5-12-1-E On-A	0.236	0.241	-0.005	0.281	0.451	-0.170	twa disturbance	Project-related disturbance persists
D604I 002--NW-5-12-1-E On-B	0.570	0.572	-0.002	0.498	0.607	-0.109	twa disturbance	Project-related disturbance persists
D604I 003--SW-5-12-1-E On-A	0.514	0.520	-0.007	0.496	0.604	-0.108	twa disturbance	Project-related disturbance persists
D604I 003--SW-5-12-1-E On-B	0.348	0.310	0.038	0.496	0.572	-0.076		No disturbance in 2020
D604I 004--SW-5-12-1-E On-A	0.523	0.520	0.002	0.545	0.604	-0.059		No disturbance in 2020
D604I 004--SW-5-12-1-E On-B	0.339	0.310	0.028	0.560	0.572	-0.013		No disturbance in 2020
D604I 005--SW-5-12-1-E On-A	0.319	0.310	0.009	0.565	0.604	-0.039		No disturbance in 2020
D604I 006--NW-32-11-1-E On-B	0.528	0.537	-0.009	0.647	0.661	-0.014		No disturbance in 2020
D604I 007--NW-32-11-1-E On-C	0.544	0.542	0.002	0.634	0.657	-0.023		No disturbance in 2020
D604I 008--NW-32-11-1-E On-D	0.522	0.534	-0.012	0.641	0.669	-0.028		No disturbance in 2020
D604I 008--SW-32-11-1-E On-A	0.500	0.543	-0.043	0.530	0.580	-0.049		No disturbance in 2020
D604I 009--SW-32-11-1-E On-A	0.556	0.534	0.022	0.532	0.580	-0.048		No disturbance in 2020
D604I 010--NW-29-11-1-E On-A	0.489	0.562	-0.073	0.495	0.578	-0.083		No disturbance in 2020
D604I 011--NW-29-11-1-E On-A	0.569	0.562	0.007	0.531	0.578	-0.047		No disturbance in 2020
D604I 012--NW-29-11-1-E On-A	0.562	0.562	0.000	0.541	0.578	-0.037		No disturbance in 2020
D604I 013--NW-29-11-1-E On-A	0.564	0.562	0.002	0.524	0.578	-0.054		No disturbance in 2020
D604I 014--NW-20-11-1-E On-A	0.397	0.477	-0.080	0.383	0.608	-0.225	twa disturbance	Project-related disturbance persists
D604I 015--NW-20-11-1-E On-A	0.493	0.477	0.017	0.364	0.608	-0.243	twa disturbance	Project-related disturbance persists
D604I 015--SW-20-11-1-E On-A	0.501	0.476	0.026	0.446	0.635	-0.189	twa disturbance	Project-related disturbance persists
D604I 016--NW-20-11-1-E On-A	0.483	0.477	0.006	0.567	0.608	-0.041		No disturbance in 2020
D604I 016--SW-20-11-1-E On-A	0.475	0.476	-0.001	0.590	0.635	-0.045		No disturbance in 2020
D604I 017--NW-20-11-1-E On-A	0.474	0.477	-0.003	0.553	0.608	-0.054		No disturbance in 2020
D604I 017--SW-20-11-1-E On-A	0.467	0.476	-0.009	0.564	0.635	-0.071		No disturbance in 2020
D604I 018--NW-17-11-1-E On-A	0.577	0.465	0.112	0.572	0.555	0.017		No disturbance in 2020
D604I 019--NW-17-11-1-E On-A	0.498	0.465	0.033	0.559	0.555	0.005		No disturbance in 2020
D604I 020--NW-17-11-1-E On-C	0.360	0.333	0.027	0.435	0.516	-0.081		No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 021--NW-17-11-1-E On-B	0.490	0.478	0.011	0.513	0.521	-0.008		No disturbance in 2020
D604I 021--RL-39-HE On-A	0.490	0.481	0.010	0.519	0.532	-0.013		No disturbance in 2020
D604I 022--RL-39-HE On-A	0.508	0.481	0.027	0.511	0.532	-0.021		No disturbance in 2020
D604I 023--RL-39-HE On-A	0.563	0.481	0.082	0.490	0.532	-0.042		No disturbance in 2020
D604I 024--RL-39-HE On-A	0.524	0.481	0.043	0.529	0.532	-0.004		No disturbance in 2020
D604I 025--RL-39-HE On-A	0.515	0.481	0.034	0.509	0.532	-0.023		No disturbance in 2020
D604I 026--RL-39-HE On-A	0.502	0.481	0.021	0.528	0.532	-0.005		No disturbance in 2020
D604I 027--RL-39-HE On-A	0.484	0.481	0.004	0.537	0.532	0.005		No disturbance in 2020
D604I 028--RL-39-HE On-A	0.522	0.481	0.041	0.505	0.532	-0.027		No disturbance in 2020
D604I 029--RL-39-HE On-B	0.463	0.447	0.016	0.610	0.666	-0.057		No disturbance in 2020
D604I 030--RL-39-HE On-B	0.477	0.447	0.031	0.607	0.666	-0.059		No disturbance in 2020
D604I 031--RL-39-HE On-C	0.479	0.462	0.017	0.587	0.654	-0.067		No disturbance in 2020
D604I 032--RL-39-HE On-C	0.477	0.462	0.015	0.607	0.654	-0.047		No disturbance in 2020
D604I 033--RL-39-HE On-C	0.489	0.462	0.027	0.611	0.654	-0.042		No disturbance in 2020
D604I 034--RL-39-HE On-C	0.452	0.462	-0.010	0.600	0.654	-0.054		No disturbance in 2020
D604I 035--RL-38-HE On-A	0.537	0.536	0.001	0.391	0.538	**-0.147**	twa disturbance	Project-related disturbance persists
D604I 036--RL-38-HE On-A	0.542	0.536	0.006	0.455	0.538	-0.084		No disturbance in 2020
D604I 037--RL-38-HE On-A	0.527	0.536	-0.009	0.451	0.538	-0.087	twa disturbance	Project-related disturbance persists
D604I 040--RL-27-HE On-A	0.493	0.478	0.015	0.537	0.553	-0.015		No disturbance in 2020
D604I 041--RL-27-HE On-A	0.492	0.478	0.014	0.535	0.553	-0.018		No disturbance in 2020
D604I 042--RL-27-HE On-A	0.476	0.478	-0.002	0.518	0.553	-0.035		No disturbance in 2020
D604I 043--RL-27-HE On-B	0.544	0.544	0.000	0.561	0.612	-0.050		No disturbance in 2020
D604I 044--RL-27-HE On-B	0.540	0.544	-0.004	0.585	0.612	-0.027		No disturbance in 2020
D604I 045--RL-27-HE On-B	0.536	0.544	-0.008	0.571	0.612	-0.041		No disturbance in 2020
D604I 046--RL-27-HE On-B	0.549	0.544	0.004	0.575	0.612	-0.036		No disturbance in 2020
D604I 047--OT-26-HE On-A	0.490	0.521	-0.031	0.527	0.584	-0.057		No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 048--OT-26-HE On-A	0.529	0.521	0.007	0.566	0.584	-0.018		No disturbance in 2020
D604I 049--OT-26-HE On-A	0.532	0.521	0.010	0.572	0.584	-0.013		No disturbance in 2020
D604I 050--OT-26-HE On-A	0.537	0.521	0.015	0.559	0.584	-0.026		No disturbance in 2020
D604I 051--OT-27-HE On-A	0.430	0.432	-0.002	0.559	0.587	-0.028		No disturbance in 2020
D604I 052--OT-27-HE On-A	0.423	0.432	-0.009	0.567	0.587	-0.021		No disturbance in 2020
D604I 053--OT-27-HE On-A	0.437	0.432	0.005	0.561	0.587	-0.026		No disturbance in 2020
D604I 054--OT-27-HE On-A	0.421	0.432	-0.011	0.535	0.587	-0.052		No disturbance in 2020
D604I 055--SW-5-10-1-E On-A	0.497	0.509	-0.012	0.427	0.568	-0.141	twa disturbance	Project-related disturbance persists
D604I 056--SW-5-10-1-E On-A	0.526	0.509	0.017	0.550	0.568	-0.018		No disturbance in 2020
D604I 058--SE-5-10-1-E On-A	0.449	0.510	-0.061	0.532	0.563	-0.030		No disturbance in 2020
D604I 059--SW-4-10-1-E On-B	0.498	0.521	-0.022	0.475	0.565	-0.090	twa disturbance	Project-related disturbance persists
D604I 060--SW-4-10-1-E On-A	0.544	0.545	-0.001	0.517	0.521	-0.004		No disturbance in 2020
D604I 061--SE-4-10-1-E On-A	0.533	0.430	0.103	0.536	0.560	-0.024		No disturbance in 2020
D604I 062--SE-4-10-1-E On-B	0.531	0.524	0.007	0.534	0.571	-0.036		No disturbance in 2020
D604I 063--NW-3-10-1-E On-A	0.355	0.374	-0.020	0.517	0.562	-0.045		No disturbance in 2020
D604I 064--NW-3-10-1-E On-A	0.408	0.374	0.033	0.541	0.562	-0.021		No disturbance in 2020
D604I 065--NW-3-10-1-E On-B	0.363	0.377	-0.013	0.542	0.555	-0.013		No disturbance in 2020
D604I 066--NE-3-10-1-E On-A	0.364	0.397	-0.033	0.526	0.557	-0.030		No disturbance in 2020
D604I 067--SW-2-10-1-E On-A	0.395	0.403	-0.009	0.530	0.612	-0.082		No disturbance in 2020
D604I 068--SW-2-10-1-E On-A	0.390	0.403	-0.014	0.473	0.612	-0.139	twa disturbance	Project-related disturbance persists
D604I 069--SW-2-10-1-E On-A	0.413	0.403	0.010	0.445	0.612	**-0.166**	twa disturbance	Project-related disturbance persists
D604I 070--SW-2-10-1-E On-A	0.431	0.403	0.028	0.443	0.612	**-0.169**	twa disturbance	Project-related disturbance persists
D604I 071--SW-2-10-1-E On-A	0.394	0.403	-0.009	0.483	0.612	-0.129	twa disturbance	Project-related disturbance persists
D604I 072--NE-35-9-1-E On-A	0.490	0.496	-0.005	0.505	0.538	-0.034		No disturbance in 2020
D604I 073--NE-35-9-1-E On-A	0.486	0.496	-0.009	0.517	0.538	-0.022		No disturbance in 2020
D604I 074--SE-35-9-1-E On-B	0.549	0.559	-0.010	0.615	0.638	-0.022		No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 075--SE-35-9-1-E On-B	0.532	0.559	-0.027	0.600	0.638	-0.038		No disturbance in 2020
D604I 076--NE-26-9-1-E On-A	0.510	0.505	0.006	0.356	0.380	-0.024		No disturbance in 2020
D604I 077--NW-26-9-1-E On-A	0.358	0.396	-0.039	0.392	0.394	-0.001		No disturbance in 2020
D604I 077--SE-26-9-1-E On-A	0.434	0.491	-0.057	0.476	0.516	-0.040		No disturbance in 2020
D604I 078--SE-26-9-1-E On-A	0.392	0.396	-0.004	0.537	0.516	0.021		No disturbance in 2020
D604I 079--NE-23-9-1-E On-A	0.514	0.506	0.009	0.373	0.362	0.012		No disturbance in 2020
D604I 080--NE-23-9-1-E On-A	0.507	0.506	0.002	0.366	0.362	0.004		No disturbance in 2020
D604I 081--SE-23-9-1-E On-A	0.479	0.474	0.005	0.508	0.528	-0.019		No disturbance in 2020
D604I 082--SE-23-9-1-E On-A	0.483	0.474	0.009	0.494	0.528	-0.034		No disturbance in 2020
D604I 083--NE-14-9-1-E On-A	0.492	0.496	-0.003	0.545	0.579	-0.034		No disturbance in 2020
D604I 084--NE-14-9-1-E On-B	0.558	0.559	-0.001	0.502	0.589	-0.087	twa disturbance	Project-related disturbance persists
D604I 085--NE-14-9-1-E On-B	0.554	0.559	-0.004	0.543	0.589	-0.046		No disturbance in 2020
D604I 086--NE-14-9-1-E On-C	0.332	0.328	0.004	0.576	0.619	-0.043		No disturbance in 2020
D604I 087--NW-13-9-1-E On-B	0.573	0.573	0.000	0.551	0.571	-0.020		No disturbance in 2020
D604I 088--NE-13-9-1-E On-A	0.551	0.515	0.035	0.555	0.583	-0.028		No disturbance in 2020
D604I 088--NW-13-9-1-E On-B	0.568	0.573	-0.005	0.533	0.571	-0.038		No disturbance in 2020
D604I 089--NE-13-9-1-E On-A	0.544	0.515	0.029	0.603	0.583	0.020		No disturbance in 2020
D604I 090--NW-18-9-2-E On-A	0.542	0.539	0.003	0.360	0.407	-0.047		No disturbance in 2020
D604I 091--NW-18-9-2-E On-A	0.542	0.539	0.002	0.363	0.407	-0.043		No disturbance in 2020
D604I 092--NE-18-9-2-E On-A	0.323	0.321	0.002	0.544	0.596	-0.052		No disturbance in 2020
D604I 093--NE-18-9-2-E On-B	0.362	0.345	0.017	0.581	0.613	-0.032		No disturbance in 2020
D604I 094--NW-17-9-2-E On-A	0.331	0.348	-0.017	0.535	0.440	0.095		No disturbance in 2020
D604I 095--NE-17-9-2-E On-A	0.361	0.348	0.013	0.548	0.566	-0.017		No disturbance in 2020
D604I 095--NW-17-9-2-E On-A	0.358	0.327	0.030	0.531	0.440	0.091		No disturbance in 2020
D604I 096--NE-17-9-2-E On-B	0.310	0.331	-0.021	0.550	0.566	-0.015		No disturbance in 2020
D604I 097--NW-16-9-2-E On-A	0.495	0.432	0.064	0.495	0.535	-0.040		No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 098--NW-16-9-2-E On-A	0.425	0.432	-0.007	0.476	0.535	-0.059		No disturbance in 2020
D604I 099--NE-16-9-2-E On-A	0.556	0.557	-0.001	0.505	0.533	-0.028		No disturbance in 2020
D604I 100--NE-16-9-2-E On-A	0.550	0.557	-0.007	0.507	0.533	-0.026		No disturbance in 2020
D604I 101--NW-15-9-2-E On-A	0.559	0.554	0.004	0.538	0.558	-0.020		No disturbance in 2020
D604I 102--NW-15-9-2-E On-B	0.449	0.447	0.002	0.316	0.344	-0.028		No disturbance in 2020
D604I 103--NE-15-9-2-E On-A	0.329	0.329	0.000	0.619	0.634	-0.015		No disturbance in 2020
D604I 104--NW-14-9-2-E On-A	0.555	0.549	0.006	0.629	0.643	-0.014		No disturbance in 2020
D604I 105--NW-14-9-2-E On-A	0.556	0.549	0.006	0.610	0.643	-0.033		No disturbance in 2020
D604I 106--OT-86-NO On-A	0.267	0.254	0.013	0.329	0.430	-0.101	twa disturbance	Project-related disturbance persists
D604I 107--OT-86-NO On-A	0.263	0.254	0.009	0.362	0.430	-0.068		No disturbance in 2020
D604I 108--OT-85-NO On-A	0.411	0.408	0.003	0.631	0.617	0.014		No disturbance in 2020
D604I 109--OT-83-NO On-A	0.315	0.361	-0.046	0.622	0.555	0.066		No disturbance in 2020
D604I 110--OT-80-NO On-A	0.149	0.148	0.001	0.544	0.585	-0.041		No disturbance in 2020
D604I 111--OT-80-NO On-A	0.132	0.148	-0.016	0.611	0.585	0.026		No disturbance in 2020
D604I 112--OT-81-NO On-A	0.394	0.367	0.027	0.629	0.637	-0.008		No disturbance in 2020
D604I 113--RL-80-NO On-A	0.455	0.448	0.007	0.502	0.463	0.039		No disturbance in 2020
D604I 114--RL-80-NO On-A	0.429	0.448	-0.019	0.473	0.463	0.010		No disturbance in 2020
D604I 115--RL-80-NO On-A	0.449	0.448	0.001	0.489	0.463	0.027		No disturbance in 2020
D604I 116--RL-74-NO On-A	0.410	0.488	-0.078	0.519	0.602	-0.083		No disturbance in 2020
D604I 119A--RL-73-NO On-A	0.253	0.215	0.038	0.309	0.328	-0.019		No disturbance in 2020
D604I 119B--RL-73-NO On-A	0.222	0.215	0.007	0.344	0.328	0.016		No disturbance in 2020
D604I 122--RL-179-NO On-B	0.236	0.221	0.015	0.472	0.427	0.044		No disturbance in 2020
D604I 123--RL-177-NO On-A	0.360	0.285	0.075	0.498	0.460	0.038		No disturbance in 2020
D604I 124--RL-174-NO On-A	0.295	0.255	0.039	0.357	0.415	-0.058		No disturbance in 2020
D604I 125--RL-174-NO On-A	0.318	0.255	0.062	0.461	0.415	0.046		No disturbance in 2020
D604I 126--RL-174-NO On-A	0.273	0.255	0.018	0.424	0.415	0.009		No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 127--RL-174-NO On-A	0.218	0.255	-0.038	0.307	0.415	-0.108	twa disturbance	Project-related disturbance persists
D604I 128--RL-174-NO On-B	0.175	0.264	-0.089	0.218	0.415	**-0.197**	twa disturbance	Project-related disturbance persists
D604I 129--OT-174-NO On-A	0.291	0.230	0.061	0.371	0.376	-0.005		No disturbance in 2020
D604I 130--OT-174-NO On-A	0.266	0.230	0.036	0.254	0.376	-0.122	twa disturbance	Project-related disturbance persists
D604I 131--OT-174-NO On-A	0.282	0.230	0.052	0.382	0.376	0.006		No disturbance in 2020
D604I 132--OT-172-NO On-A	0.257	0.319	-0.063	0.423	0.478	-0.054		No disturbance in 2020
D604I 133--OT-172-NO On-A	0.213	0.319	-0.106	0.242	0.478	**-0.235**	twa disturbance	Project-related disturbance persists
D604I 134--OT-172-NO On-A	0.193	0.319	-0.126	0.306	0.478	**-0.172**	twa disturbance	Project-related disturbance persists
D604I 135--OT-172-NO On-A	0.241	0.319	-0.078	0.343	0.478	-0.135	twa disturbance	Project-related disturbance persists
D604I 136--OT-172-NO On-A	0.214	0.319	-0.105	0.323	0.478	**-0.155**	twa disturbance	Project-related disturbance persists
D604I 137--SW-31-9-4-E On-B	0.293	0.344	-0.051	0.382	0.465	-0.083		No disturbance in 2020
D604I 138--SW-31-9-4-E On-A	0.256	0.222	0.034	0.313	0.361	-0.048		No disturbance in 2020
D604I 139--NW-31-9-4-E On-A	0.314	0.256	0.058	0.372	0.397	-0.025		No disturbance in 2020
D604I 140--NE-31-9-4-E On-B	0.220	0.236	-0.016	0.347	0.396	-0.049		No disturbance in 2020
D604I 141--NE-31-9-4-E On-A	0.107	0.135	-0.028	0.192	0.414	**-0.222**	twa disturbance	Project-related disturbance persists
D604I 142--SW-5-10-4-E On-A	0.115	0.181	-0.066	0.463	0.410	0.053		No disturbance in 2020
D604I 143--SW-5-10-4-E On-B	0.141	0.184	-0.043	0.382	0.421	-0.039		No disturbance in 02020
D604I 144--SW-5-10-4-E On-B	0.133	0.184	-0.051	0.358	0.421	-0.064		No disturbance in 2020
D604I 145--SW-5-10-4-E On-B	0.146	0.184	-0.038	0.345	0.421	-0.076		No disturbance in 2020
D604I 146--SE-9-10-4-E On-A	0.155	0.238	-0.083	0.385	0.462	-0.077		No disturbance in 2020
D604I 147--SE-9-10-4-E On-A	0.214	0.238	-0.024	0.319	0.462	-0.143	twa disturbance	Project-related disturbance persists
D604I 148--SE-9-10-4-E On-A	0.261	0.238	0.023	0.315	0.462	**-0.147**	twa disturbance	Project-related disturbance persists
D604I 149--SE-9-10-4-E On-A	0.289	0.238	0.052	0.291	0.462	**-0.171**	twa disturbance	Project-related disturbance persists
D604I 150--SW-10-10-4-E On-A	0.296	0.255	0.041	0.290	0.429	-0.139	twa disturbance	Project-related disturbance persists
D604I 151--SW-10-10-4-E On-A	0.275	0.255	0.019	0.309	0.429	-0.120	twa disturbance	Project-related disturbance persists
D604I 152--SW-10-10-4-E On-A	0.278	0.255	0.022	0.291	0.429	-0.137	twa disturbance	Project-related disturbance persists

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 153--SW-10-10-4-E On-A	0.271	0.255	0.015	0.281	0.429	-0.148	twa disturbance	Project-related disturbance persists
D604I 154--SW-10-10-4-E On-B	0.290	0.312	-0.022	0.308	0.389	-0.080		No disturbance in 2020
D604I 155--SW-10-10-4-E On-B	0.330	0.312	0.018	0.442	0.389	0.053		No disturbance in 2020
D604I 156--SW-14-10-4-E On-A	0.304	0.281	0.023	0.366	0.431	-0.065		No disturbance in 2020
D604I 157--NW-14-10-4-E On-A	0.283	0.266	0.017	0.264	0.264	0.000		No disturbance in 2020
D604I 158--NW-14-10-4-E On-A	0.300	0.266	0.034	0.330	0.264	0.066		No disturbance in 2020
D604I 159--NW-14-10-4-E On-A	0.269	0.266	0.003	0.237	0.264	-0.027		No disturbance in 2020
D604I 160--NW-14-10-4-E On-A	0.272	0.266	0.006	0.266	0.264	0.001		No disturbance in 2020
D604I 161--SW-23-10-4-E On-A	0.270	0.319	-0.049	0.378	0.165	0.213		No disturbance in 2020
D604I 163--NW-23-10-4-E On-B	0.166	0.121	0.045	0.248	0.285	-0.037		No disturbance in 2020
D604I 166--SE-26-10-4-E On-A	0.192	0.153	0.039	0.267	0.266	0.001		No disturbance in 2020
D604I 167--SE-26-10-4-E On-A	0.218	0.153	0.065	0.356	0.266	0.090		No disturbance in 2020
D604I 168--SW-25-10-4-E On-A	0.252	0.289	-0.037	0.545	0.681	-0.136	twa disturbance	Project-related disturbance persists
D604I 169--SW-25-10-4-E On-A	0.284	0.289	-0.005	0.494	0.681	-0.187	twa disturbance	Project-related disturbance persists
D604I 170--SW-25-10-4-E On-A	0.297	0.289	0.008	0.553	0.681	-0.128	twa disturbance	Project-related disturbance persists
D604I 171-SW-25-10-4-E On-A	0.272	0.289	-0.017	0.401	0.681	-0.280	twa disturbance	Project-related disturbance persists
D604I 172-SW-30-10-5-E On-A	0.399	0.433	-0.034	0.522	0.535	-0.013		No disturbance in 2020
D604I 173-SW-30-10-5-E On-A	0.399	0.433	-0.034	0.513	0.535	-0.022		No disturbance in 2020
D604I 174-SE-30-10-5-E On-B	0.366	0.381	-0.015	0.548	0.605	-0.057		No disturbance in 2020
D604I 175--SE-30-10-5-E On-B	0.350	0.381	-0.031	0.555	0.605	-0.050		No disturbance in 2020
D604I 176--SW-29-10-5-E On-A	0.467	0.491	-0.025	0.638	0.640	-0.002		No disturbance in 2020
D604I 177--SW-29-10-5-E On-A	0.443	0.491	-0.049	0.607	0.640	-0.032		No disturbance in 2020
D604I 178--SW-29-10-5-E On-A	0.471	0.491	-0.020	0.605	0.640	-0.034		No disturbance in 2020
D604I 179--SW-29-10-5-E On-A	0.470	0.491	-0.021	0.579	0.640	-0.060		No disturbance in 2020
D604I 180--SW-28-10-5-E On-A	0.270	0.348	-0.078	0.531	0.519	0.012		No disturbance in 2020
D604I 181--SE-28-10-5-E On-A	0.295	0.196	0.099	0.472	0.305	0.166		No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 181--SW-28-10-5-E On-A	0.352	0.348	0.003	0.447	0.519	-0.072		No disturbance in 2020
D604I 182--SE-28-10-5-E On-A	0.159	0.196	-0.037	0.385	0.305	0.080		No disturbance in 2020
D604I 183--SE-28-10-5-E On-A	0.182	0.196	-0.013	0.383	0.305	0.077		No disturbance in 2020
D604I 184--SW-27-10-5-E On-A	0.207	0.276	-0.070	0.520	0.568	-0.047		No disturbance in 2020
D604I 185--SE-27-10-5-E On-A	0.240	0.276	-0.036	0.475	0.551	-0.076		No disturbance in 2020
D604I 185--SW-27-10-5-E On-A	0.368	0.452	-0.085	0.465	0.568	-0.102	twa disturbance	Project-related disturbance persists
D604I 186--SE-27-10-5-E On-A	0.417	0.452	-0.035	0.513	0.551	-0.038		No disturbance in 2020
D604I 187--SE-27-10-5-E On-A	0.414	0.452	-0.038	0.515	0.551	-0.036		No disturbance in 2020
D604I 188--SW-26-10-5-E On-A	0.484	0.488	-0.005	0.368	0.409	-0.041		No disturbance in 2020
D604I 189--SW-26-10-5-E On-A	0.494	0.488	0.005	0.397	0.409	-0.012		No disturbance in 2020
D604I 190--SW-26-10-5-E On-A	0.498	0.488	0.010	0.364	0.409	-0.046		No disturbance in 2020
D604I 191--SW-26-10-5-E On-A	0.481	0.488	-0.007	0.313	0.409	-0.097	twa disturbance	Project-related disturbance persists
D604I 192--SW-25-10-5-E On-A	0.371	0.401	-0.030	0.448	0.503	-0.055		No disturbance in 2020
D604I 193--SW-25-10-5-E On-A	0.315	0.401	-0.086	0.468	0.503	-0.035	below negative threshold in 2019; not outlier in 2020	No disturbance in 2020
D604I 194--SW-25-10-5-E On-A	0.351	0.401	-0.050	0.516	0.503	0.012		No disturbance in 2020
D604I 195--SW-25-10-5-E On-A	0.362	0.401	-0.040	0.477	0.503	-0.026		No disturbance in 2020
D604I 196--SW-30-10-6-E On-A	0.578	0.551	0.027	0.186	0.158	0.027		No disturbance in 2020
D604I 197--SW-30-10-6-E On-A	0.562	0.551	0.010	0.190	0.158	0.032		No disturbance in 2020
D604I 198--SE-30-10-6-E On-A	0.437	0.515	-0.077	0.166	0.188	-0.022		No disturbance in 2020
D604I 199--SE-30-10-6-E On-A	0.383	0.515	-0.132	0.171	0.188	-0.017	below negative threshold in 2019; not outlier in 2020	No disturbance in 2020
D604I 200--SE-30-10-6-E On-A	0.408	0.515	-0.106	0.182	0.188	-0.006	below negative threshold in 2019; not outlier in 2020	No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 201--SW-29-10-6-E On-A	0.198	0.187	0.011	0.486	0.525	-0.039		No disturbance in 2020
D604I 202--SW-29-10-6-E On-A	0.204	0.187	0.017	0.503	0.525	-0.022		No disturbance in 2020
D604I 203--SE-29-10-6-E On-A	0.223	0.260	-0.037	0.509	0.548	-0.039		No disturbance in 2020
D604I 204--SE-29-10-6-E On-A	0.238	0.260	-0.022	0.455	0.548	-0.093	twa disturbance	Project-related disturbance persists
D604I 205--SW-28-10-6-E On-A	0.412	0.495	-0.082	0.497	0.519	-0.022		No disturbance in 2020
D604I 206--SE-28-10-6-E On-A	0.422	0.459	-0.036	0.514	0.519	-0.006		No disturbance in 2020
D604I 206--SW-28-10-6-E On-A	0.348	0.495	-0.147	0.472	0.519	-0.046	below negative threshold in 2019; not outlier in 2020	No disturbance in 2020
D604I 207--SE-28-10-6-E On-A	0.423	0.459	-0.036	0.501	0.519	-0.018		No disturbance in 2020
D604I 208--SE-28-10-6-E On-A	0.447	0.459	-0.012	0.497	0.519	-0.022		No disturbance in 2020
D604I 209--SW-27-10-6-E On-A	0.265	0.269	-0.004	0.367	0.445	-0.078		No disturbance in 2020
D604I 210--SE-27-10-6-E On-A	0.181	0.269	-0.088	0.333	0.293	0.041	below negative threshold in 2019; not outlier in 2020	No disturbance in 2020
D604I 210--SW-27-10-6-E On-A	0.202	0.454	-0.252	0.404	0.445	-0.041	below negative threshold in 2019; not outlier in 2020	No disturbance in 2020
D604I 211--SE-27-10-6-E On-A	0.451	0.454	-0.003	0.212	0.293	-0.080		No disturbance in 2020
D604I 212--SE-27-10-6-E On-A	0.408	0.454	-0.045	0.239	0.293	-0.053		No disturbance in 2020
D604I 213--SW-26-10-6-E On-A	0.341	0.370	-0.029	0.282	0.349	-0.067		No disturbance in 2020
D604I 214--SW-26-10-6-E On-A	0.456	0.370	0.086	0.357	0.349	0.007		No disturbance in 2020
D604I 218--SW-25-10-6-E On-A	0.408	0.471	-0.063	0.402	0.485	-0.083		No disturbance in 2020
D604I 219--SE-25-10-6-E On-A	0.408	0.349	0.060	0.416	0.304	0.112		No disturbance in 2020
D604I 220-SE-25-10-6-E On-A	0.372	0.349	0.023	0.288	0.304	-0.016		No disturbance in 2020
D604I 221-SW-30-10-7-E On-A	0.634	0.615	0.019	0.253	0.231	0.022		No disturbance in 2020
D604I 222--SE-30-10-7-E On-A	0.593	0.615	-0.022	0.358	0.384	-0.027		No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 222-SW-30-10-7-E On-A	0.479	0.432	0.047	0.243	0.231	0.012		No disturbance in 2020
D604I 223--SE-30-10-7-E On-B	0.393	0.371	0.023	0.246	0.264	-0.018		No disturbance in 2020
D604I 224--SE-30-10-7-E On-B	0.366	0.371	-0.005	0.275	0.264	0.011		No disturbance in 2020
D604I 225--SW-29-10-7-E On-B	0.405	0.392	0.013	0.102	0.409	**-0.307**	twa disturbance	Project-related disturbance persists
D604I 226--NW-20-10-7-E On-A	0.313	0.324	-0.011	0.141	0.352	**-0.211**	twa disturbance	Project-related disturbance persists
D604I 227--NW-20-10-7-E On-B	0.426	0.408	0.018	0.299	0.395	-0.096	twa disturbance	Project-related disturbance persists
D604I 228--NW-20-10-7-E On-B	0.489	0.408	0.081	0.393	0.395	-0.002		No disturbance in 2020
D604I 230--NW-17-10-7-E On-A	0.442	0.420	0.022	0.392	0.488	-0.096	twa disturbance	Project-related disturbance persists
D604I 231--NW-17-10-7-E On-A	0.437	0.420	0.016	0.325	0.488	**-0.163**	twa disturbance	Project-related disturbance persists
D604I 232--NW-17-10-7-E On-A	0.397	0.420	-0.023	0.379	0.488	-0.109	twa disturbance	Project-related disturbance persists
D604I 233--NW-17-10-7-E On-A	0.482	0.420	0.061	0.326	0.488	**-0.162**	twa disturbance	Project-related disturbance persists
D604I 242--SE-5-10-7-E On-A	0.354	0.396	-0.042	0.248	0.384	-0.136	twa disturbance	Project-related disturbance persists
D604I 243--NE-32-9-7-E On-A	0.529	0.515	0.014	0.500	0.519	-0.020		No disturbance in 2020
D604I 258--NE-15-9-7-E On-A	0.442	0.395	0.047	0.407	0.388	0.019		No disturbance in 2020
D604I 259--SE-15-9-7-E On-A	0.402	0.386	0.016	0.283	0.447	**-0.164**	twa disturbance	Project-related disturbance persists
D604I 263--SW-11-9-7-E On-B	0.358	0.402	-0.043	0.266	0.458	**-0.192**	twa disturbance	Project-related disturbance persists
D604I 278--NE-24-8-7-E On-A	0.456	0.446	0.010	0.422	0.481	-0.060		No disturbance in 2020
D604I 279--NE-24-8-7-E On-A	0.454	0.446	0.009	0.419	0.481	-0.062		No disturbance in 2020
D604I 285--SW-18-8-8-E On-A	0.391	0.348	0.042	0.236	0.305	-0.070		No disturbance in 2020
D604I 286--NE-7-8-8-E On-A	0.421	0.472	-0.051	0.346	0.308	0.038		No disturbance in 2020
D604I 305--SE-19-7-8-E On-A	0.571	0.568	0.002	0.603	0.718	-0.115	twa disturbance	Project-related disturbance persists
D604I 306--SE-19-7-8-E On-A	0.513	0.568	-0.055	0.669	0.718	-0.049		No disturbance in 2020
D604I 307--NE-18-7-8-E On-B	0.501	0.508	-0.007	0.632	0.679	-0.046		No disturbance in 2020
D604I 308--NE-18-7-8-E On-A	0.374	0.478	-0.105	0.637	0.603	0.034	below negative threshold in 2019; not outlier in 2020	No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 308--SE-18-7-8-E On-A	0.417	0.416	0.001	0.665	0.597	0.068		No disturbance in 2020
D604I 309--SE-18-7-8-E On-A	0.410	0.416	-0.006	0.625	0.597	0.028		No disturbance in 2020
D604I 310--SE-18-7-8-E On-A	0.419	0.416	0.003	0.566	0.597	-0.030		No disturbance in 2020
D604I 311--NE-7-7-8-E On-A	0.524	0.495	0.029	0.589	0.610	-0.021		No disturbance in 2020
D604I 312--SE-7-7-8-E On-A	0.629	0.634	-0.005	0.108	0.138	-0.030		No disturbance in 2020
D604I 313--SE-7-7-8-E On-B	0.504	0.410	0.094	0.449	0.409	0.040		No disturbance in 2020
D604I 313--SE-7-7-8-E On-C	0.477	0.517	-0.040	0.501	0.587	-0.087	twa disturbance	Project-related disturbance persists
D604I 314--NE-6-7-8-E On-A	0.327	0.461	-0.134	0.308	0.718	**-0.409**	appears natural low productivity in field corner	Negative outlier, nature unknown
D604I 314--NE-6-7-8-E On-B	0.477	0.550	-0.073	0.462	0.660	**-0.198**	twa disturbance	Project-related disturbance persists
D604I 315--NE-6-7-8-E On-A	0.435	0.461	-0.026	0.656	0.718	-0.061		No disturbance in 2020
D604I 316--SE-6-7-8-E On-A	0.446	0.464	-0.018	0.556	0.605	-0.049		No disturbance in 2020
D604I 317--SE-6-7-8-E On-B	0.479	0.493	-0.014	0.526	0.624	-0.098	twa disturbance	Project-related disturbance persists
D604I 317--SE-6-7-8-E On-B	0.479	0.493	-0.014	0.526	0.624	-0.098	twa disturbance	Project-related disturbance persists
D604I 319--NW-32-6-8-E On-A	0.325	0.346	-0.020	0.430	0.478	-0.048		No disturbance in 2020
D604I 320--SW-32-6-8-E On-A	0.514	0.528	-0.014	0.613	0.620	-0.007		No disturbance in 2020
D604I 321--SW-32-6-8-E On-B	0.374	0.397	-0.023	0.481	0.590	-0.110	twa disturbance	Project-related disturbance persists
D604I 322--NW-29-6-8-E On-A	0.432	0.221	**0.211**	0.448	0.316	0.132		No disturbance in 2020
D604I 323--NW-29-6-8-E On-A	0.373	0.221	**0.152**	0.346	0.316	0.030		No disturbance in 2020
D604I 324--SW-29-6-8-E On-B	0.312	0.316	-0.004	0.412	0.388	0.025		No disturbance in 2020
D604I 325--SW-29-6-8-E On-C	0.485	0.463	0.022	0.370	0.287	0.083		No disturbance in 2020
D604I 326--NW-20-6-8-E On-B	0.337	0.335	0.002	0.567	0.615	-0.047		No disturbance in 2020
D604I 327--NW-20-6-8-E On-A	0.495	0.441	0.055	0.591	0.631	-0.041		No disturbance in 2020
D604I 328--NW-20-6-8-E On-A	0.511	0.441	0.070	0.704	0.631	0.072		No disturbance in 2020
D604I 329--SW-20-6-8-E On-B	0.535	0.561	-0.026	0.472	0.535	-0.062		No disturbance in 2020
D604I 330--SW-20-6-8-E On-B	0.606	0.561	0.045	0.430	0.535	-0.104	twa disturbance	Project-related disturbance persists

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 331--NW-17-6-8-E On-A	0.425	0.443	-0.017	0.620	0.632	-0.013		No disturbance in 2020
D604I 332--NE-17-6-8-E On-A	0.487	0.443	0.044	0.737	0.755	-0.018		No disturbance in 2020
D604I 332--NW-17-6-8-E On-A	0.271	0.338	-0.067	0.542	0.632	-0.091	twa disturbance	Project-related disturbance persists
D604I 333--SE-17-6-8-E On-A	0.468	0.450	0.018	0.551	0.668	-0.117	twa disturbance	Project-related disturbance persists
D604I 334--SE-17-6-8-E On-A	0.344	0.450	-0.106	0.581	0.668	-0.087	limited project dist	Project-related disturbance persists
D604I 334--SW-17-6-8-E On-B	0.437	0.443	-0.006	0.499	0.545	-0.046		No disturbance in 2020
D604I 335--NE-8-6-8-E On-A	0.474	0.373	0.100	0.494	0.511	-0.016		No disturbance in 2020
D604I 335--NW-8-6-8-E On-A	0.334	0.324	0.010	0.555	0.618	-0.063		No disturbance in 2020
D604I 336--SE-8-6-8-E On-A	0.432	0.427	0.005	0.394	0.510	-0.117	twa disturbance	Project-related disturbance persists
D604I 336--SW-8-6-8-E On-A	0.509	0.529	-0.020	0.518	0.673	**-0.155**	twa disturbance	Project-related disturbance persists
D604I 337--SE-8-6-8-E On-E	0.455	0.546	-0.091	0.629	0.721	-0.092	additional project dist	Negative outlier, nature unknown
D604I 337--SE-8-6-8-E On-F	0.471	0.509	-0.039	0.619	0.688	-0.069		No disturbance in 2020
D604I 337--SW-8-6-8-E On-B	0.509	0.545	-0.037	0.519	0.487	0.032		No disturbance in 2020
D604I 338--NE-5-6-8-E On-A	0.575	0.594	-0.019	0.282	0.309	-0.027		No disturbance in 2020
D604I 338--NW-5-6-8-E On-A	0.577	0.625	-0.047	0.501	0.570	-0.069		No disturbance in 2020
D604I 339--NE-5-6-8-E On-B	0.432	0.358	0.073	0.435	0.539	-0.105	twa disturbance	Project-related disturbance persists
D604I 340--NE-5-6-8-E On-B	0.443	0.358	0.085	0.466	0.539	-0.074		No disturbance in 2020
D604I 341--SE-5-6-8-E On-A	0.562	0.430	0.132	0.374	0.276	0.098		No disturbance in 2020
D604I 342--NE-32-5-8-E On-B	0.319	0.370	-0.052	0.114	0.284	**-0.170**	twa disturbance	Project-related disturbance persists
D604I 342--NW-32-5-8-E On-A	0.338	0.371	-0.033	0.186	0.309	-0.123	twa disturbance	Project-related disturbance persists
D604I 349--NW-20-5-8-E On-A	0.499	0.552	-0.052	0.489	0.467	0.022		No disturbance in 2020
D604I 350--SE-20-5-8-E On-A	0.436	0.376	0.060	0.276	0.238	0.038		No disturbance in 2020
D604I 350--SW-20-5-8-E On-A	0.510	0.522	-0.013	0.260	0.273	-0.013		No disturbance in 2020
D604I 351--SE-20-5-8-E On-B	0.421	0.428	-0.007	0.221	0.291	-0.070		No disturbance in 2020
D604I 351--SW-20-5-8-E On-B	0.426	0.375	0.051	0.254	0.240	0.015		No disturbance in 2020
D604I 352--N-17-5-8-E On-A	0.370	0.361	0.009	0.326	0.252	0.074		No disturbance in 2020
D604I 353--N-17-5-8-E On-A	0.439	0.361	0.078	0.435	0.252	**0.183**		No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 354--S-17-5-8-E On-A	0.480	0.451	0.030	0.375	0.484	-0.110	twa disturbance	Project-related disturbance persists
D604I 355--S-17-5-8-E On-A	0.451	0.451	0.000	0.400	0.484	-0.084		No disturbance in 2020
D604I 356--NE-8-5-8-E On-B	0.410	0.384	0.026	0.508	0.461	0.048		No disturbance in 2020
D604I 357--NE-8-5-8-E On-B	0.400	0.384	0.016	0.360	0.461	-0.100	twa disturbance	Project-related disturbance persists
D604I 362--SE-5-5-8-E On-A	0.622	0.621	0.000	0.405	0.554	**-0.149**	twa disturbance	Project-related disturbance persists
D604I 363--NE-32-4-8-E On-A	0.480	0.570	-0.090	0.397	0.558	**-0.160**	twa disturbance	Project-related disturbance persists
D604I 378--NE-9-4-8-E On-A	0.570	0.554	0.016	0.277	0.253	0.024		No disturbance in 2020
D604I 379--SE-9-4-8-E On-A	0.496	0.429	0.067	0.188	0.308	-0.120	twa disturbance	Project-related disturbance persists
D604I 381--SW-10-4-8-E On-A	0.544	0.566	-0.022	0.470	0.498	-0.028		No disturbance in 2020
D604I 386--NW-35-3-8-E On-A	0.528	0.528	-0.001	0.381	0.442	-0.062		No disturbance in 2020
D604I 387--NW-35-3-8-E On-A	0.586	0.528	0.058	0.393	0.442	-0.049		No disturbance in 2020
D604I 389--SE-35-3-8-E On-B	0.439	0.517	-0.078	0.287	0.388	-0.101	twa disturbance	Project-related disturbance persists
D604I 390--SE-35-3-8-E On-B	0.451	0.517	-0.066	0.217	0.388	**-0.171**	twa disturbance	Project-related disturbance persists
D604I 411--NE-4-3-9-E On-B	0.648	0.658	-0.010	0.475	0.515	-0.041		No disturbance in 2020
D604I 424--SE-25-2-9-E On-A	0.539	0.518	0.021	0.318	0.400	-0.081		No disturbance in 2020
D604I 440--NW-4-2-10-E On-A	0.584	0.568	0.016	0.366	0.505	-0.139	twa disturbance	Project-related disturbance persists
D604I 474--NW-24-1-11-E On-A	0.491	0.499	-0.008	0.251	0.510	**-0.259**	twa disturbance	Project-related disturbance persists
D604I 475--NE-24-1-11-E On-A	0.642	0.538	0.104	0.440	0.492	-0.052		No disturbance in 2020
D604I 475--NW-24-1-11-E On-A	0.529	0.499	0.029	0.405	0.510	-0.106	twa disturbance	Project-related disturbance persists
D604I 476--NE-24-1-11-E On-A	0.563	0.538	0.025	0.438	0.492	-0.055		No disturbance in 2020
D604I 478--W-19-1-12-E On-A	0.674	0.617	0.057	0.430	0.396	0.034		No disturbance in 2020
D604I 479--SE-19-1-12-E On-A	0.611	0.617	-0.006	0.425	0.481	-0.056		No disturbance in 2020
D604I 479--W-19-1-12-E On-A	0.640	0.628	0.011	0.459	0.396	0.063		No disturbance in 2020
D604I 480--SE-19-1-12-E On-A	0.632	0.628	0.003	0.417	0.481	-0.064		No disturbance in 2020
D604I 481--NE-18-1-12-E On-A	0.511	0.548	-0.037	0.297	0.298	0.000		No disturbance in 2020
D604I 482--NE-18-1-12-E On-B	0.500	0.490	0.010	0.332	0.421	-0.088	twa disturbance	Project-related disturbance persists
D604I 484--SW-17-1-12-E On-A	0.558	0.548	0.010	0.272	0.323	-0.051		No disturbance in 2020
D604I 485--SW-17-1-12-E On-B	0.564	0.574	-0.010	0.265	0.384	-0.120	twa disturbance	Project-related disturbance persists
D604I 486--NW-8-1-12-E On-A	0.698	0.681	0.017	0.476	0.521	-0.045		No disturbance in 2020

Table A.2 TWA FMU NDVI Values for 2019 and 2020, and 2020 Disturbance Categories

TWA ID	2019 TWA NDVI Mean	2019 Off NDVI Mean	2019 Diff TWA-Off ROW	2020 TWA NDVI Mean	2020 Off NDVI Mean	2020 Diff TWA-Off ROW	2020 Evaluation Comment	2020 Disturbance Category
D604I 487--NW-8-1-12-E On-A	0.620	0.643	-0.023	0.528	0.521	0.007		No disturbance in 2020
D604I 487--NW-8-1-12-E On-B	0.597	0.681	-0.084	0.497	0.526	-0.029		No disturbance in 2020
D604I 488--E-8-1-12-E On-A	0.613	0.584	0.028	0.595	0.638	-0.044		No disturbance in 2020
D604I 489--E-8-1-12-E On-A	0.561	0.584	-0.023	0.558	0.638	-0.080		No disturbance in 2020
D604I 490--SE-8-1-12-E On-A	0.530	0.520	0.010	0.317	0.406	-0.089	twa disturbance	Project-related disturbance persists
D604I 491--NW-4-1-12-E On-A	0.560	0.554	0.005	0.622	0.643	-0.020		No disturbance in 2020
D604I 492--NW-4-1-12-E On-A	0.567	0.554	0.012	0.606	0.643	-0.037		No disturbance in 2020
D604I 493--SW-4-1-12-E On-A	0.599	0.578	0.021	0.609	0.663	-0.054		No disturbance in 2020

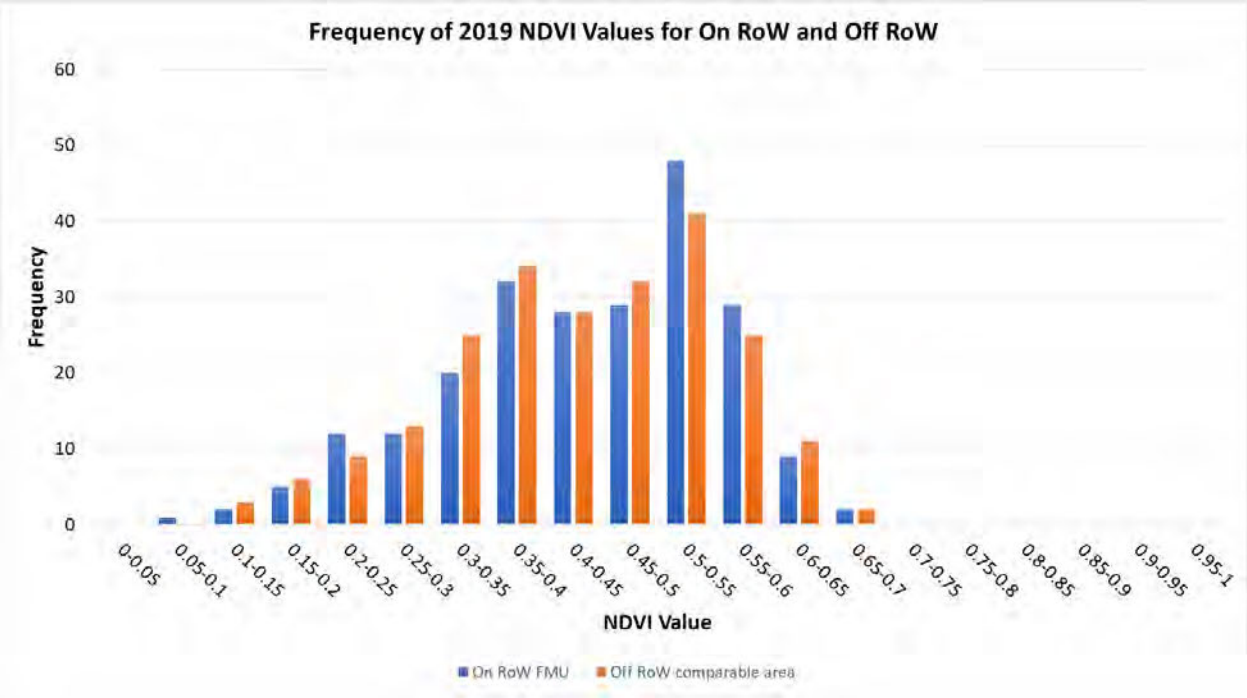
Notes:
NDVI difference outliers are indicated as follows:

	Major negative outlier	Minor negative outlier	Minor positive outlier	Major positive outlier	

Appendix B STATISTICAL ANALYSES

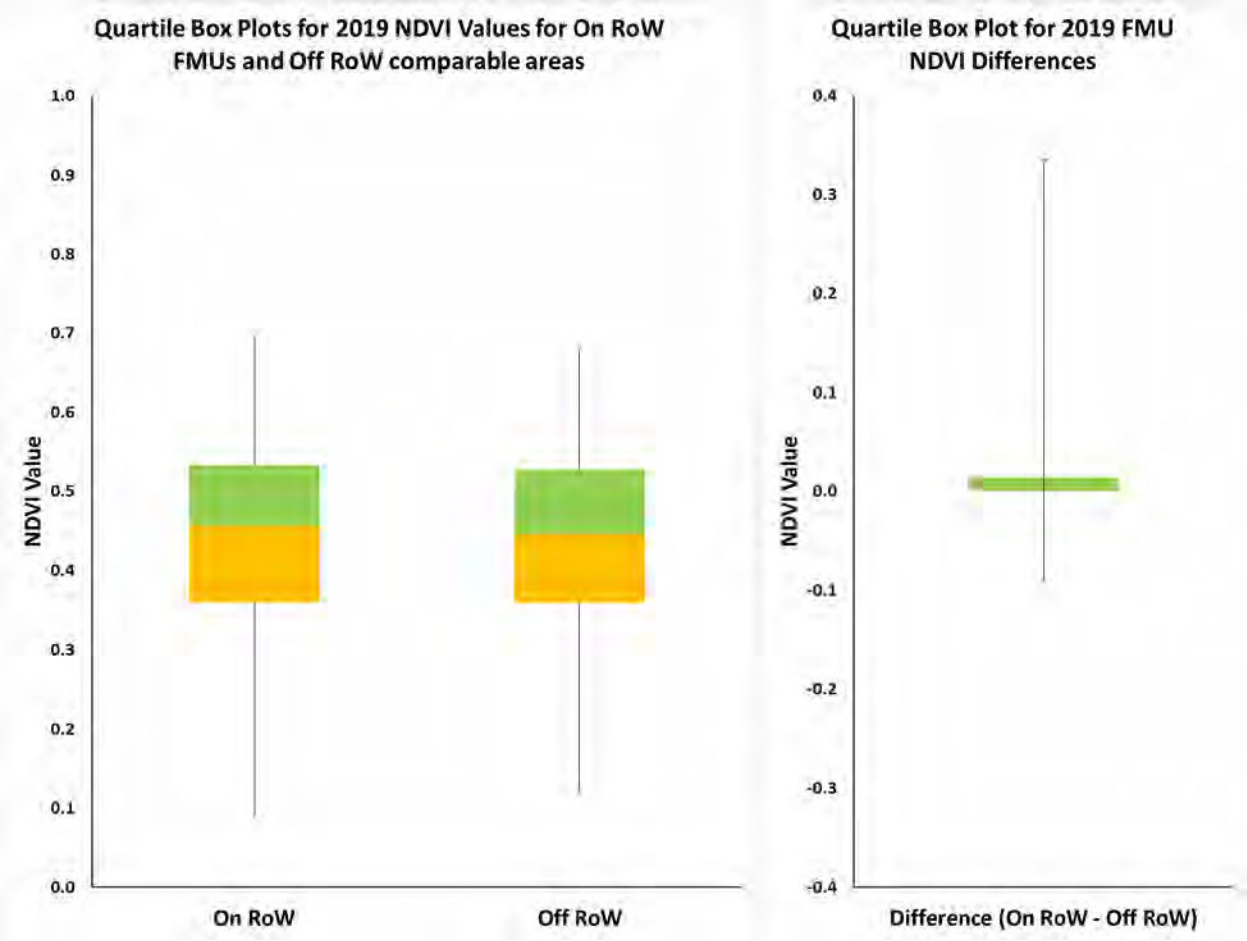
B.1 ON RoW FIELD MANAGEMENT UNITS (ON RoW FMUs)

B.1.1 Pre-Construction (2019)



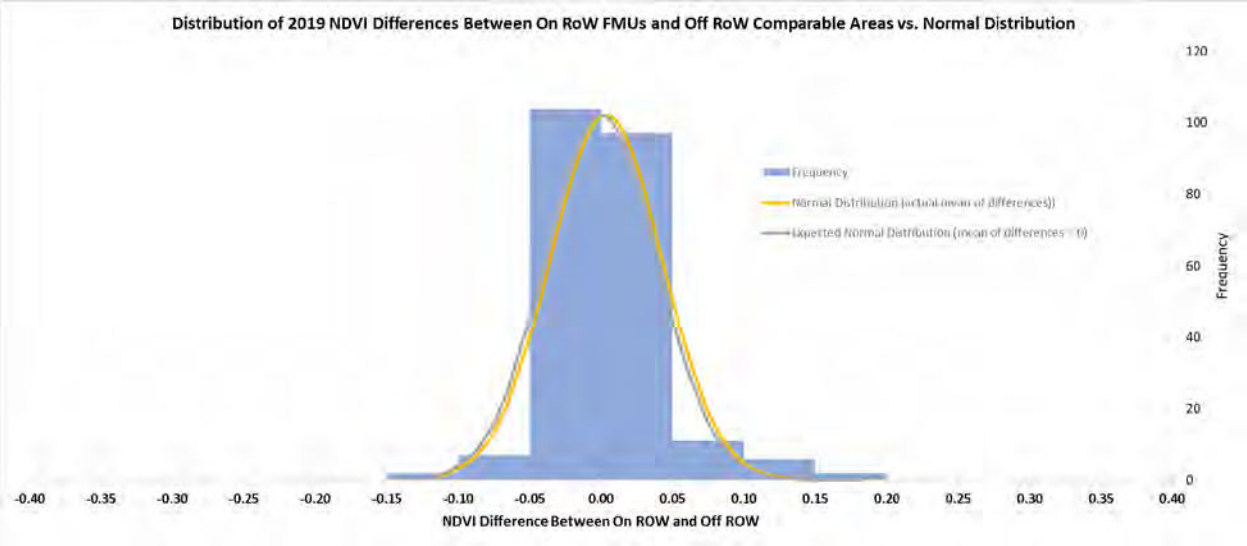
The frequency histogram above shows that there is a similar frequency of NDVI values over the range of NDVI value classes for On RoW FMUs and Off RoW comparable areas. This demonstrates similar soil productivity On RoW and Off RoW.

Figure B.1.1 Frequency of 2019 NDVI Values for On RoW and Off RoW



The quartile box plots for On RoW and Off RoW indicate that the ranges (between minimum and maximum values shown by the "whiskers") are fairly similar between On RoW FMUs and Off RoW comparable areas. The median value (centre of box) as well as the first quartile (25th percentile; orange) and third quartile (75th percentile; green) are also similar between On RoW FMUs and Off RoW comparable areas. When the box plot for NDVI differences is examined, it shows the median is zero and 50% of the data (between 25th and 75th percentile) are in a very tight range (narrow distribution), while the maximum and minimum values are much wider ranging, particularly in the positive direction (suggests "extreme" values).

Figure B.1.2 Quartile Box Plots for 2019 NDVI Values for On RoW FMUs, Off RoW Comparable Areas, and for NDVI Differences Values

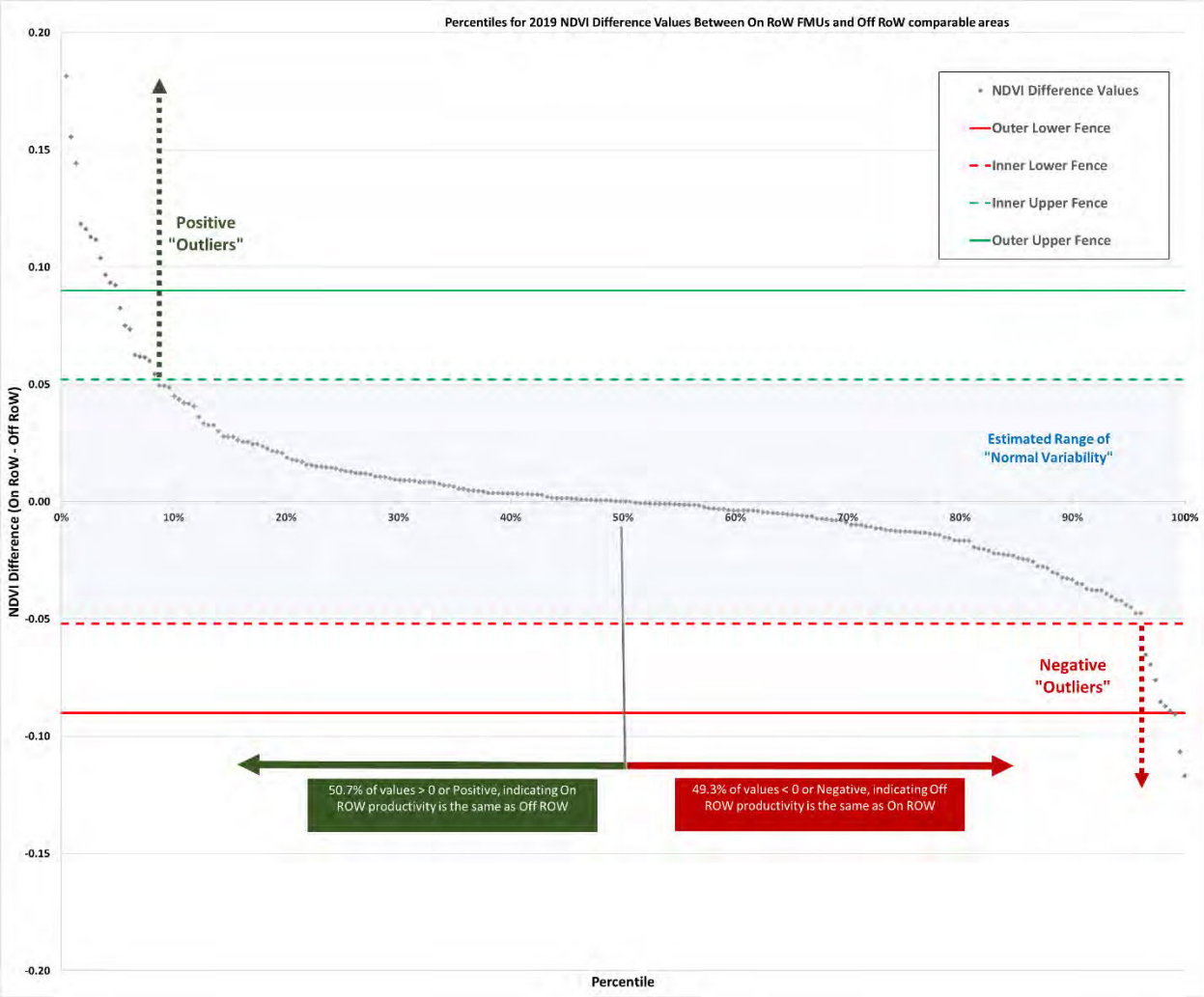


The frequency of difference values is displayed in columns (blue bars) relative to the:

- *normal distribution curve (orange line; based on actual data around the actual mean value of 0.004), and,*
- *"expected" normal distribution curve (grey line; assumed mean difference of 0 and same shape of curve as the actual normal distribution).*

These data demonstrate that the actual difference values are a very close fit to the expected normal distribution.

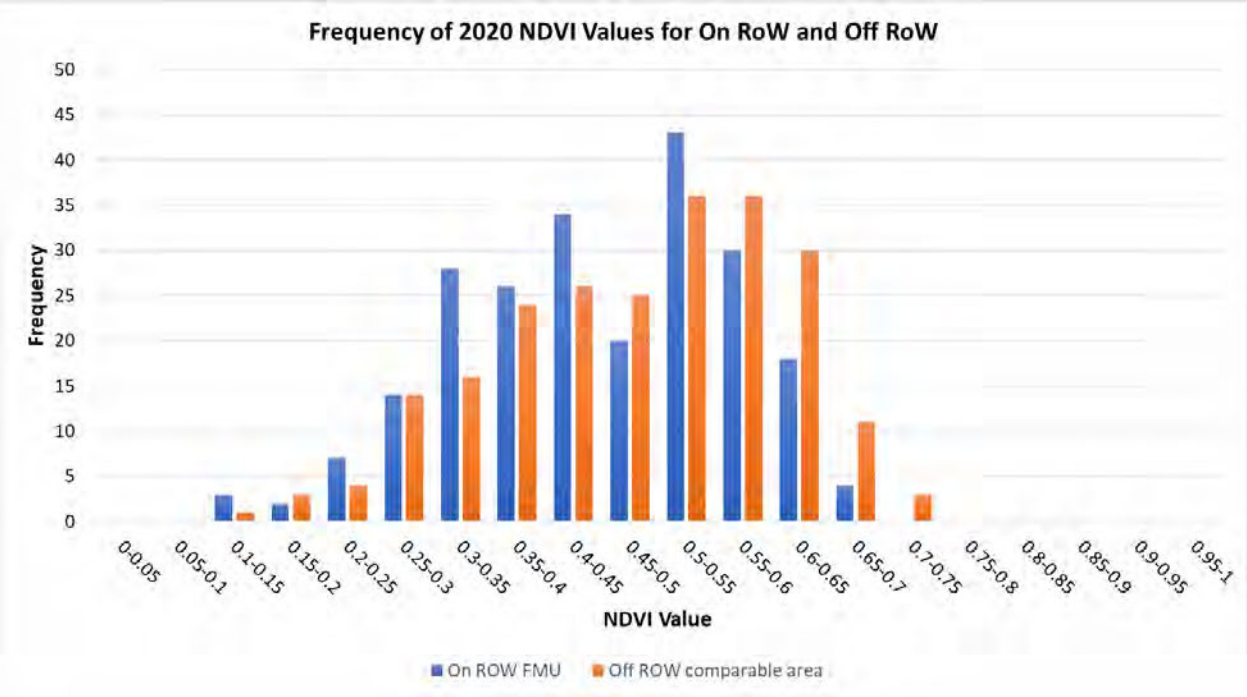
Figure B.1.3 Distribution of 2019 NDVI Differences Between On RoW FMUs and Off RoW Comparable Areas



The percentiles chart provides a visual display of the difference values for individual FMUs. Approximately 51% of differences were found to be positive (On RoW FMU – Off RoW comparable area = >0), while 49% were found to be negative (On RoW FMU – Off RoW comparable area = <0). This is further evidence of the similarity of the data. The estimated range of "normal variability" around an expected difference of 0 is estimated to be -0.052 to +0.052. Therefore, values above 0.052 can be considered "positive outliers" while values below -0.052 can be considered "negative outliers". Approximately 3.9% of On RoW FMUs (9) are considered in the "negative outlier" range, while 8.3% of On RoW FMUs (19) are considered in the "positive outlier" range.

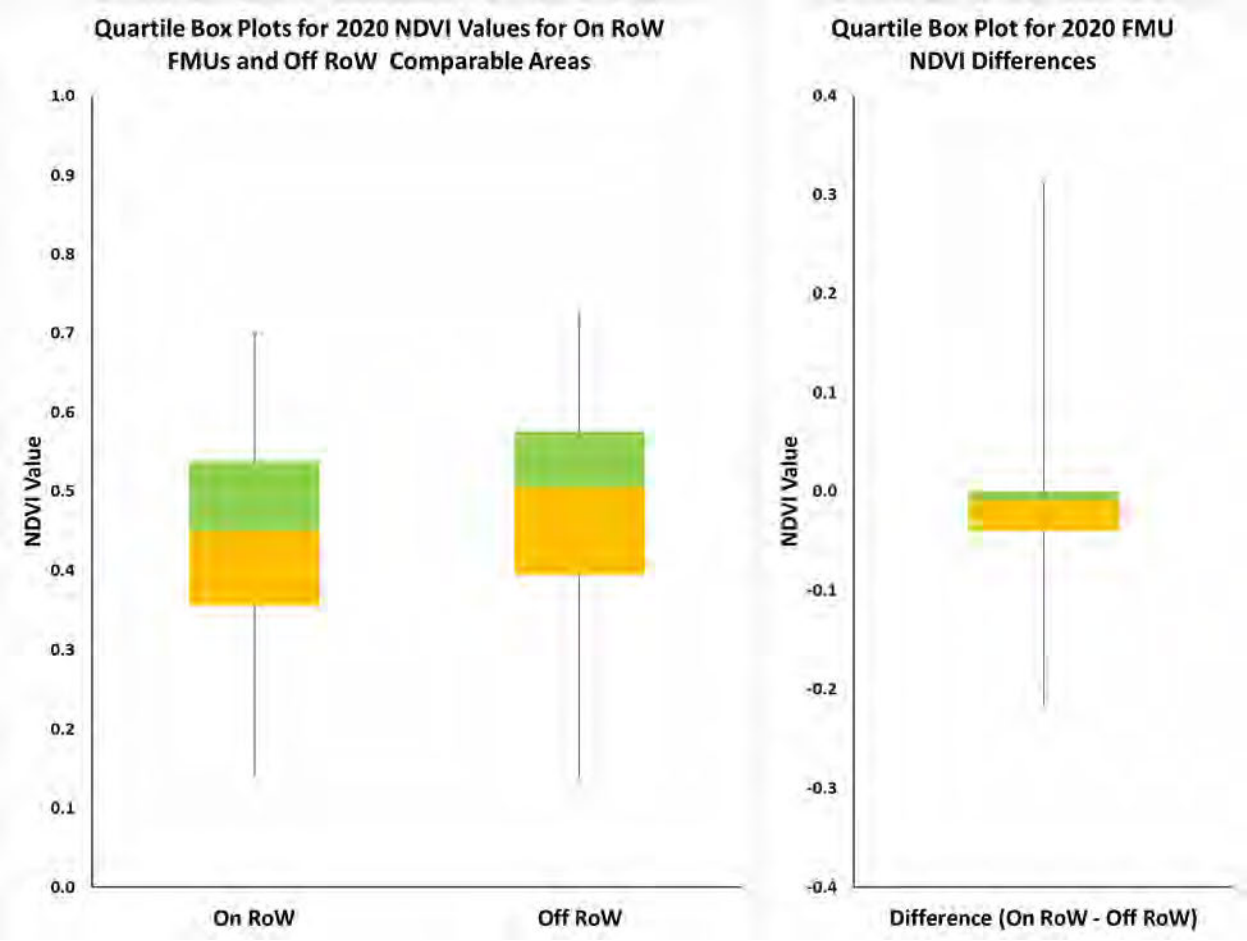
Figure B.1.4 Percentiles for 2019 NDVI Differences Between On RoW FMUs and Off RoW Comparable Areas

B.1.2 Post-Construction Year 1 (2020)



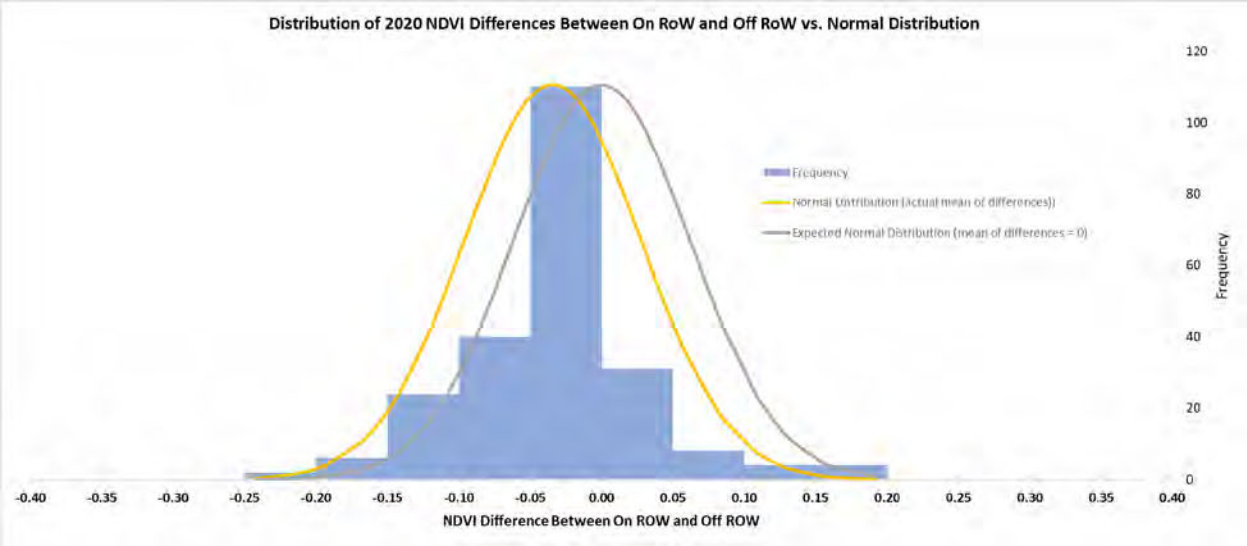
The frequency histogram above shows that there is a higher frequency of NDVI values in lower NDVI value classes for On RoW FMUs relative to Off RoW comparable areas. This demonstrates reduced soil productivity On RoW relative to Off RoW.

Figure B.1.5 Frequency of 2020 NDVI Values for On RoW and Off RoW



The quartile box plots for On RoW and Off RoW indicate that the ranges (between minimum and maximum values shown by the "whiskers") are lower for On RoW FMUs than Off RoW comparable areas. The median value (centre of box) as well as the first quartile (25th percentile; orange) and third quartile (75th percentile; green) are lower for On RoW FMUs than Off RoW comparable areas. When the box plot for NDVI differences is examined, it shows the median is below zero and 50% of the data (between 25th and 75th percentile) are below zero, indicating a strong negative skew in the NDVI difference data.

Figure B.1.6 Quartile Box Plots for 2020 NDVI Values for On RoW FMUs, Off RoW Comparable Areas, and for NDVI Differences Values

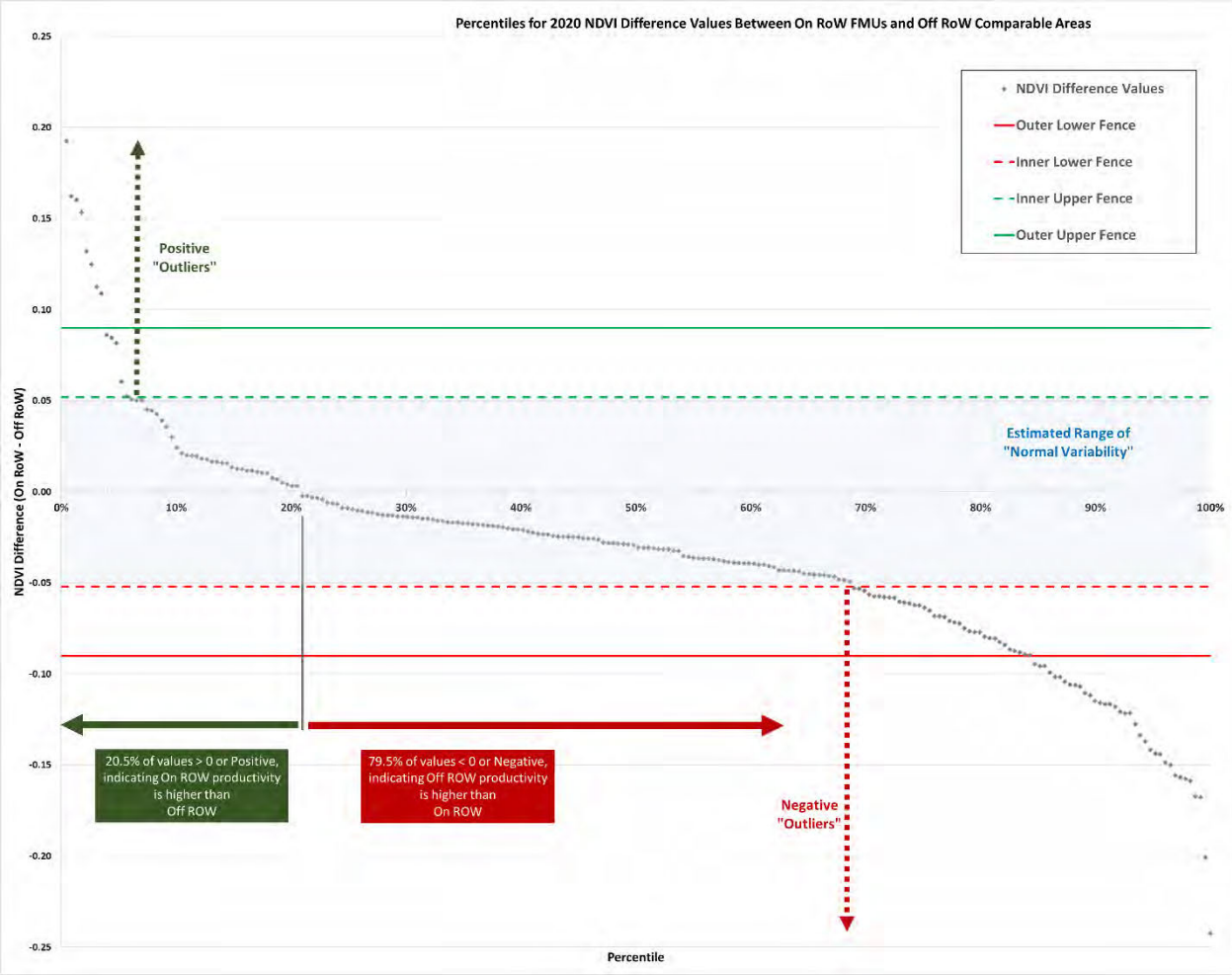


The frequency of difference values is displayed in columns (blue bars) relative to the:

- *normal distribution curve (orange line; based on actual data around the actual mean value of -0.034), and,*
- *"expected" normal distribution curve (grey line; assumed mean difference of 0 and same shape of curve as the actual normal distribution).*

These data demonstrate that the actual difference values shifted in the negative difference direction relative to the expected normal distribution.

Figure B.1.7 Distribution of 2020 NDVI Differences Between On RoW FMUs and Off RoW Comparable Areas

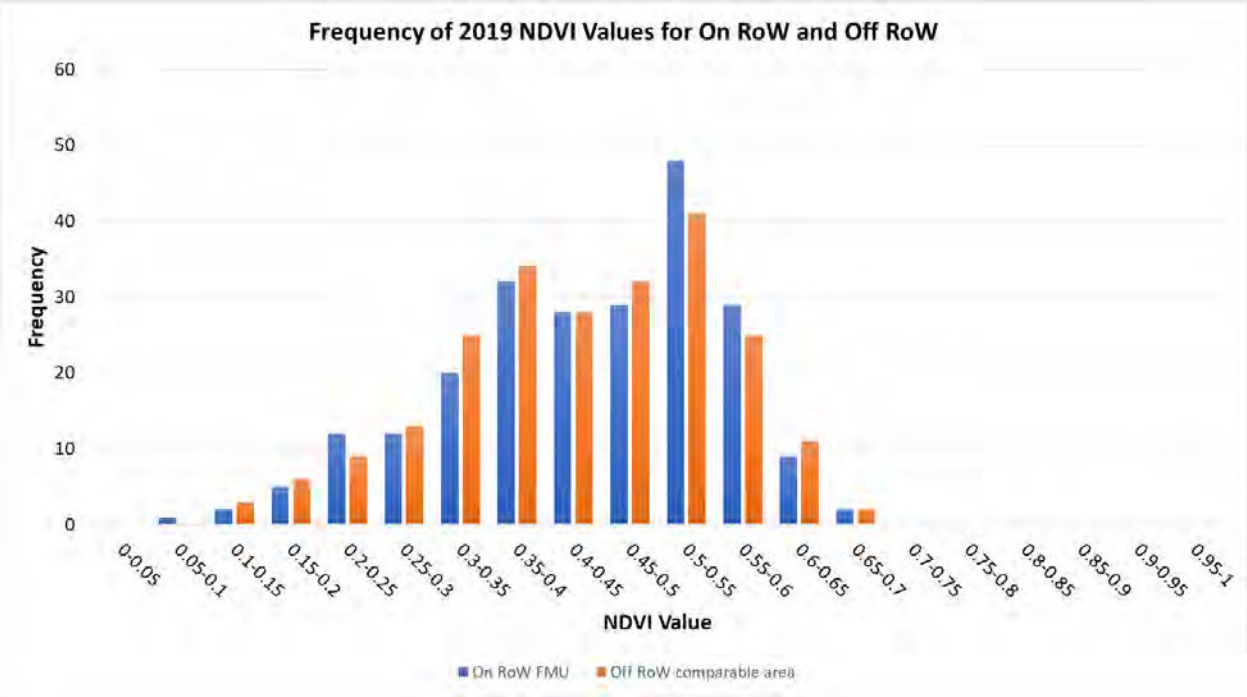


The percentiles chart provides a visual display of the difference values for individual FMUs. Approximately 20.5% of differences were found to be positive (On RoW FMU – Off RoW comparable area = >0), while 79.5% were found to be negative (On RoW FMU – Off RoW comparable area = <0). This is further evidence of the negative skewness of the data. The estimated range of "normal variability" around an expected difference of 0 is estimated to be -0.052 to +0.052. Therefore, values above 0.052 can be considered "positive outliers" while values below -0.052 can be considered "negative outliers". Based on this analysis there are many more "negative outliers" than "positive outliers". Approximately 31.4% of On RoW FMUs (72) are considered in the "negative outlier" range, while 5.7% of On RoW FMUs (13) are considered in the "positive outlier" range.

Figure B.1.8 Percentiles for 2019 NDVI Differences Between On RoW FMUs and Off RoW Comparable Areas

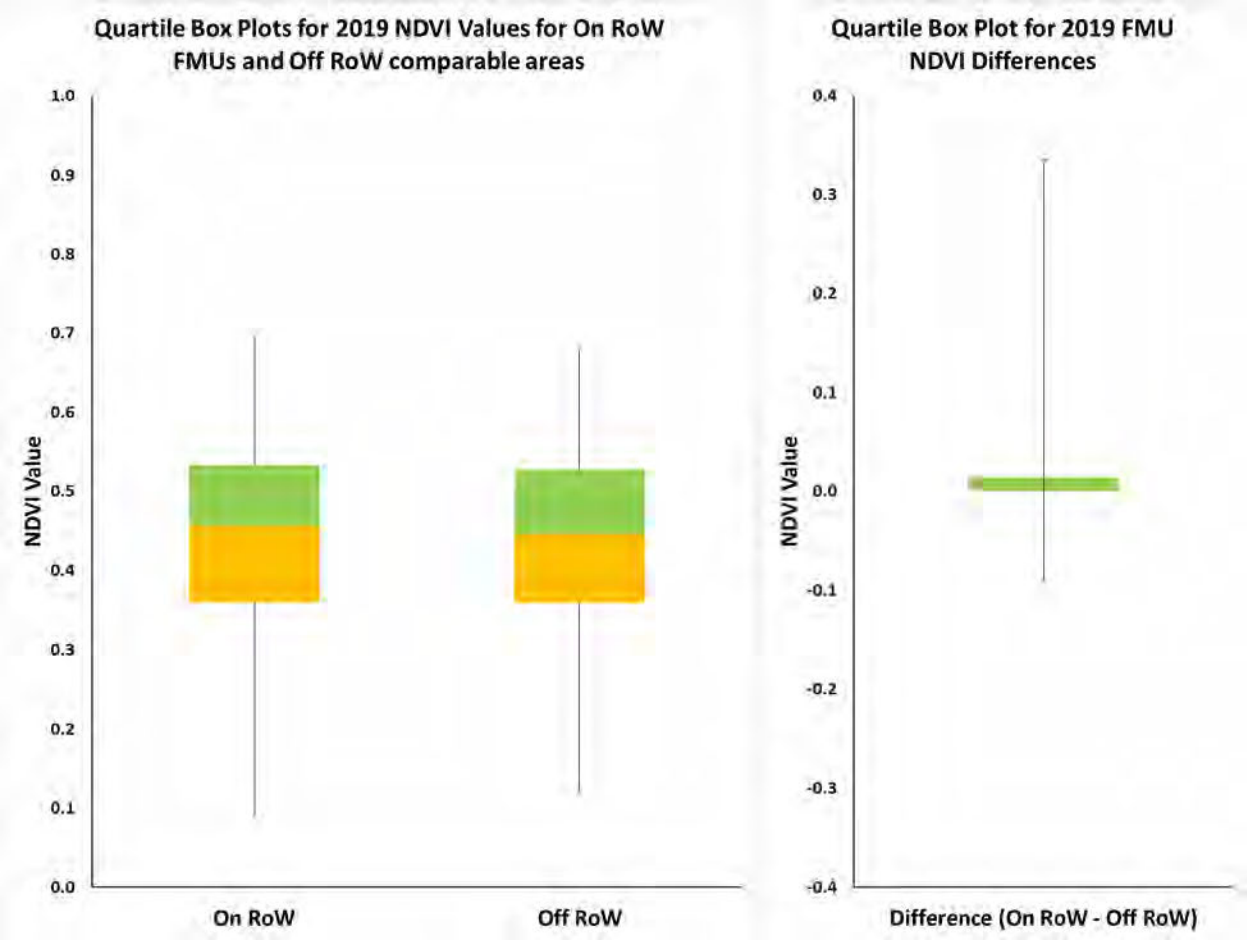
B.2 TOWER WORK AREAS (TWAs)

B.2.1 Pre-Construction (2019)



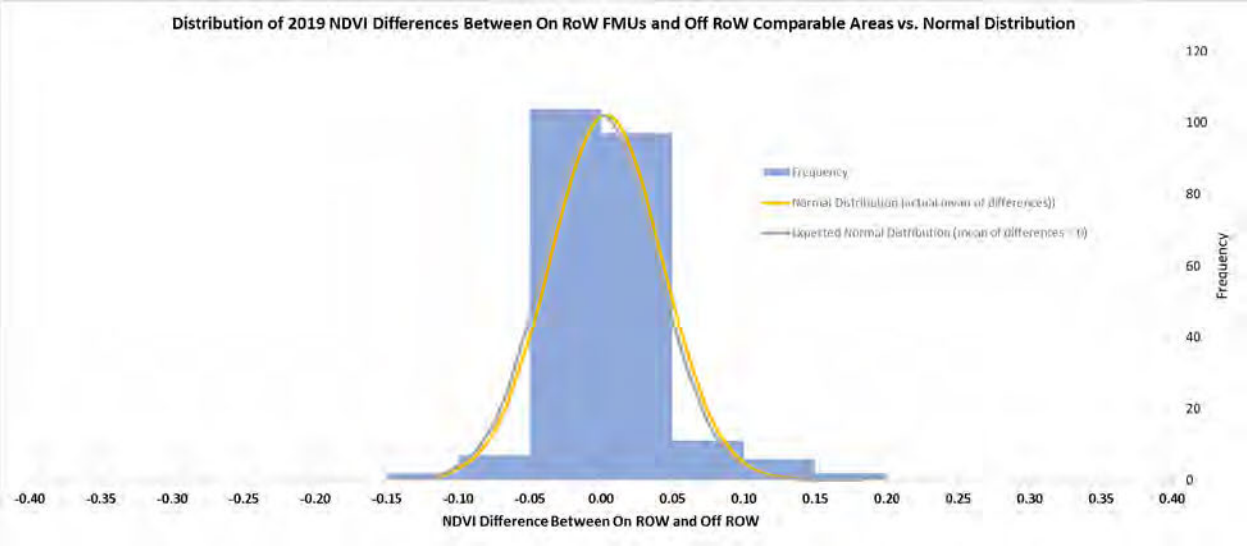
The frequency histogram above shows that there is a similar frequency of NDVI values over the range of NDVI values classes for On RoW FMUs and Off RoW comparable areas. This demonstrates similar soil productivity On RoW and Off RoW.

Figure B.2.1 Frequency of 2019 NDVI Values for On RoW and Off RoW



The quartile box plots for On RoW and Off RoW display the ranges (between minimum and maximum values shown by the "whiskers") are fairly similar between On RoW FMUs and Off RoW comparable areas. The median value (centre of box) as well as the first quartile (25th percentile) and third quartile (75th percentile) are also similar between On RoW FMUs and Off RoW comparable areas. When the box plot for NDVI differences is examined, it shows the median is zero and 50% of the data (between 25th and 75th percentile) are in a very tight range (narrow distribution), while the maximum and minimum values are much wider ranging, particularly in the positive direction (suggests "extreme" values).

Figure B.2.2 Quartile Box Plots for 2019 NDVI Values for On RoW FMUs, Off RoW Comparable Areas, and for NDVI Differences Values

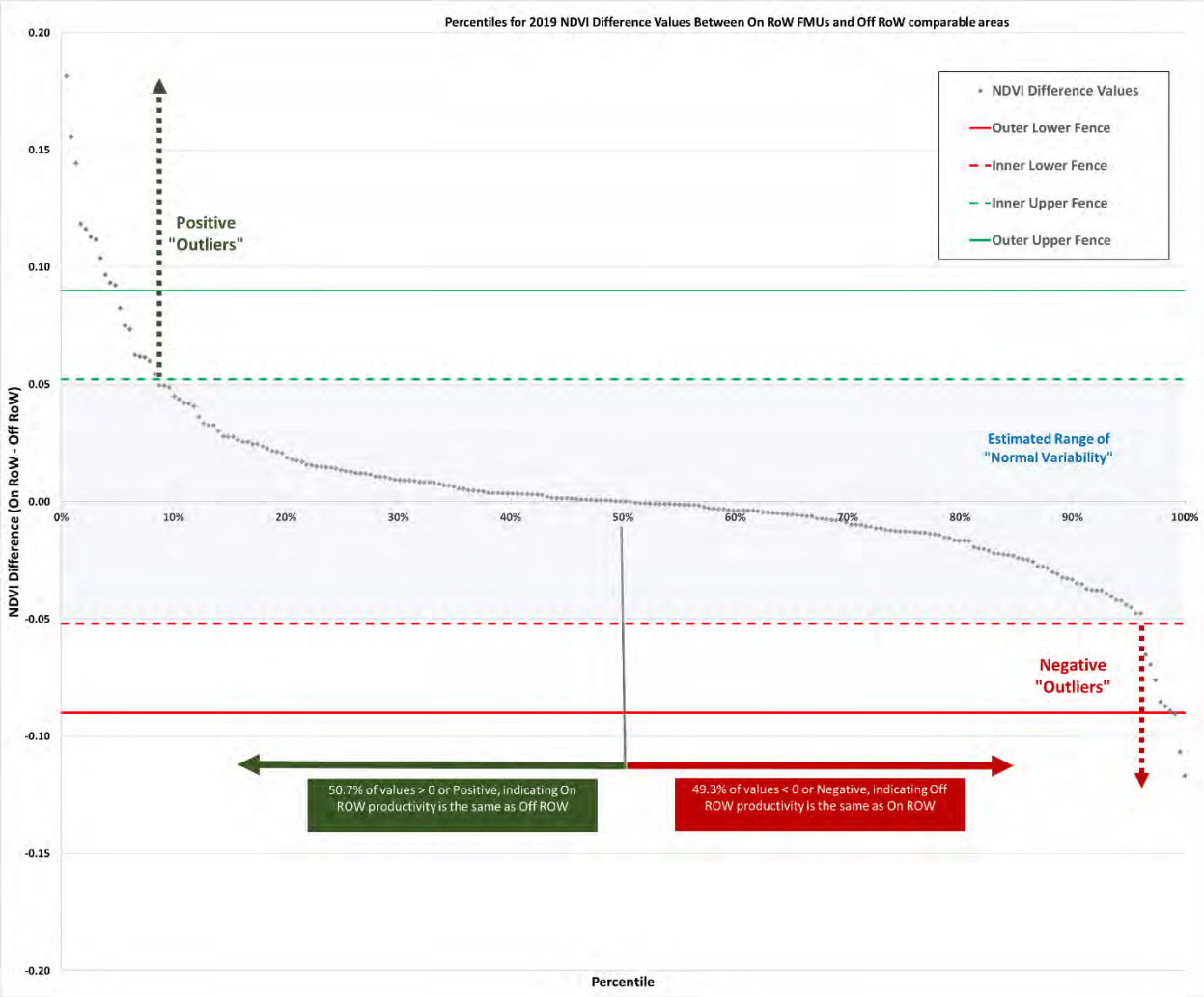


The frequency of difference values is displayed in columns (blue bars) relative to the:

- *normal distribution curve (orange line; based on actual data around the actual mean value of 0.004), and,*
- *"expected" normal distribution curve (grey line; assumed mean difference of 0 and same shape of curve as the actual normal distribution).*

These data demonstrate that the actual difference values are a very close fit to the expected normal distribution.

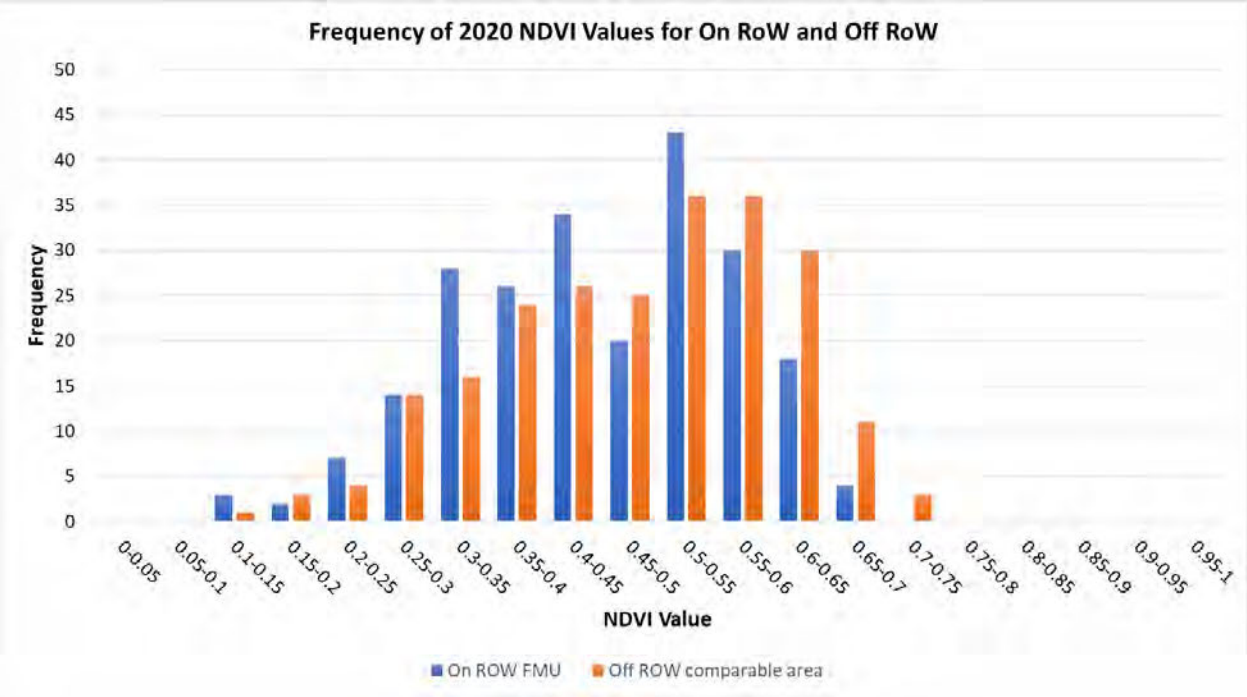
Figure B.2.3 Distribution of 2019 NDVI Differences Between On RoW FMUs and Off RoW Comparable Areas



The percentiles chart provides a visual display of the difference values for individual FMUs. Approximately 51% of differences were found to be positive (On RoW FMU – Off RoW comparable area = >0), while 49% were found to be negative (On RoW FMU – Off RoW comparable area = <0). This is further evidence of the similarity of the data. The estimated range of "normal variability" around an expected difference of 0 is estimated to be -0.052 to +0.052. Therefore, values above 0.052 can be considered "positive outliers" while values below -0.052 can be considered "negative outliers". Approximately 3.9% of On RoW FMUs (13) are considered in the "positive outlier" range, while 4.8% of On RoW FMUs (16) are considered in the "negative outlier" range.

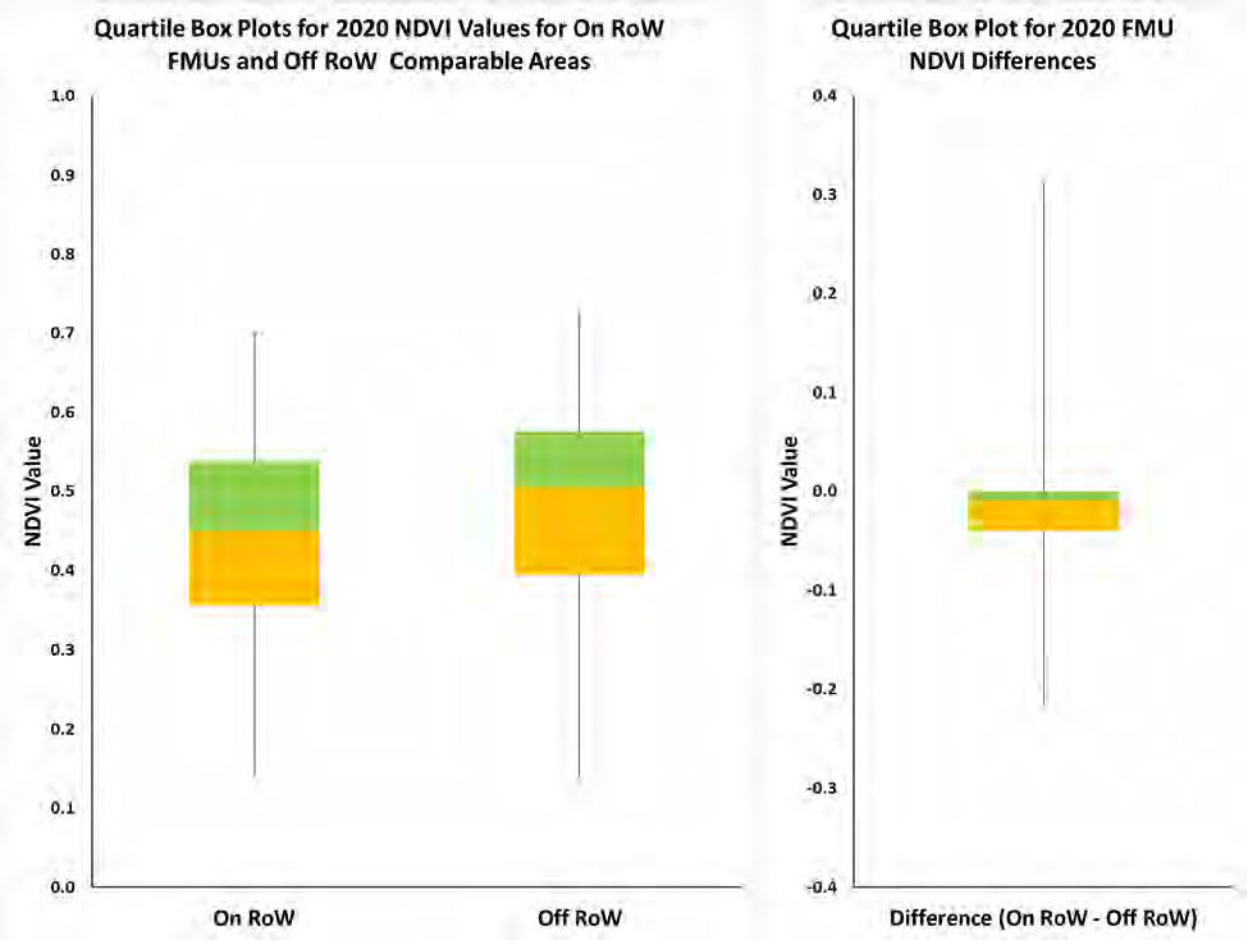
Figure B.2.4 Percentiles for 2019 NDVI Differences Between On RoW FMUs and Off RoW Comparable Areas

B.2.2 Post-Construction Year 1 (2020)



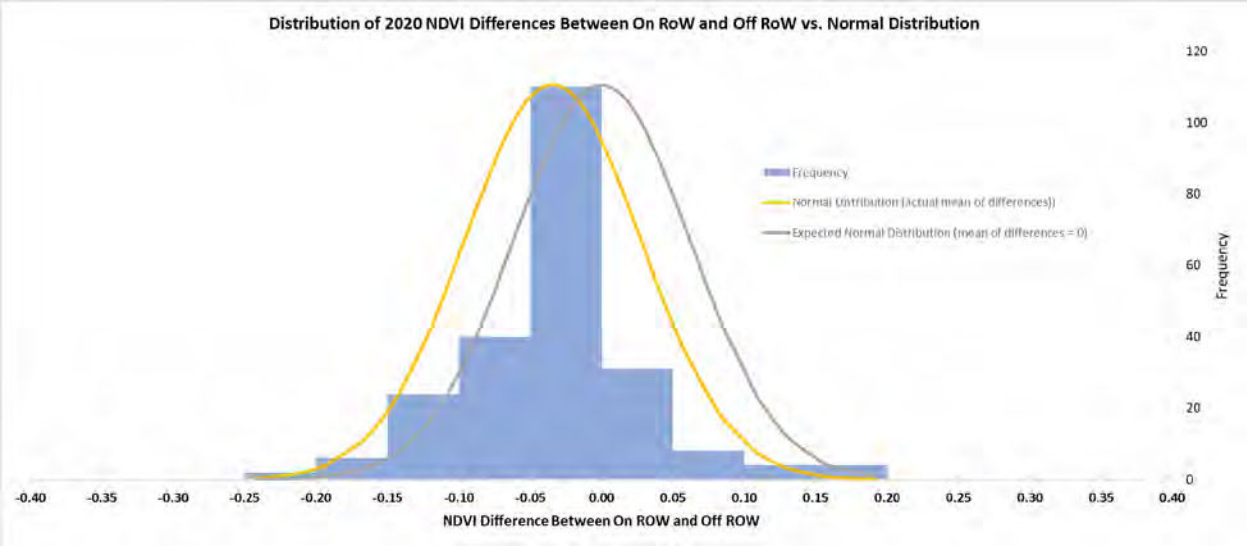
The frequency histogram above shows that there is a higher frequency of NDVI values in lower NDVI value classes for On RoW FMUs relative to Off RoW comparable areas. This demonstrates reduced soil productivity On RoW relative to Off RoW.

Figure B.2.5 Frequency of 2020 NDVI Values for On RoW and Off RoW



The quartile box plots for On RoW and Off RoW indicate that the ranges (between minimum and maximum values shown by the "whiskers") are similar for On RoW FMU and Off RoW comparable areas. However, the median value (centre of box) as well as the first quartile (25th percentile; orange) and third quartile (75th percentile; green) are lower for On RoW FMUs than Off RoW comparable areas. When the box plot for NDVI differences is examined, it shows the median is below zero and 50% of the data (between 25th and 75th percentile) are below zero, indicating a strong negative skew in the NDVI difference data.

Figure B.2.6 Quartile Box Plots for 2020 NDVI Values for On RoW FMUs, Off RoW Comparable Areas, and for NDVI Differences Values

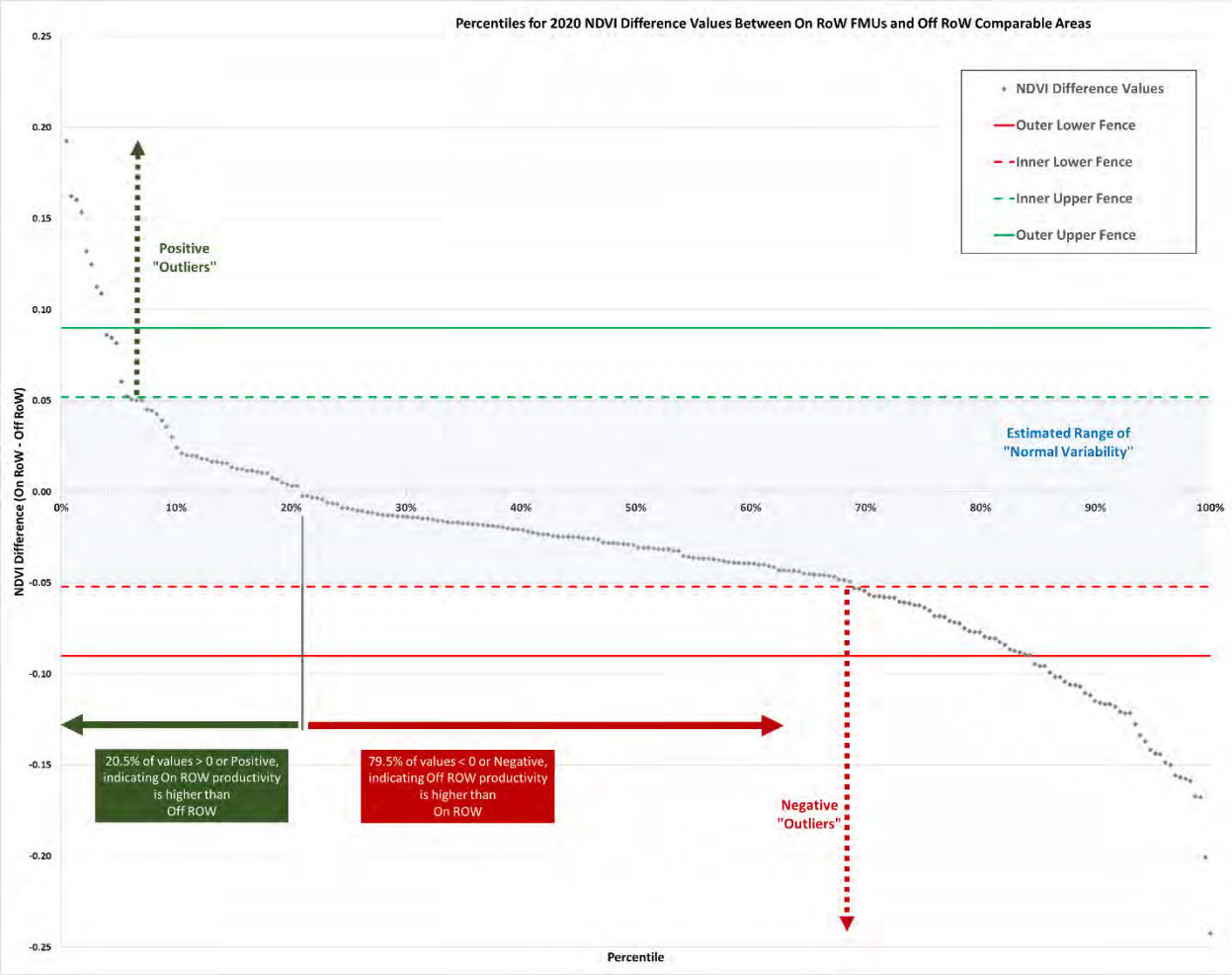


The frequency of difference values is displayed in columns (blue bars) relative to the:

- *normal distribution curve (orange line; based on actual data around the actual mean value of -0.034), and,*
- *"expected" normal distribution curve (grey line; assumed mean difference of 0 and same shape of curve as the actual normal distribution).*

These data demonstrate that the actual difference values shifted in the negative difference direction relative to the expected normal distribution.

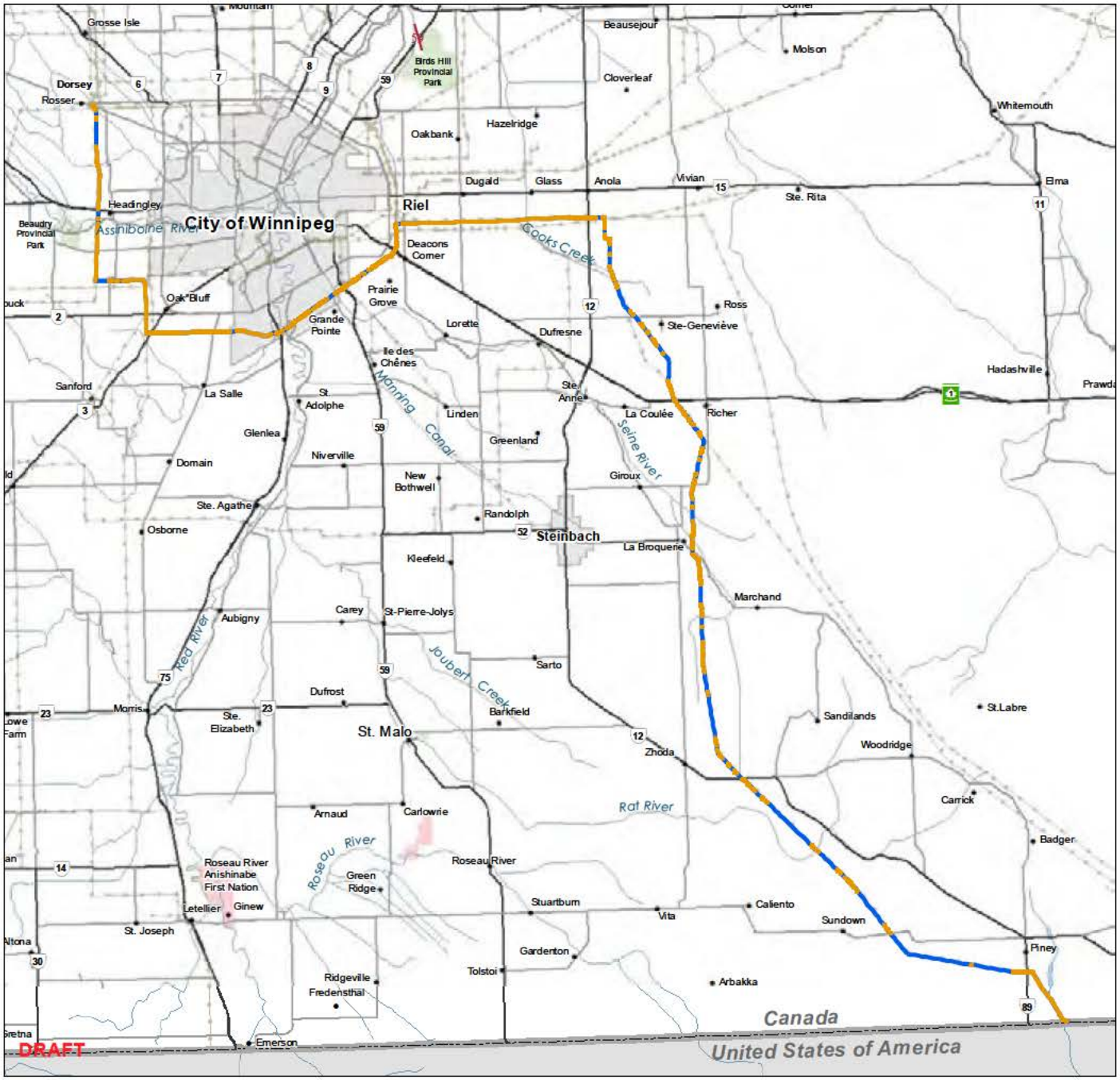
Figure B.2.7 Distribution of 2020 NDVI Differences Between On RoW FMUs and Off RoW Comparable Areas



The percentiles chart provides a visual display of the difference values for individual FMUs. Approximately 19.0% of differences were found to be positive (On RoW FMU – Off RoW comparable area = >0), while 81.0% were found to be negative (On RoW FMU – Off RoW comparable area = <0). This is further evidence of the negative skewness of the data. The estimated range of "normal variability" around an expected difference of 0 is estimated to be -0.052 to +0.052. Therefore, values above 0.052 can be considered "positive outliers" while values below -0.052 can be considered "negative outliers". Based on this analysis there are many more "negative outliers" than "positive outliers". Approximately 23.1% of On RoW FMUs (78) are considered in the "negative outlier" range, while 3.3% of On RoW FMUs (11) are considered in the "positive outlier" range.

Figure B.2.8 Percentiles for 2019 NDVI Differences Between On RoW FMUs and Off RoW Comparable Areas

Appendix C MAPBOOK



Stantec

Legend

- Manitoba-Minnesota Transmission Line
- Agricultural Land Use Along the Transmission Line
- Provincial Highway
- Provincial Road
- Existing Transmission Lines
- Community
- First Nation Lands
- Provincial Park
- City

N

0 10 20 km

(At original document size of 8.5x11)
1:700,000

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Government of Manitoba, Government of Canada, Manitoba Hydro
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Project Location
Winnipeg,
Manitoba

Prepared by JH on 2021-05-15
TR by DW on 2021-05-15
IR Review by ABC on 2021-05-15

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Performance & Crop Performance Monitoring

111477020-003 REVB

Figure No.
1.1

Title
Manitoba Minnesota Transmission Line - Project Overview

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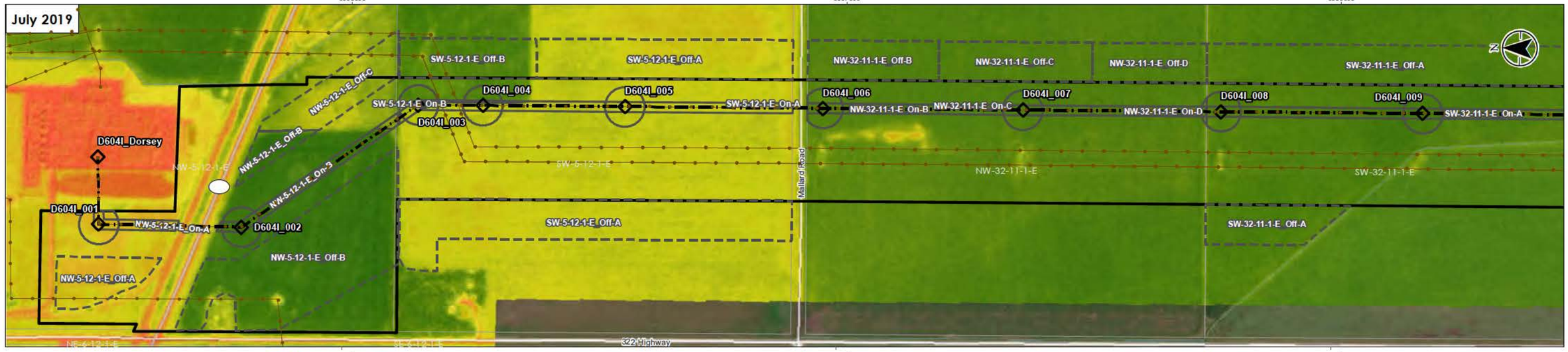

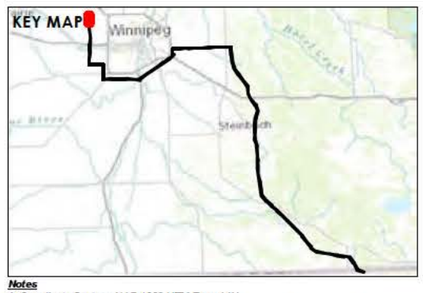

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1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

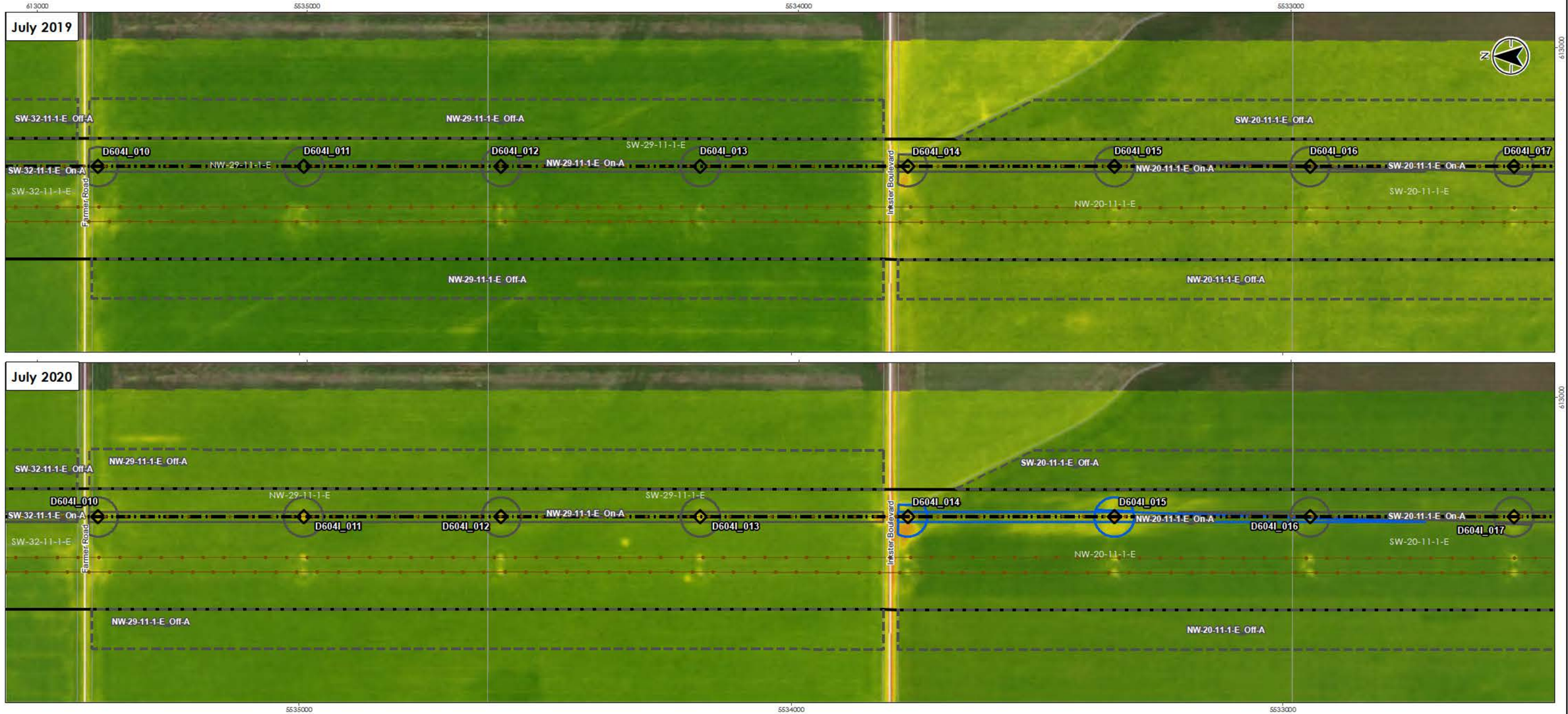
Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

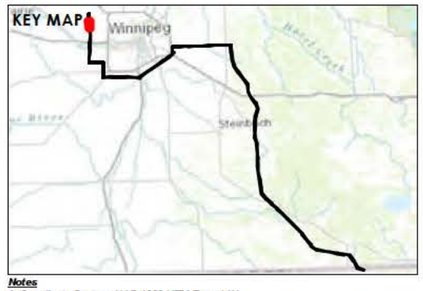
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-1

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020





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1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

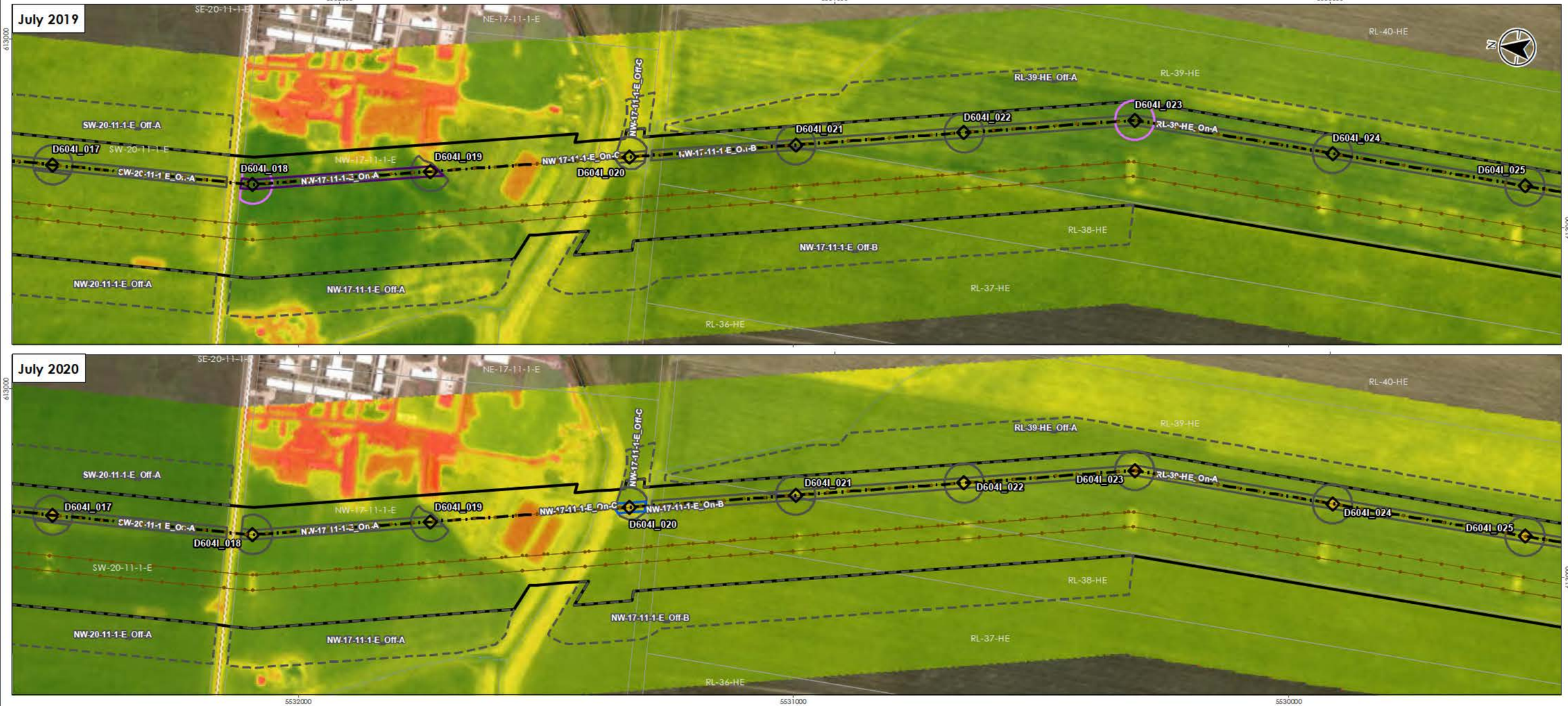
Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-2

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Local Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Stantec

Project Location
Near Winnipeg
Manitoba

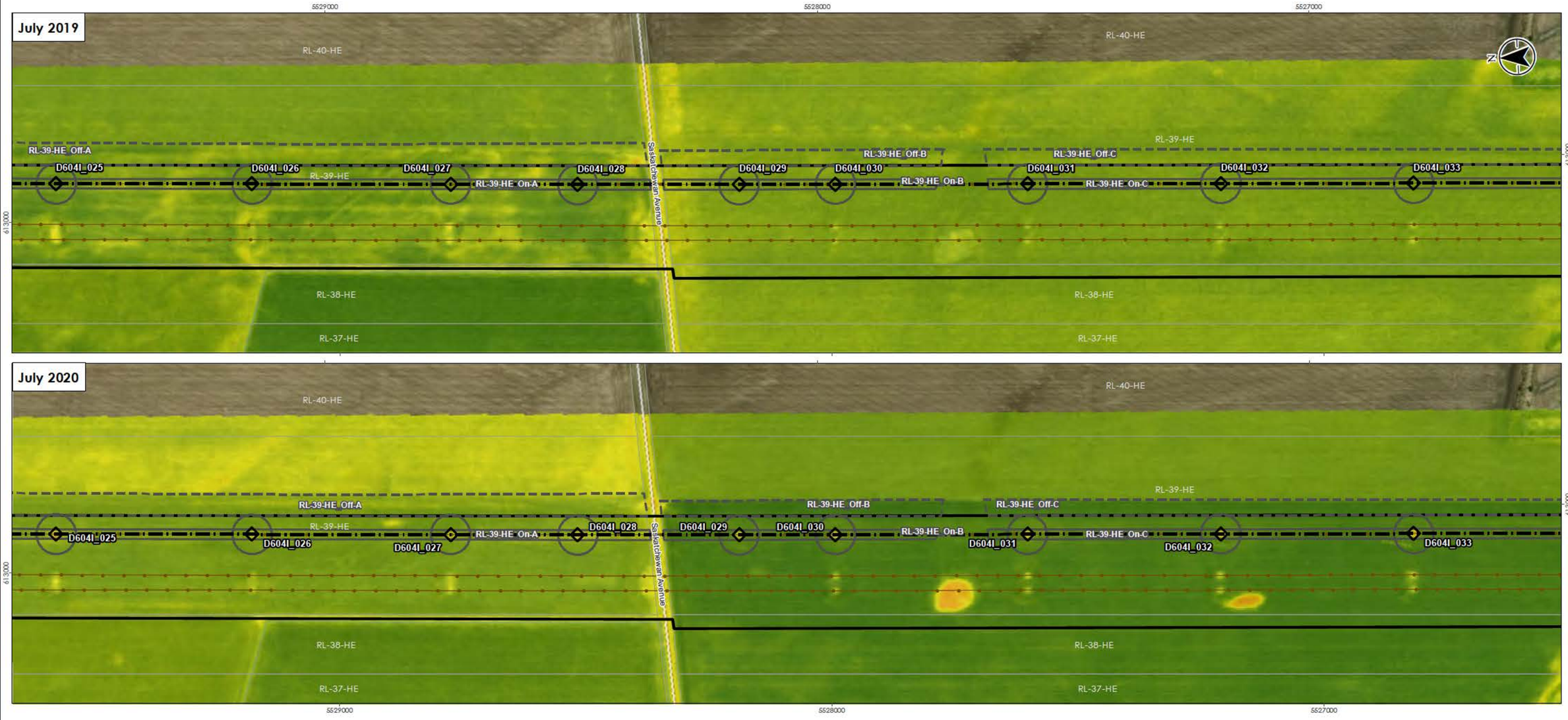
Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

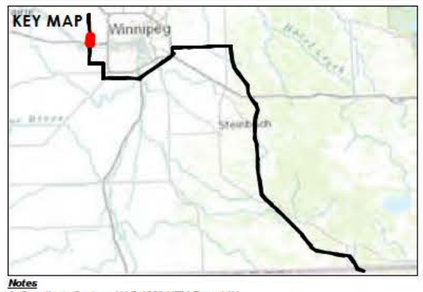
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-3

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020





Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-4

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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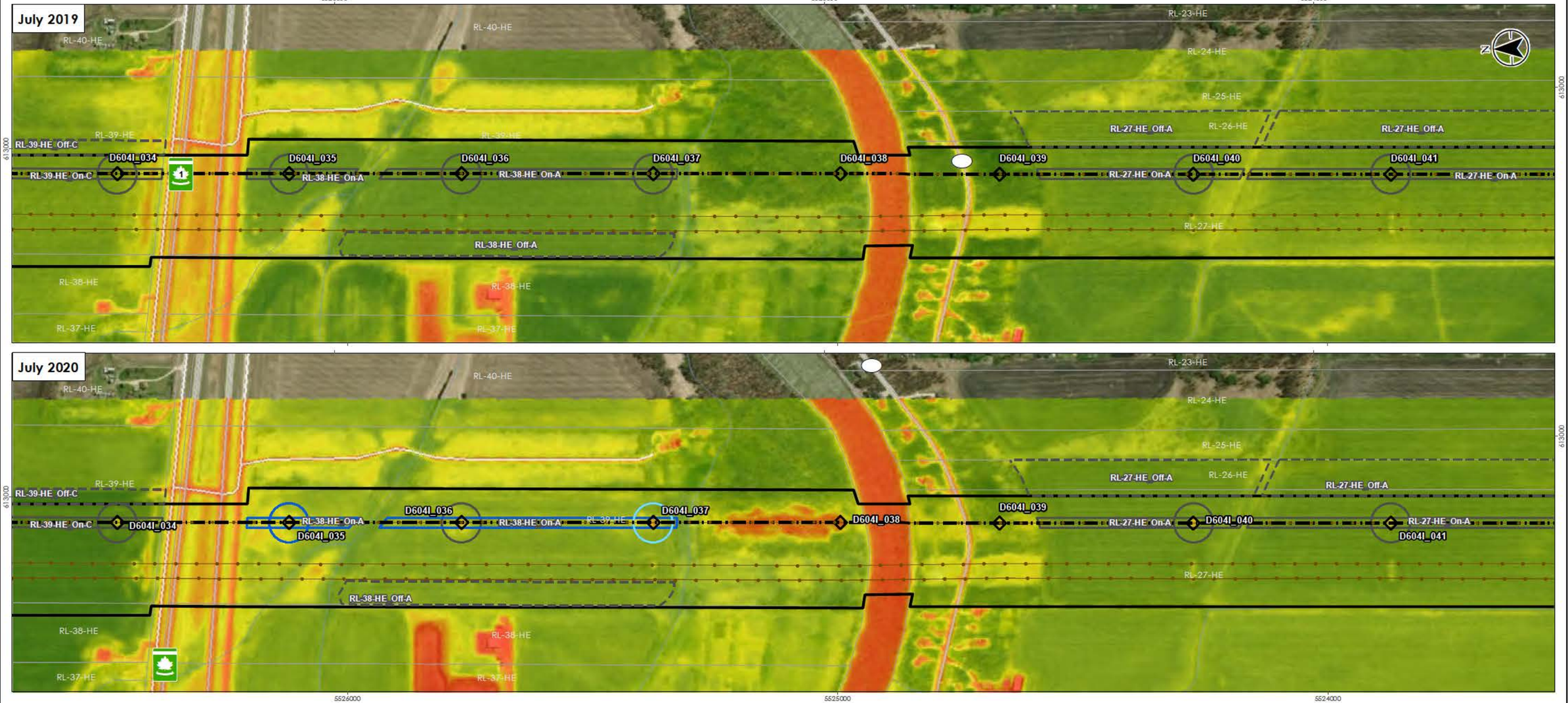

KEY MAP

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

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2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-5

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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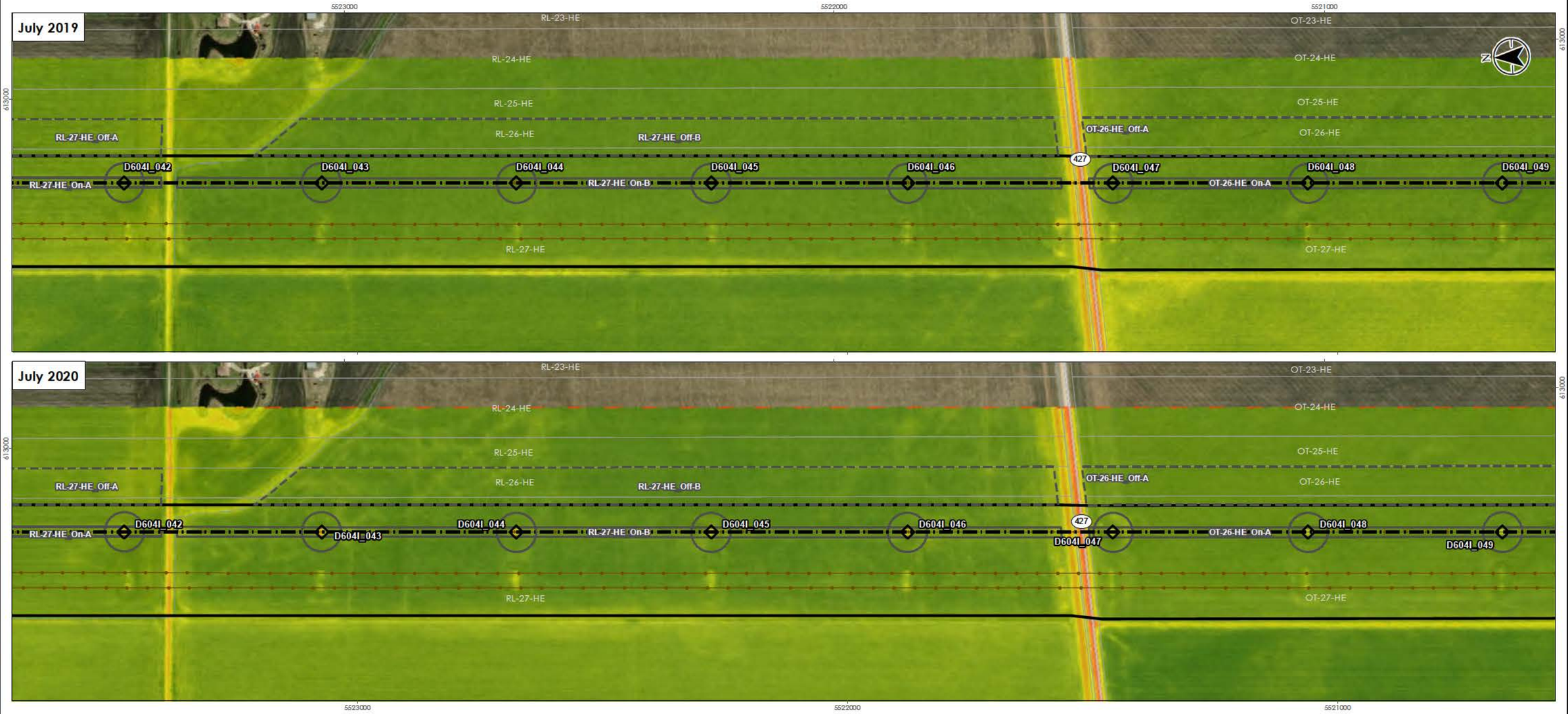
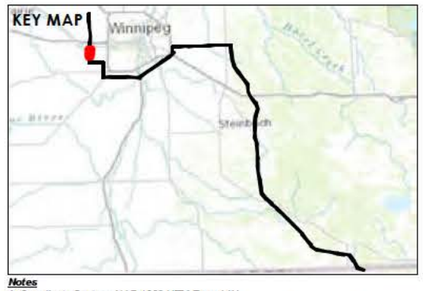


KEY MAP



Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

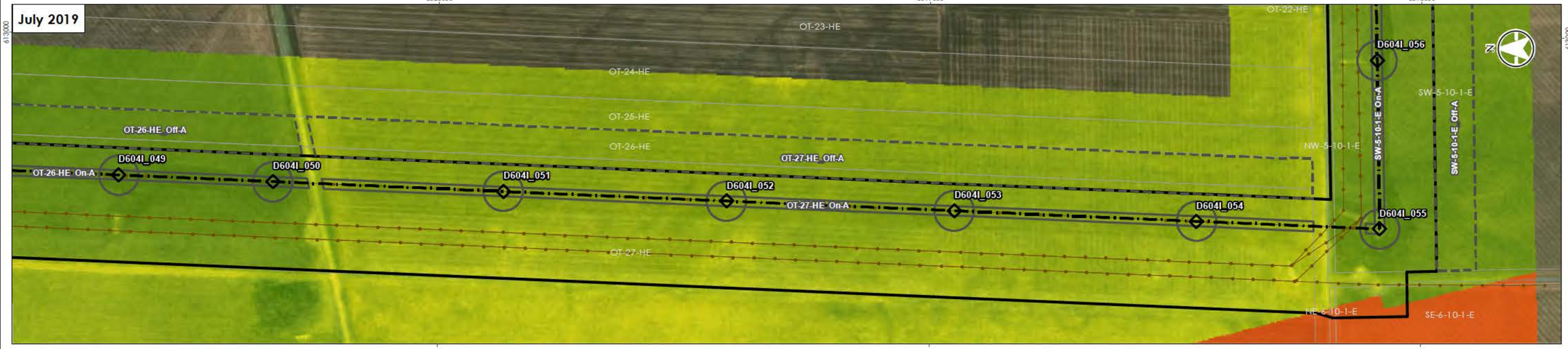
111477020-002-REVC

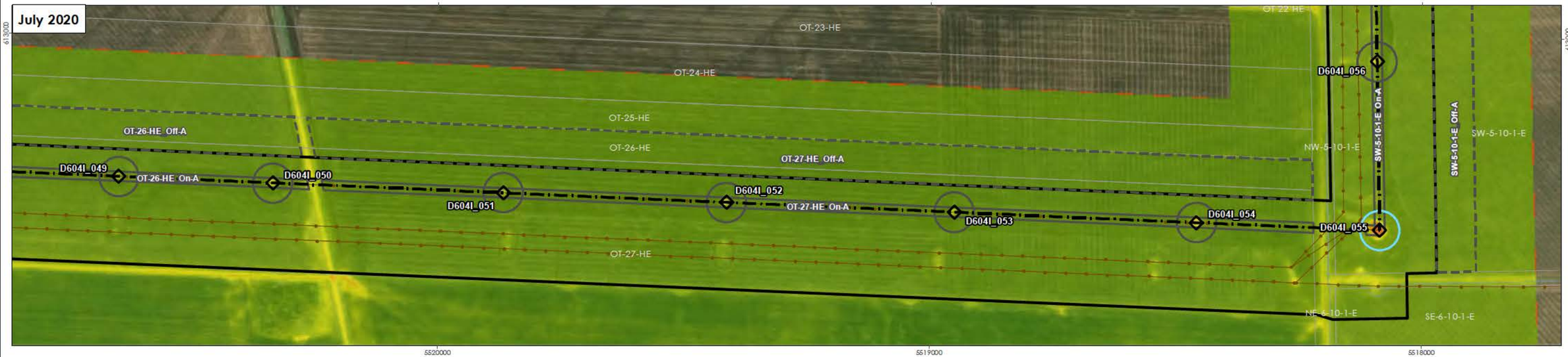
Map No.

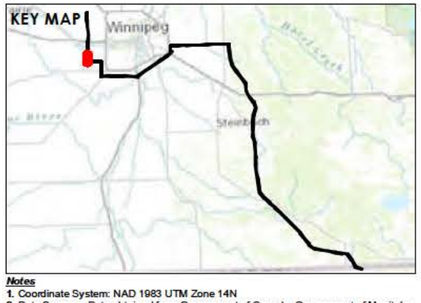
C.2-6

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

G:\GIS_Project_Folder\00_Hydro\111477020_MMTP_Soil_Crop_Biosecurity_Monitoring\figures\111477020_002_REVC_NDVI_Mapbook.mxd Revised: 2021-05-16 By: JHilbert







Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

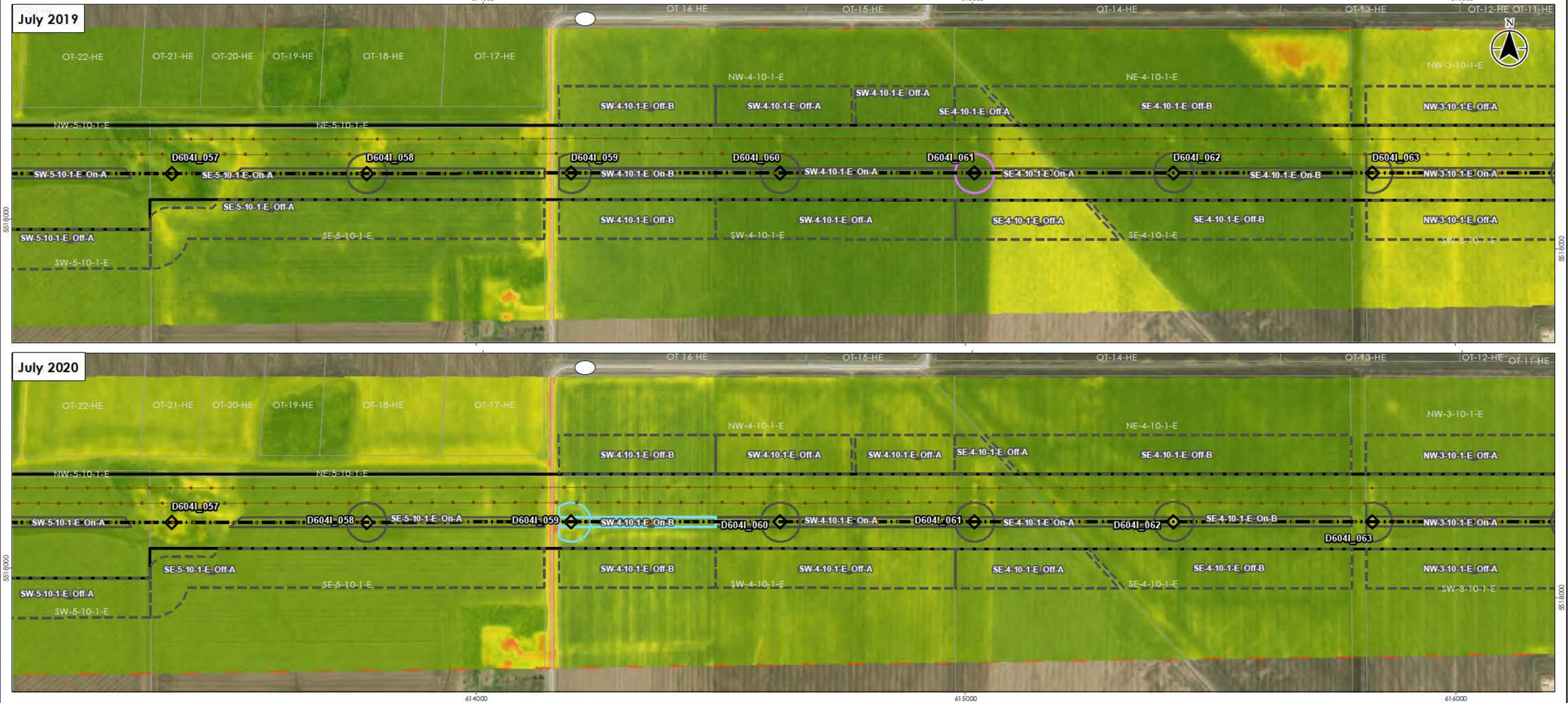
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

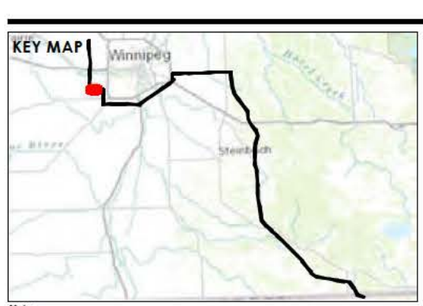
111477020-002-REVC

Map No.
C.2-7

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

G:\GIS_Project_Folder\00_Hydro\111477020_MMTP_Soil_Crop_Biosecurity_Monitoring\figures\111477020_002_REVC_NDVI_Mapbook.mxd Revised 2021-05-16 By JHilbert





Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Stantec

Project Location
Near Winnipeg
Manitoba

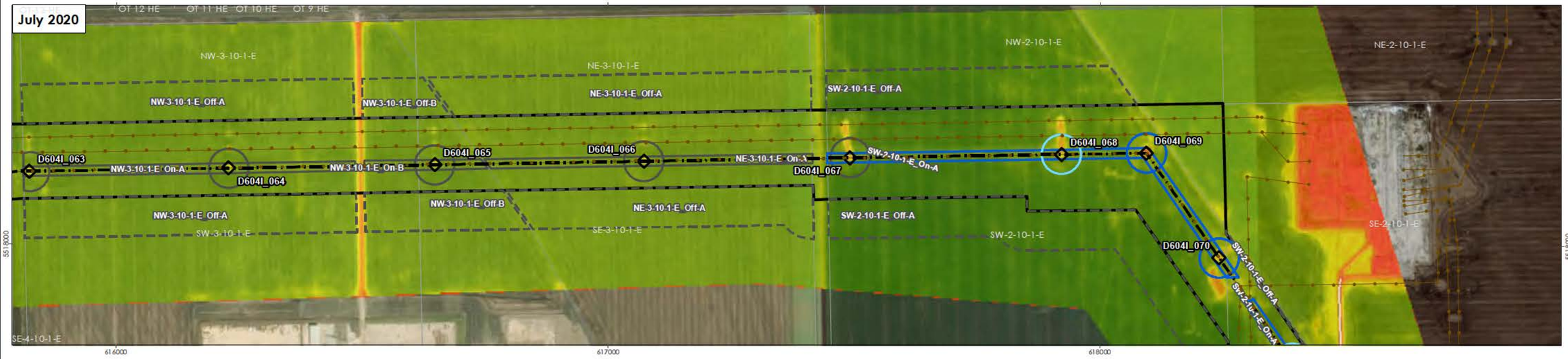
Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-8

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

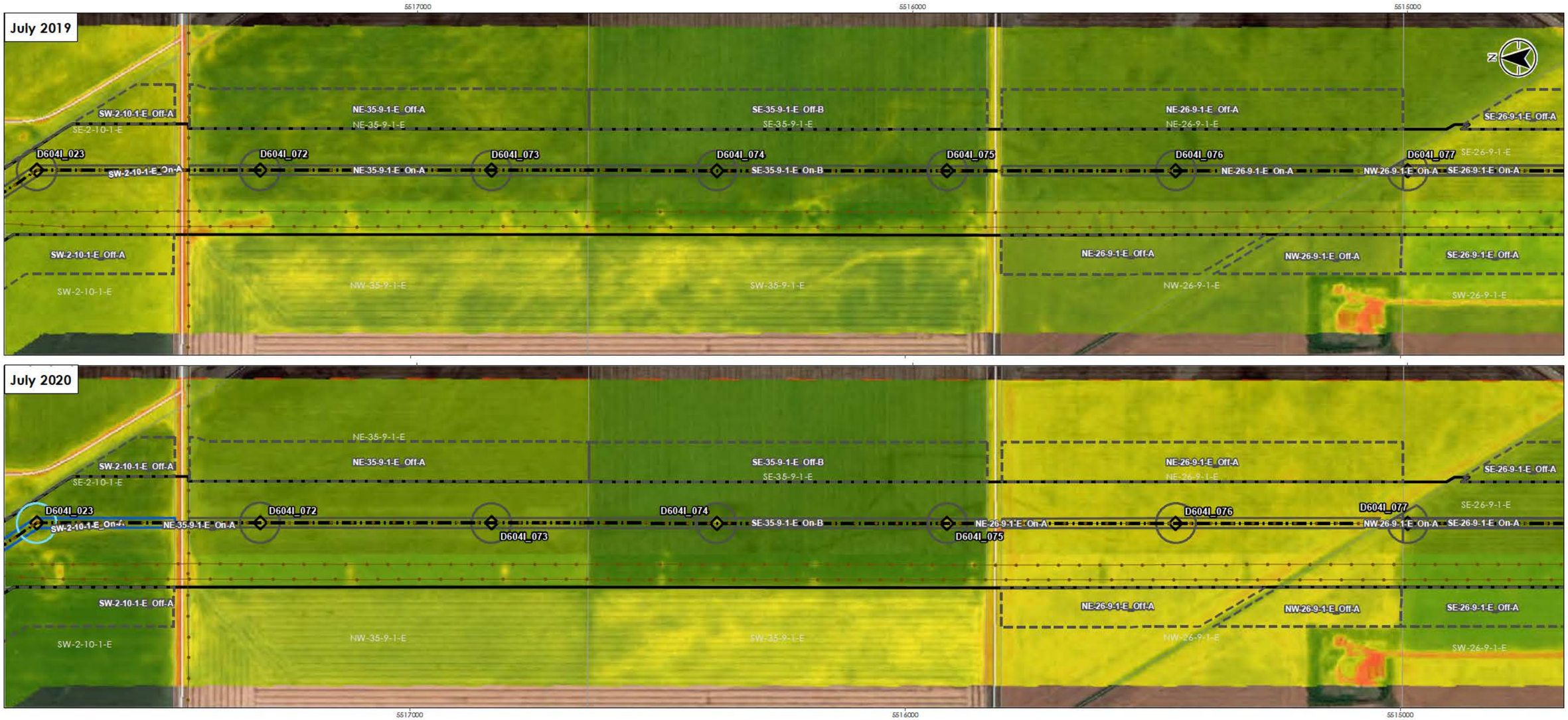
Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

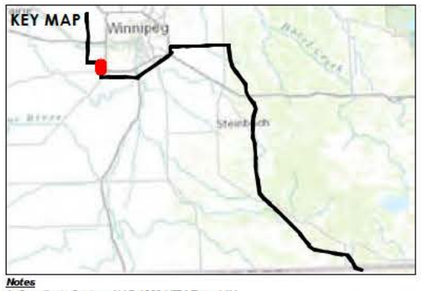
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-9

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020





Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

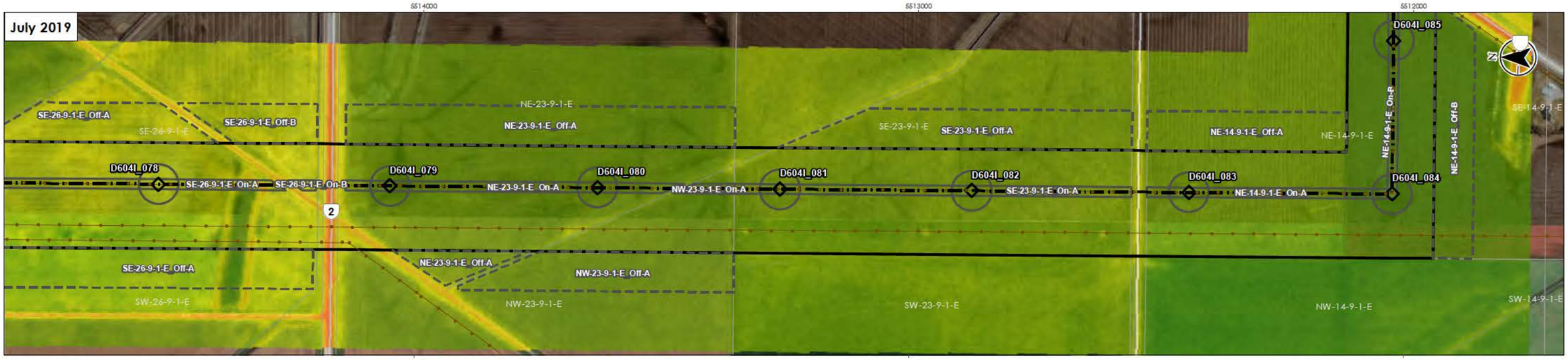
Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

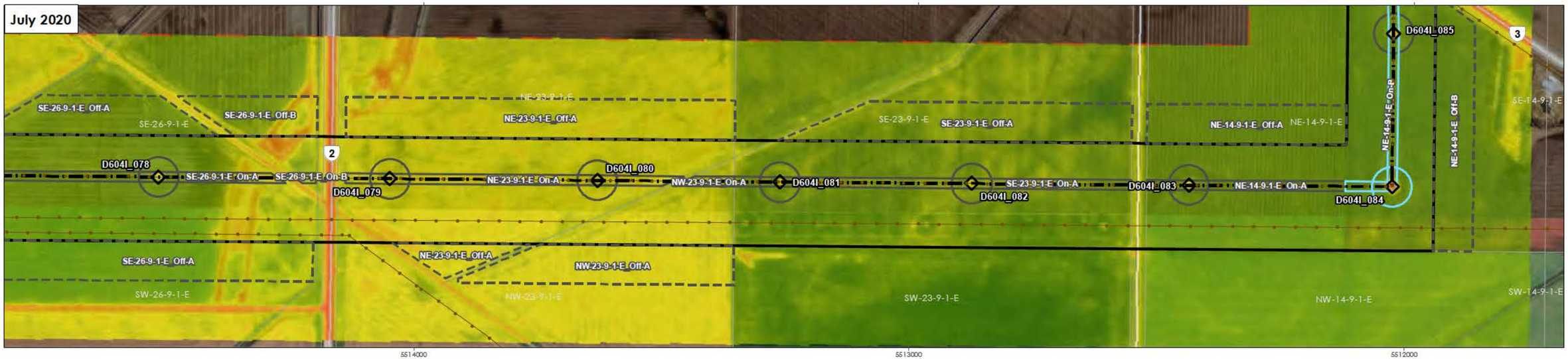
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-10

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020





Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
111477020-002-REVC

Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.

C.2-11

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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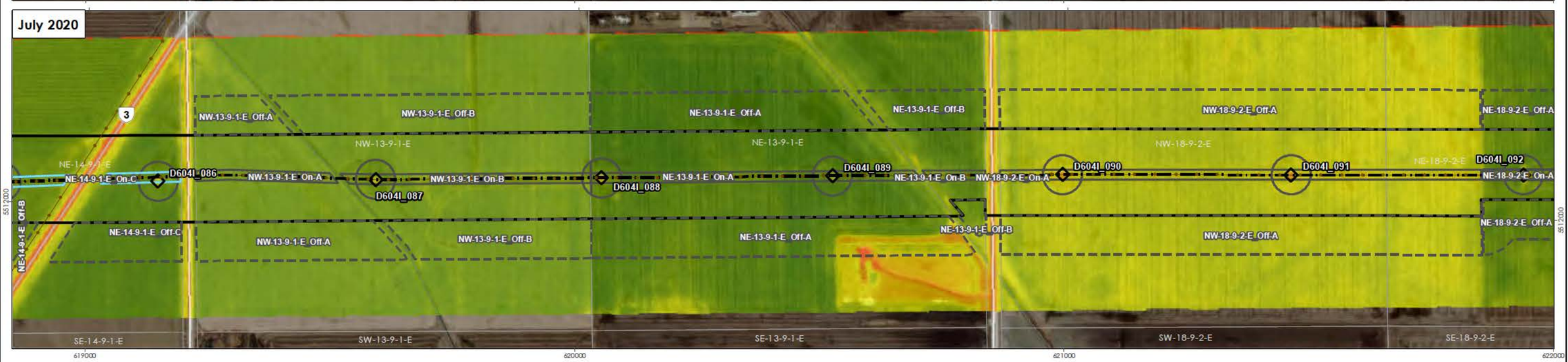

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-12

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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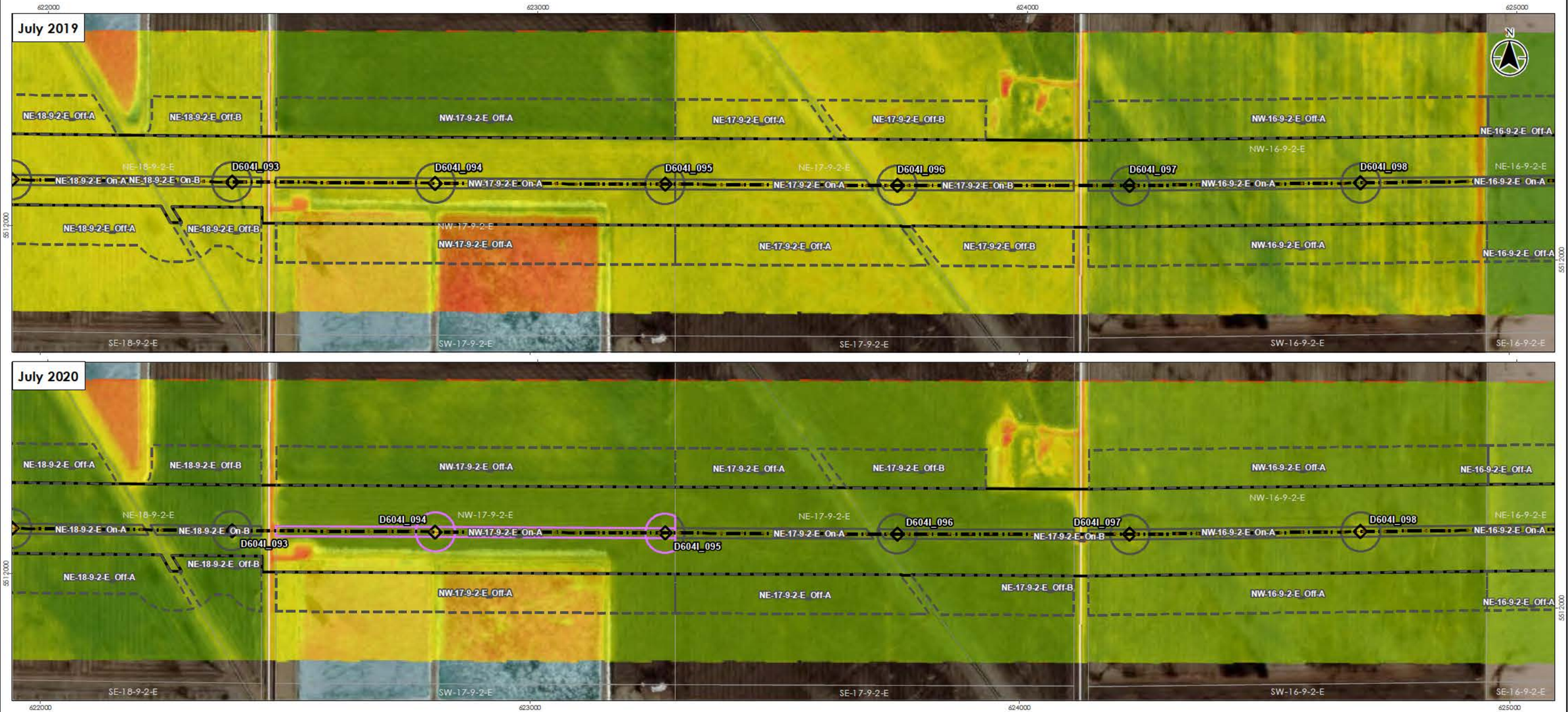

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

High: 1.0

Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project 111477020-002-REVC
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.
C.2-13

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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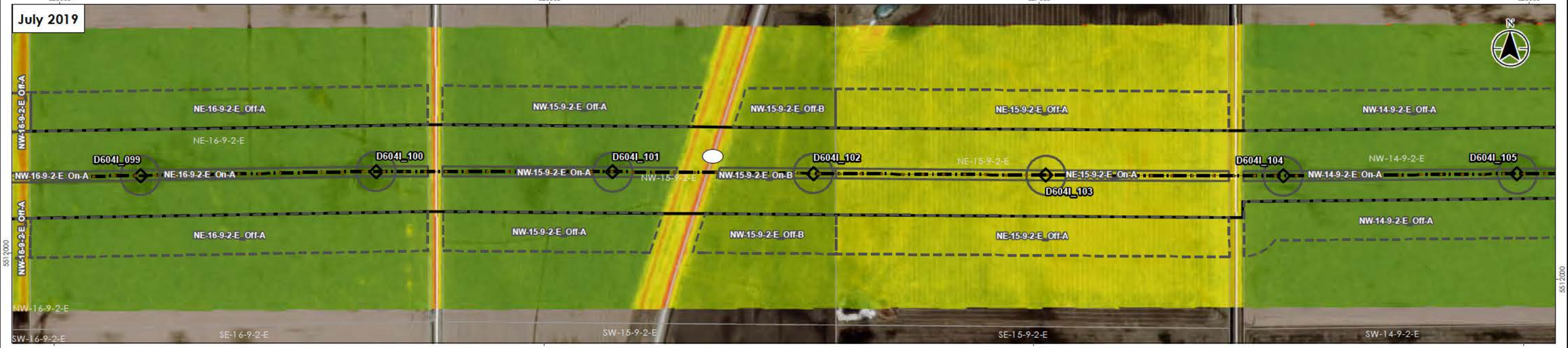

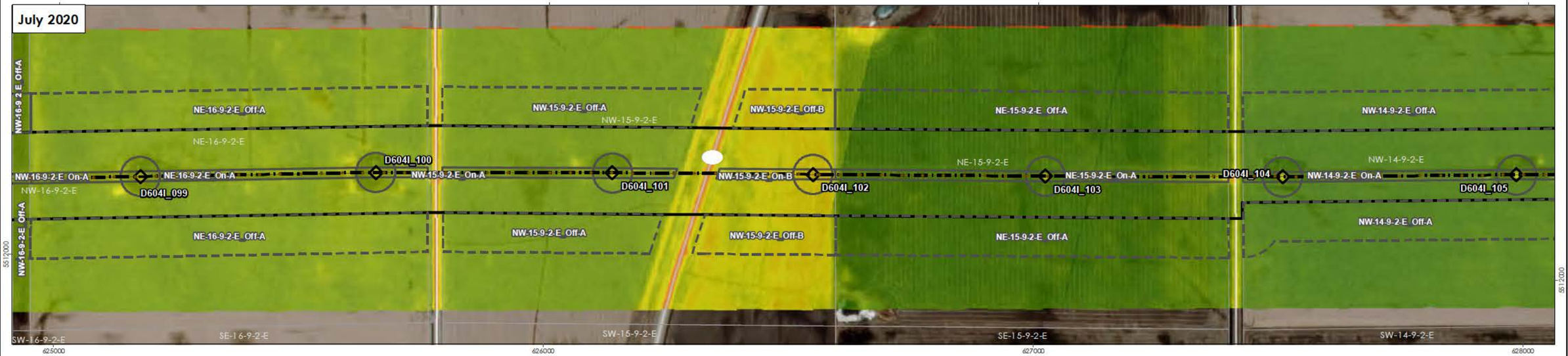

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-14

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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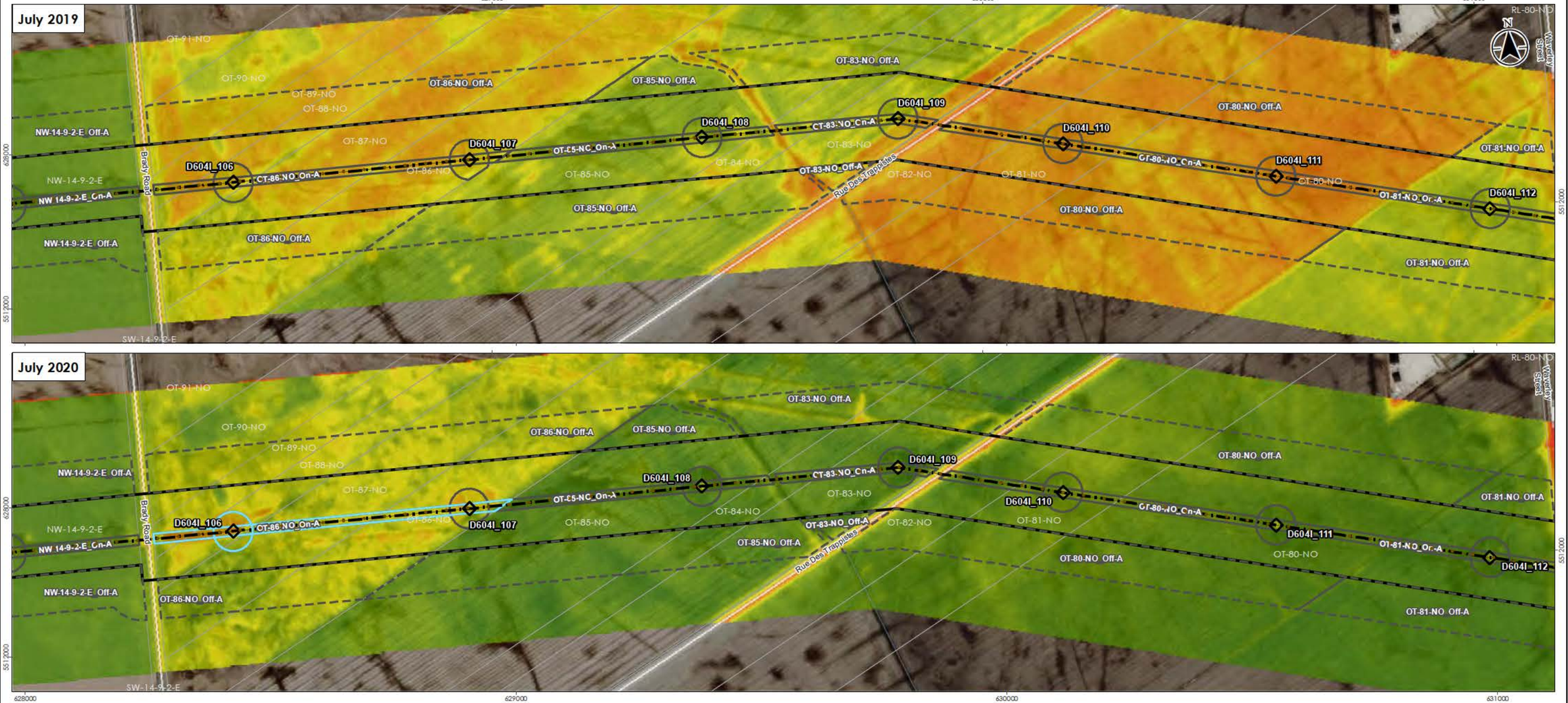

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

High: 1.0

Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-15

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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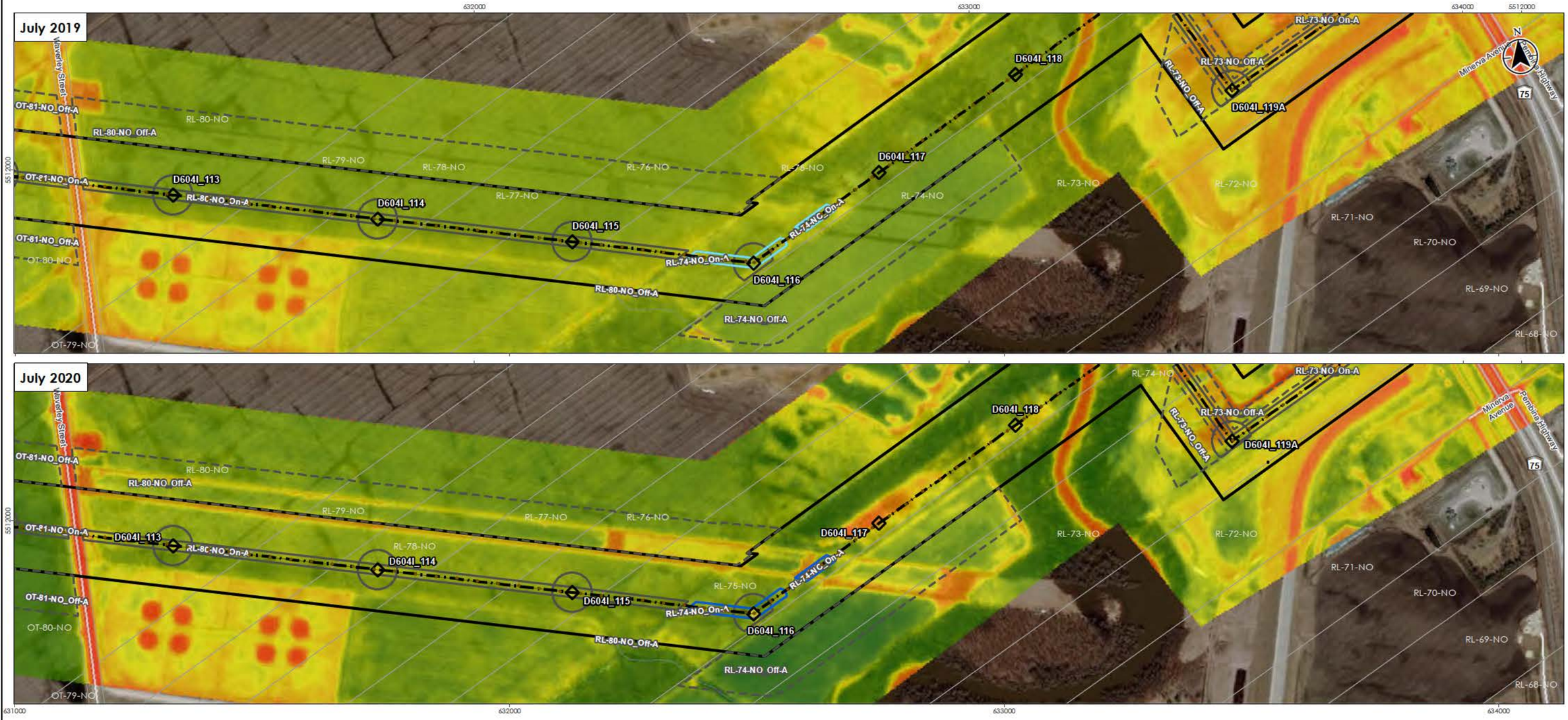

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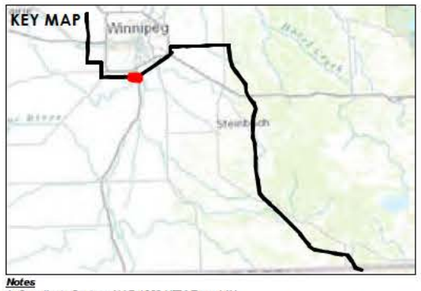

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

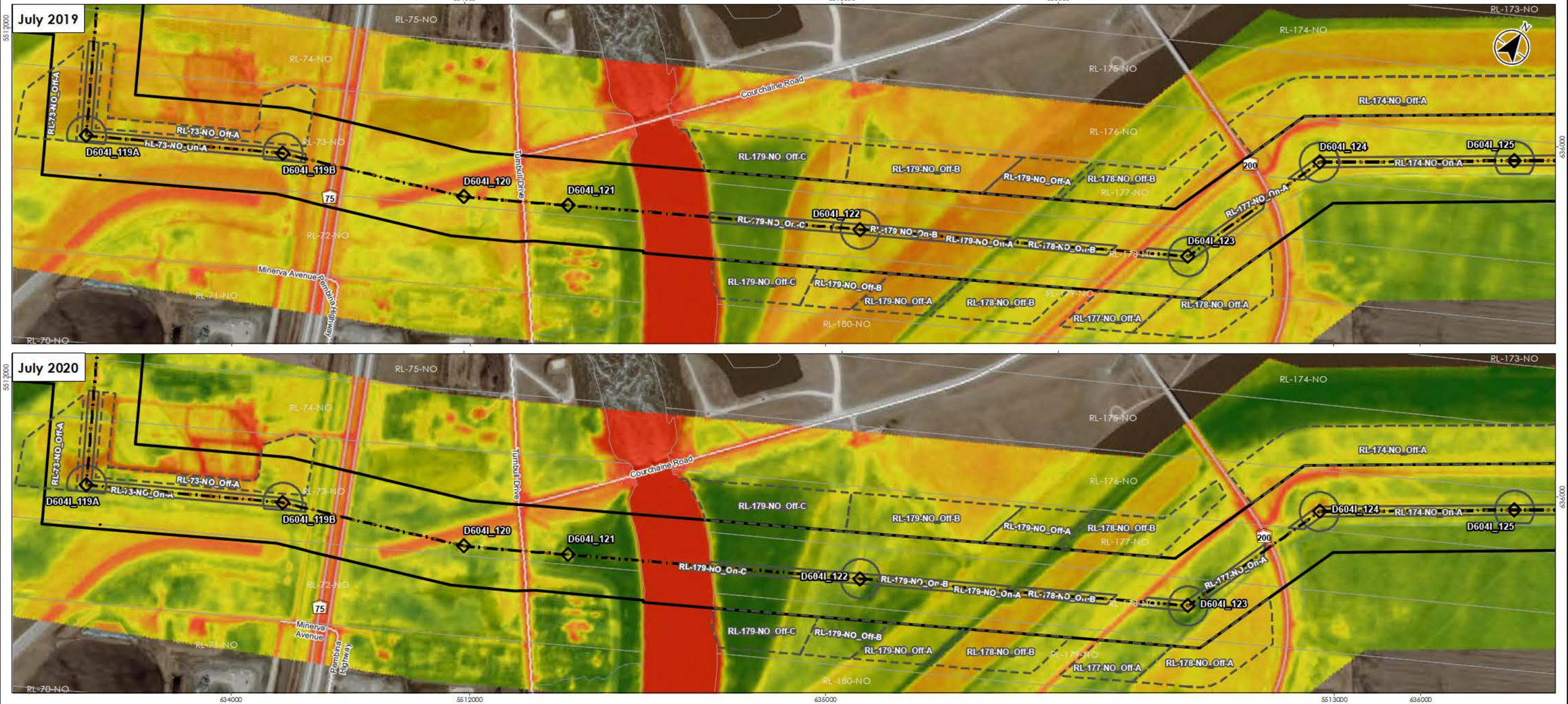
Client/Project
111477020-002-REVC

Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.

C.2-16

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-17

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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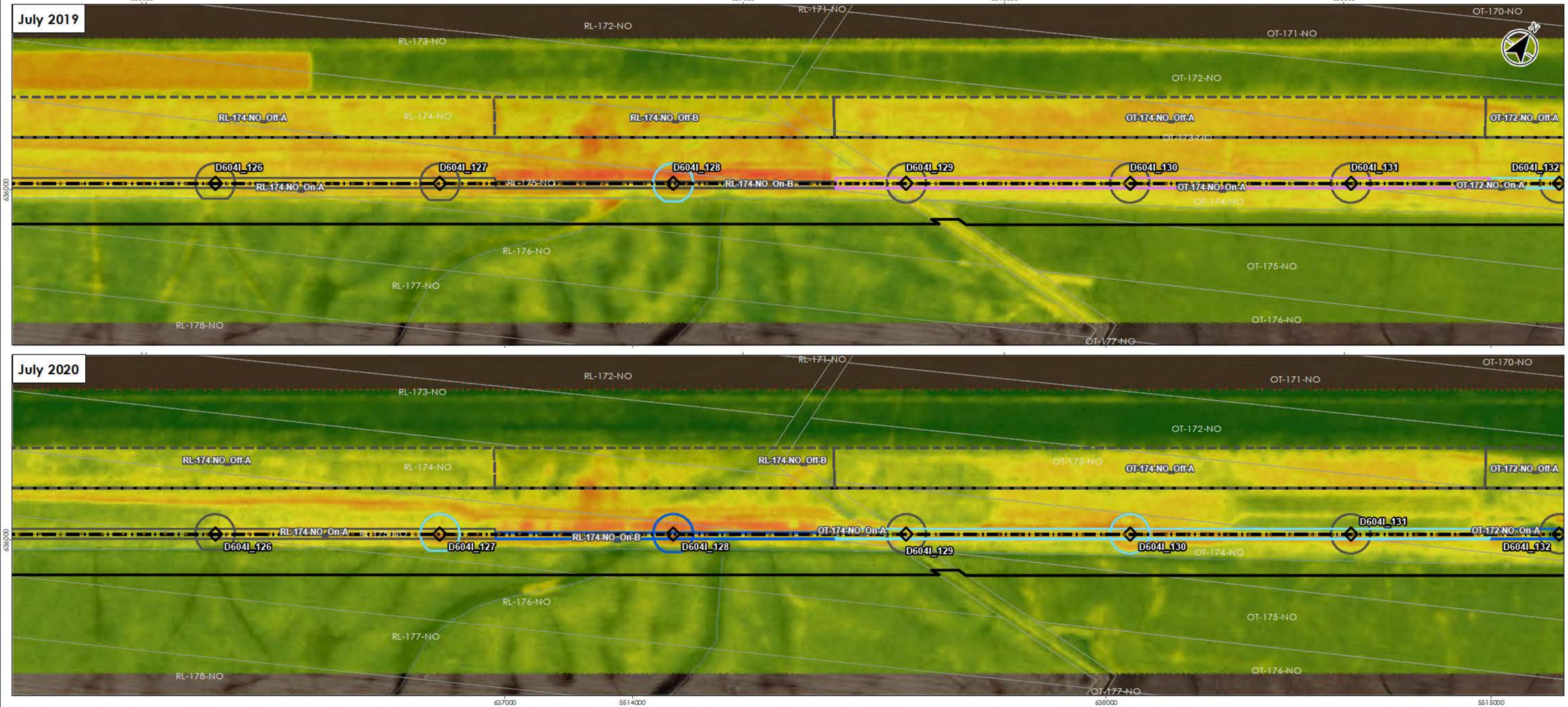

KEY MAP

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Quarter Sections
- Watercourse

0 125 250 metres

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Stantec

Project Location
Near Winnipeg
Manitoba

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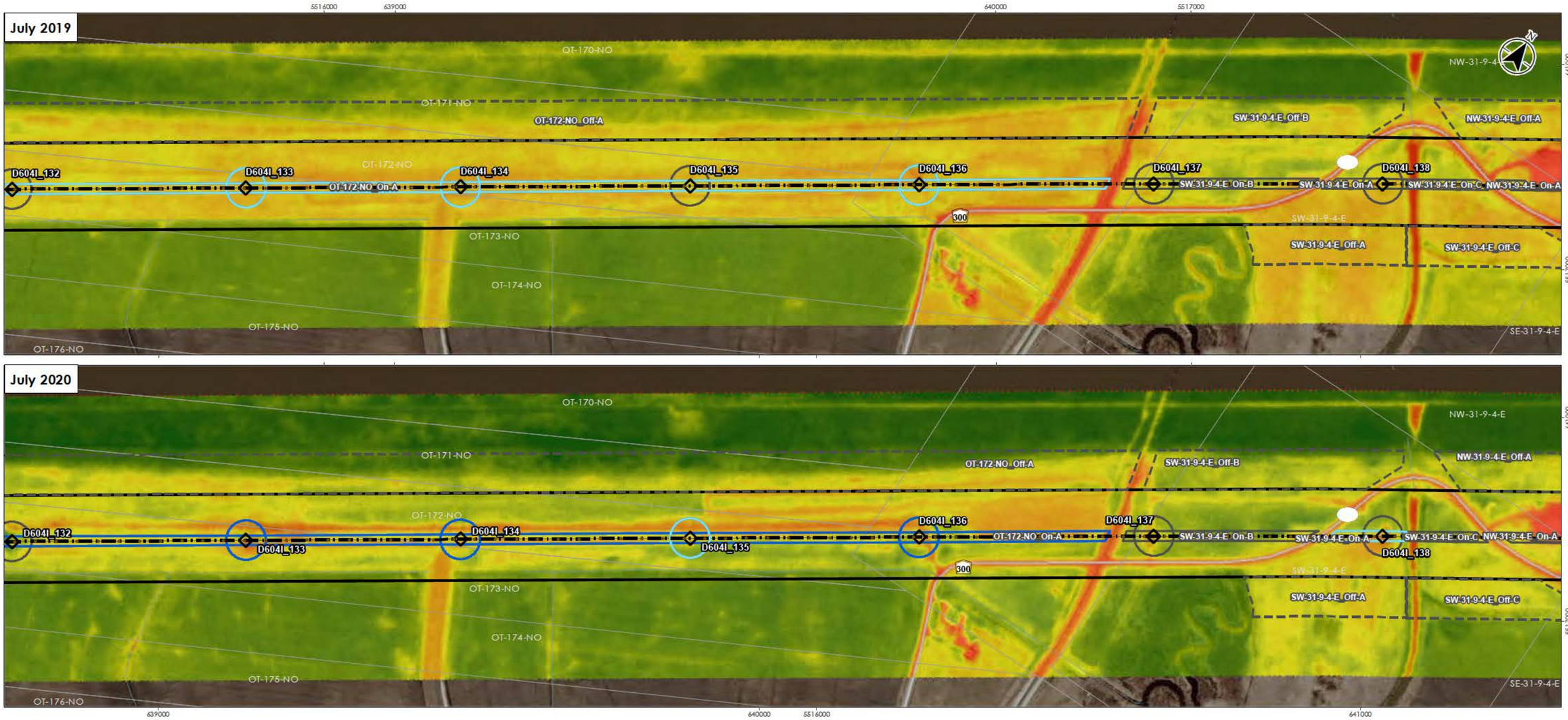
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-18

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



Notes

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

High: 1.0

Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
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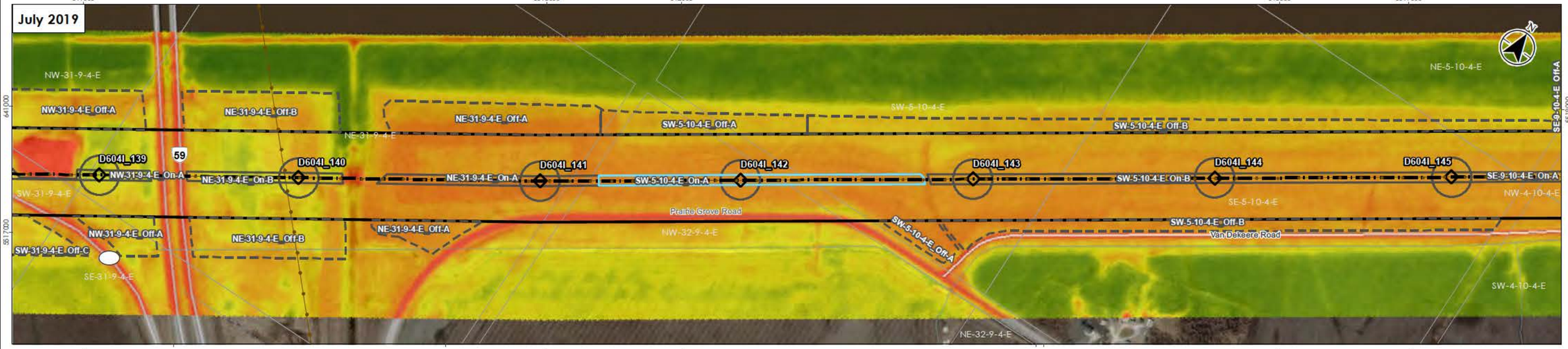
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-19

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
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- Existing Transmission Lines
- Highway
- Major Road
- Local Road
- Quarter Sections
- Watercourse

0 125 250 metres

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Stantec

Project Location
Near Winnipeg
Manitoba

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Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-20

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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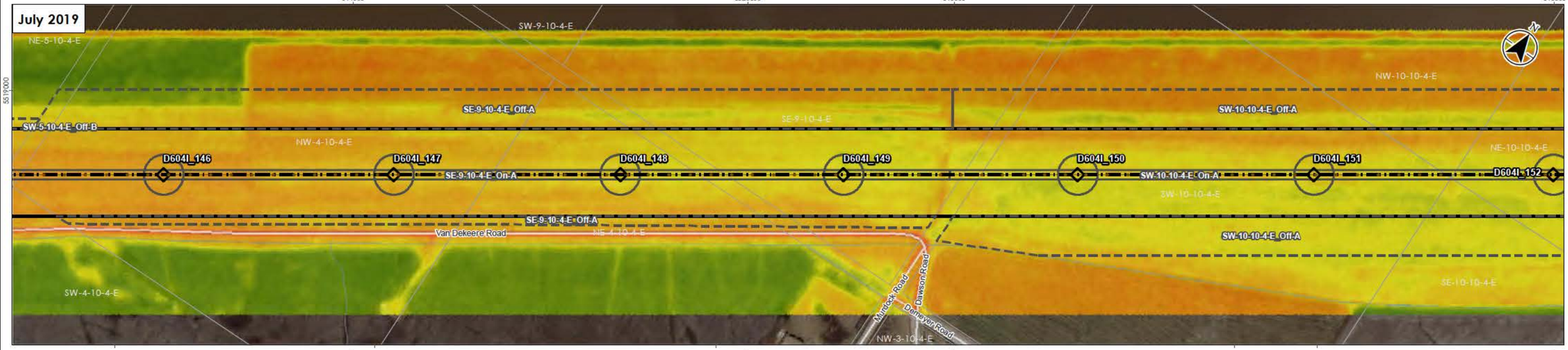
644000 5520000 645000 646000

July 2019



July 2020

644000 5519000 645000 5520000 646000

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

High: 1.0

Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
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- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

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Notes

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Stantec

Project Location
Near Winnipeg
Manitoba

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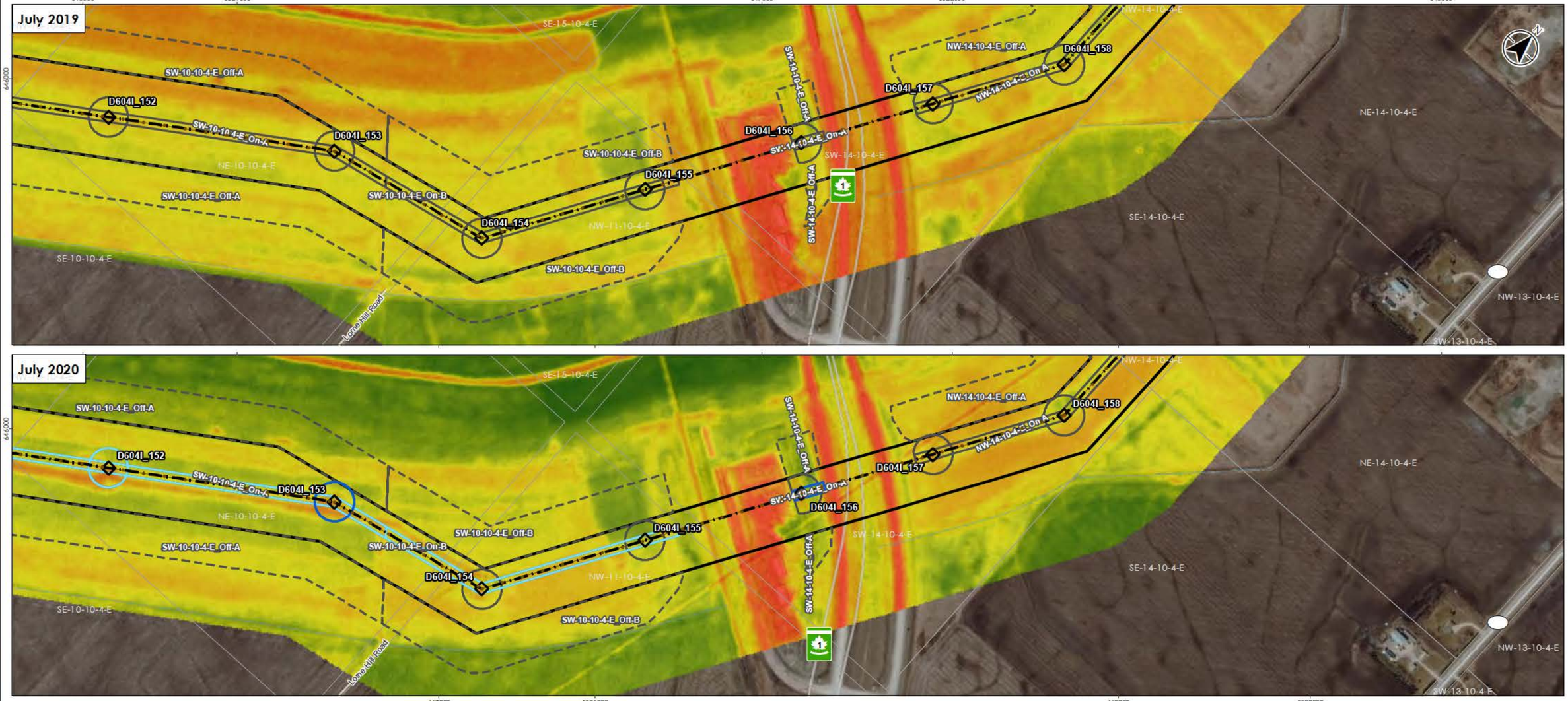
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-21

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-22

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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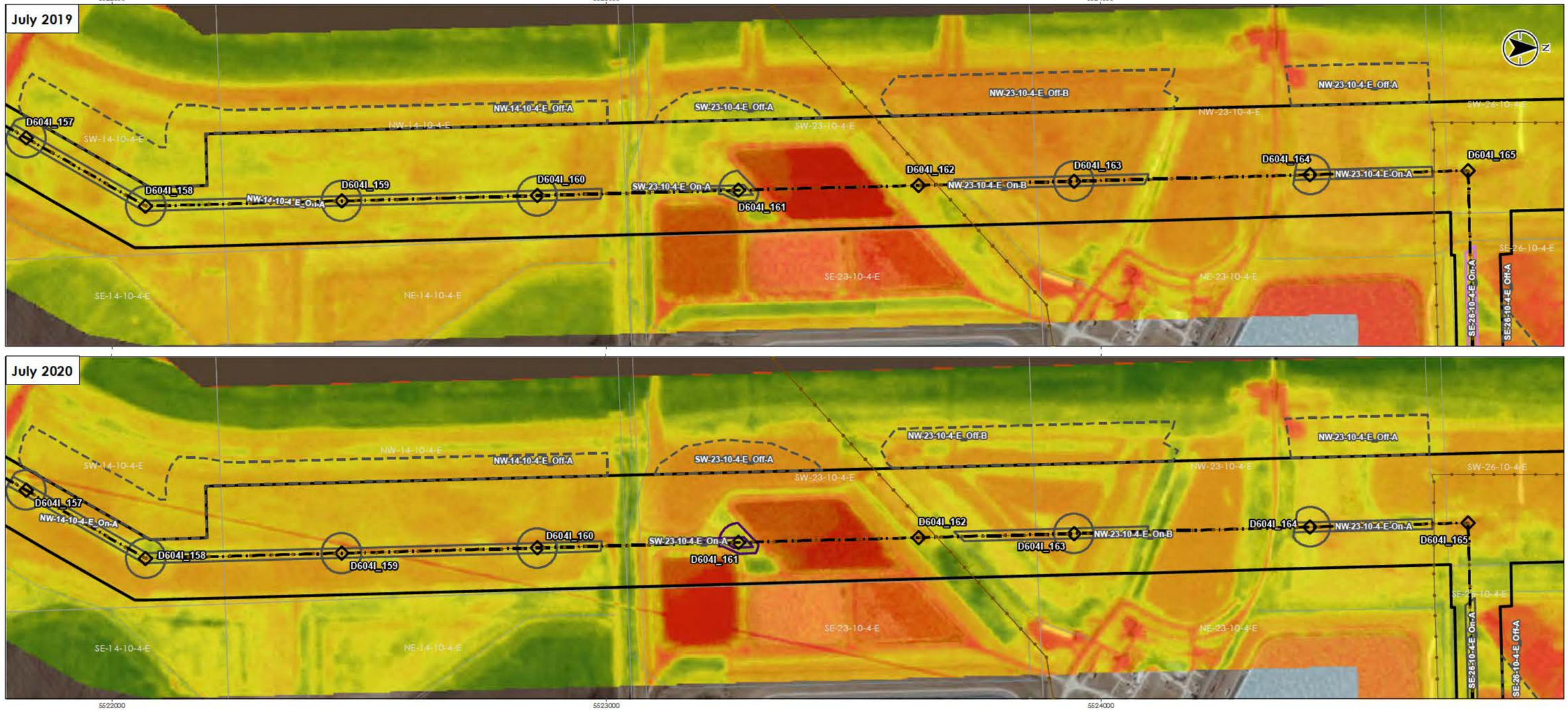

KEY MAP

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-23

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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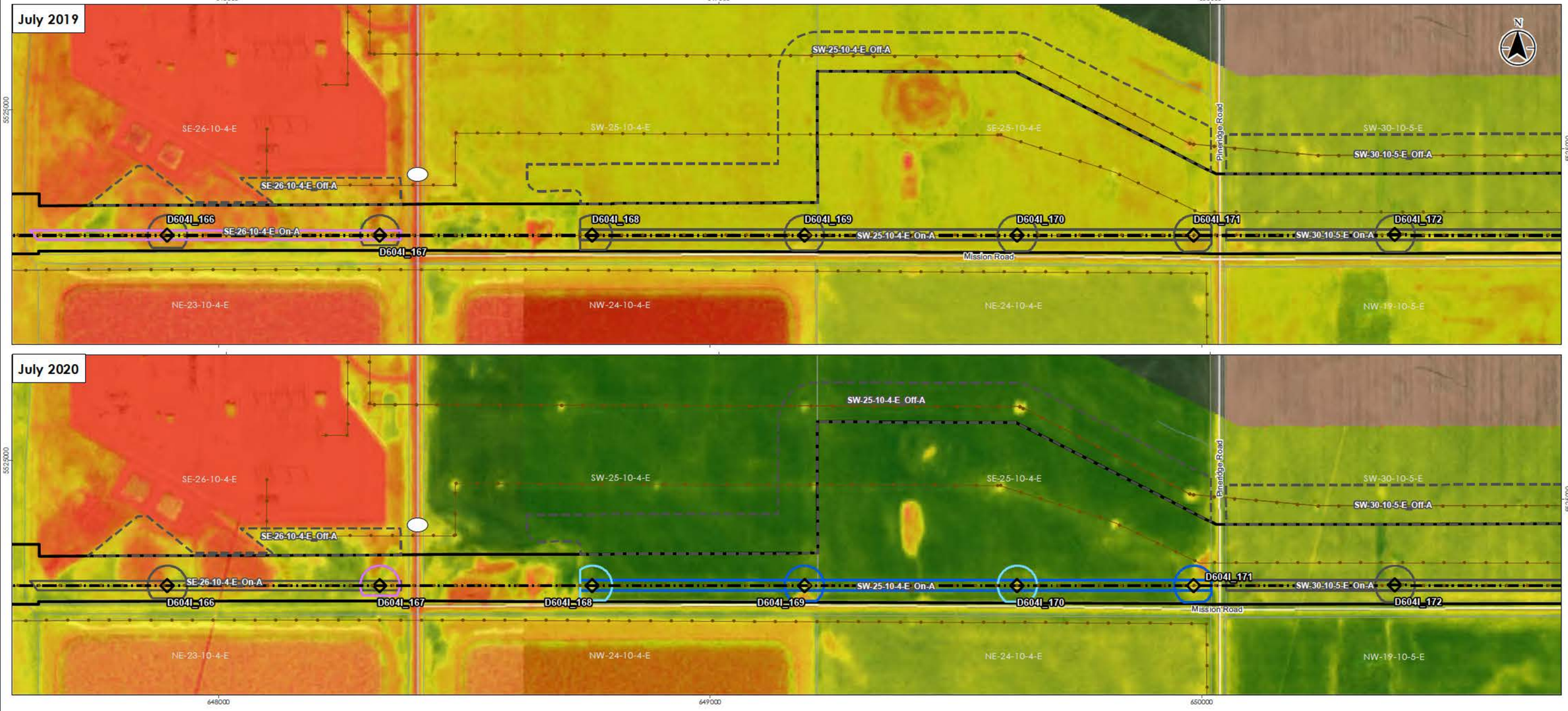
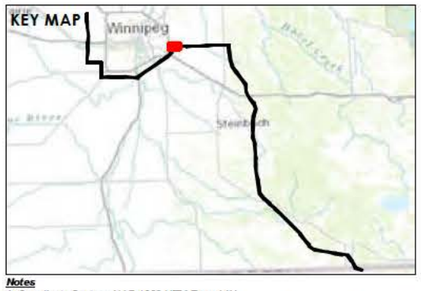


KEY MAP



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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
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Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-24

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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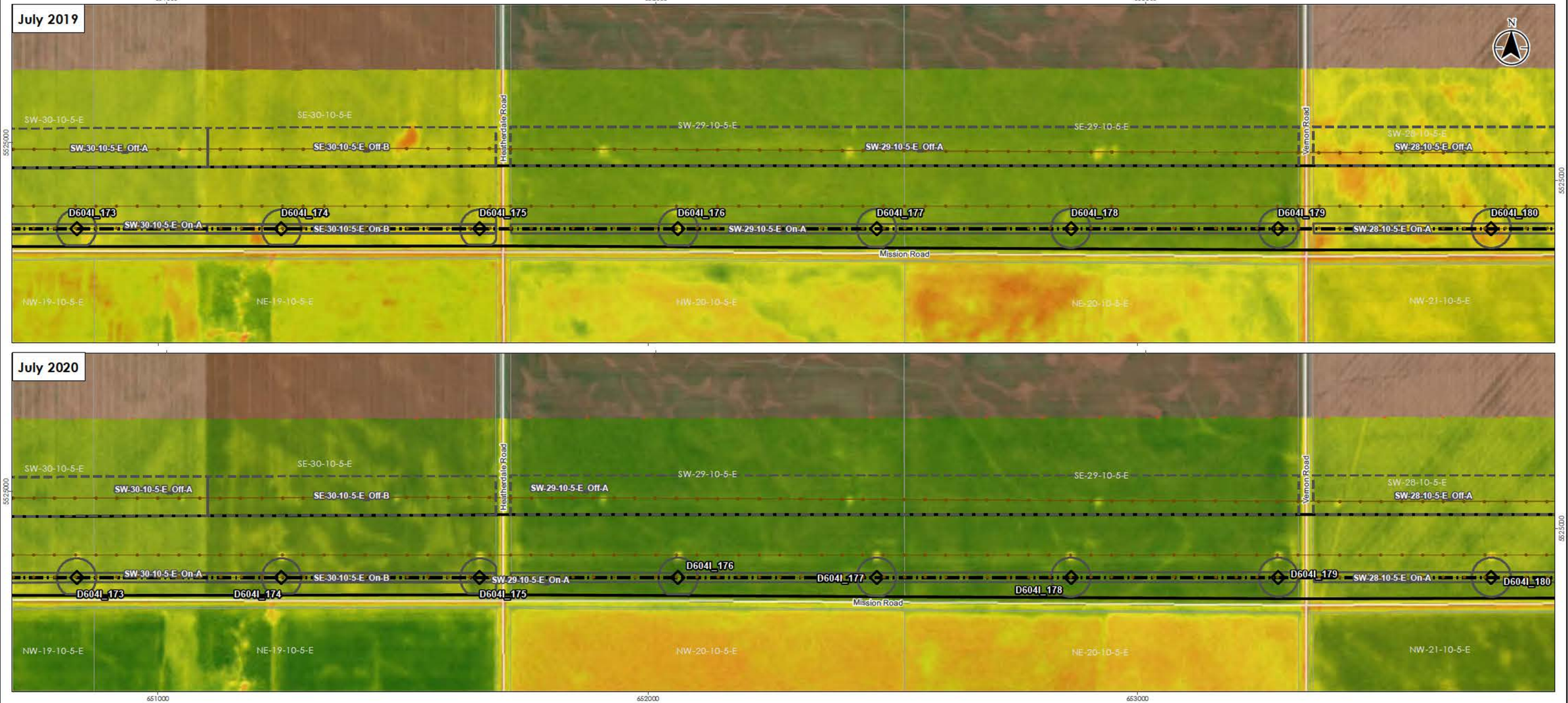

Notes

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
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Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-25

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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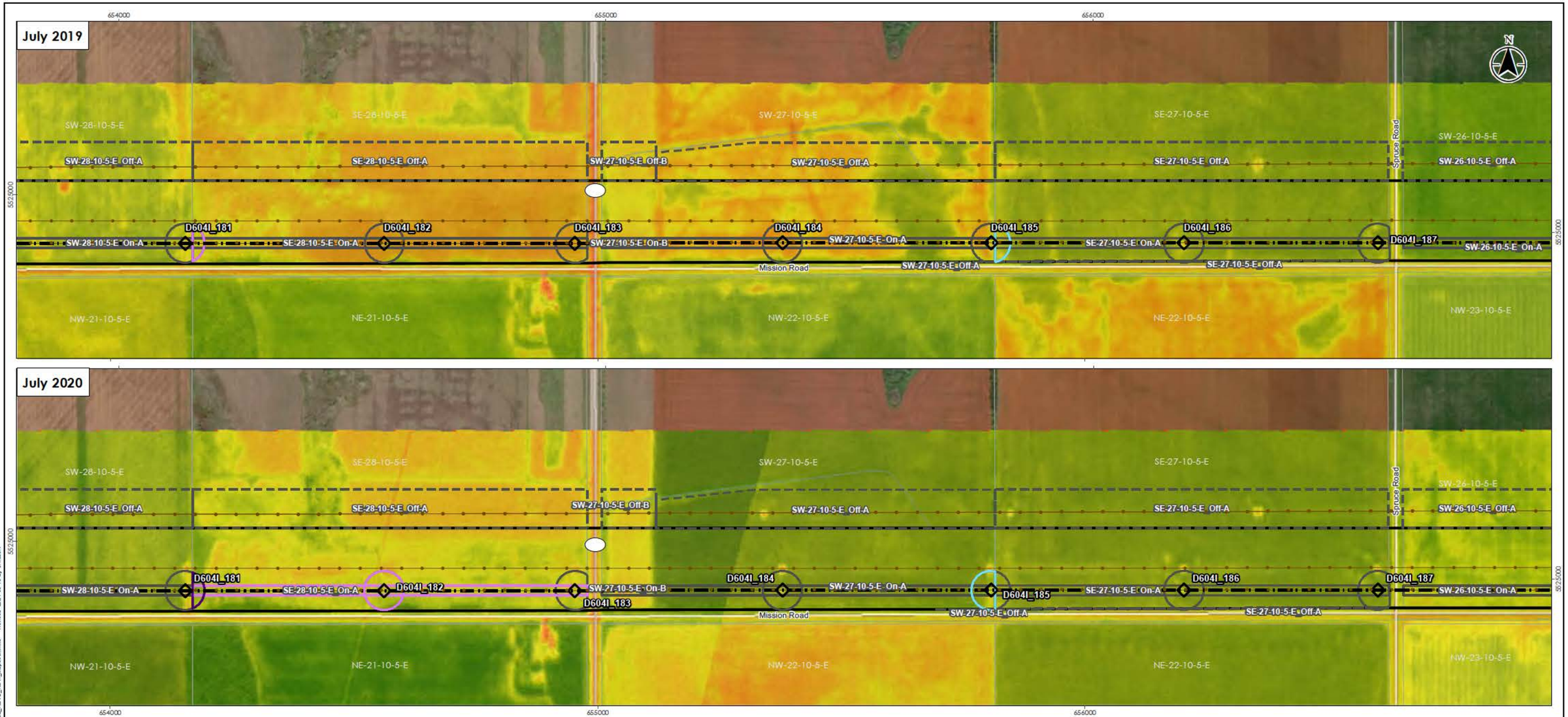

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

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Stantec

Project Location
Near Winnipeg
Manitoba

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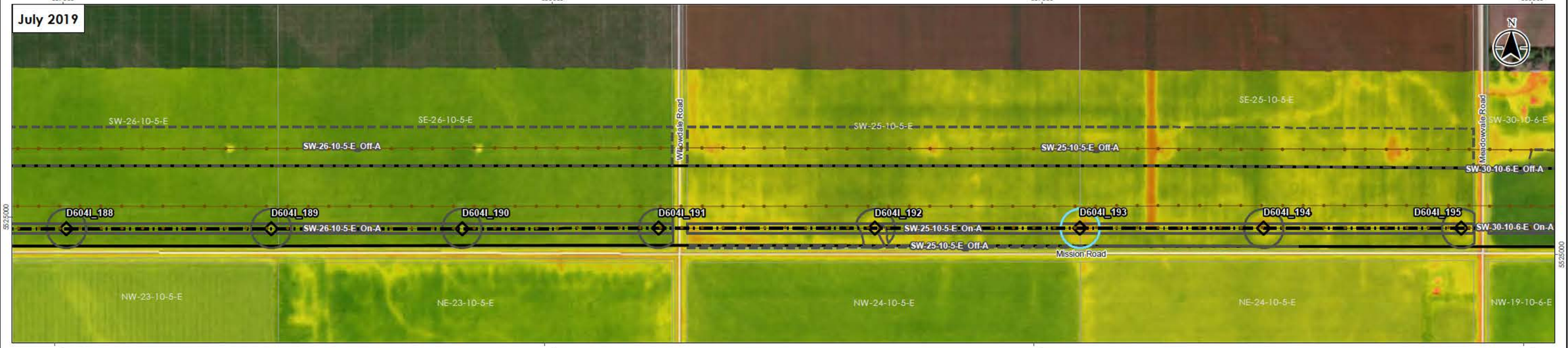
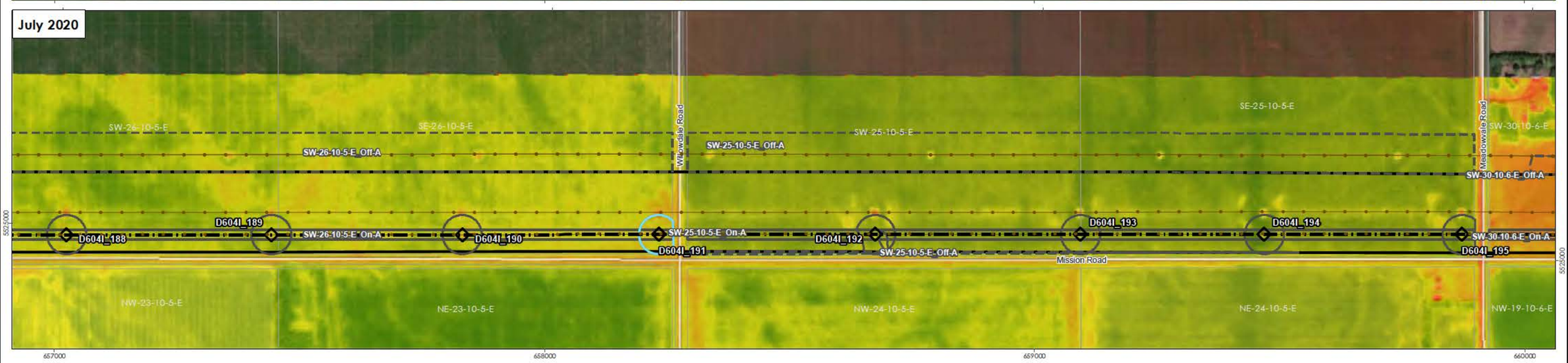
Client/Project
111477020-002-REVC

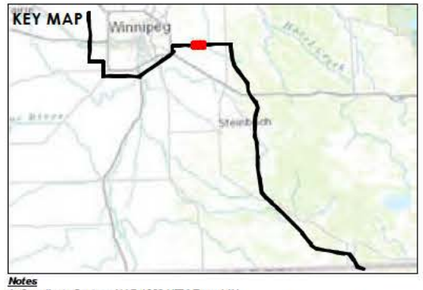
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.
C.2-26

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020







Notes
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
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- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

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Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-27

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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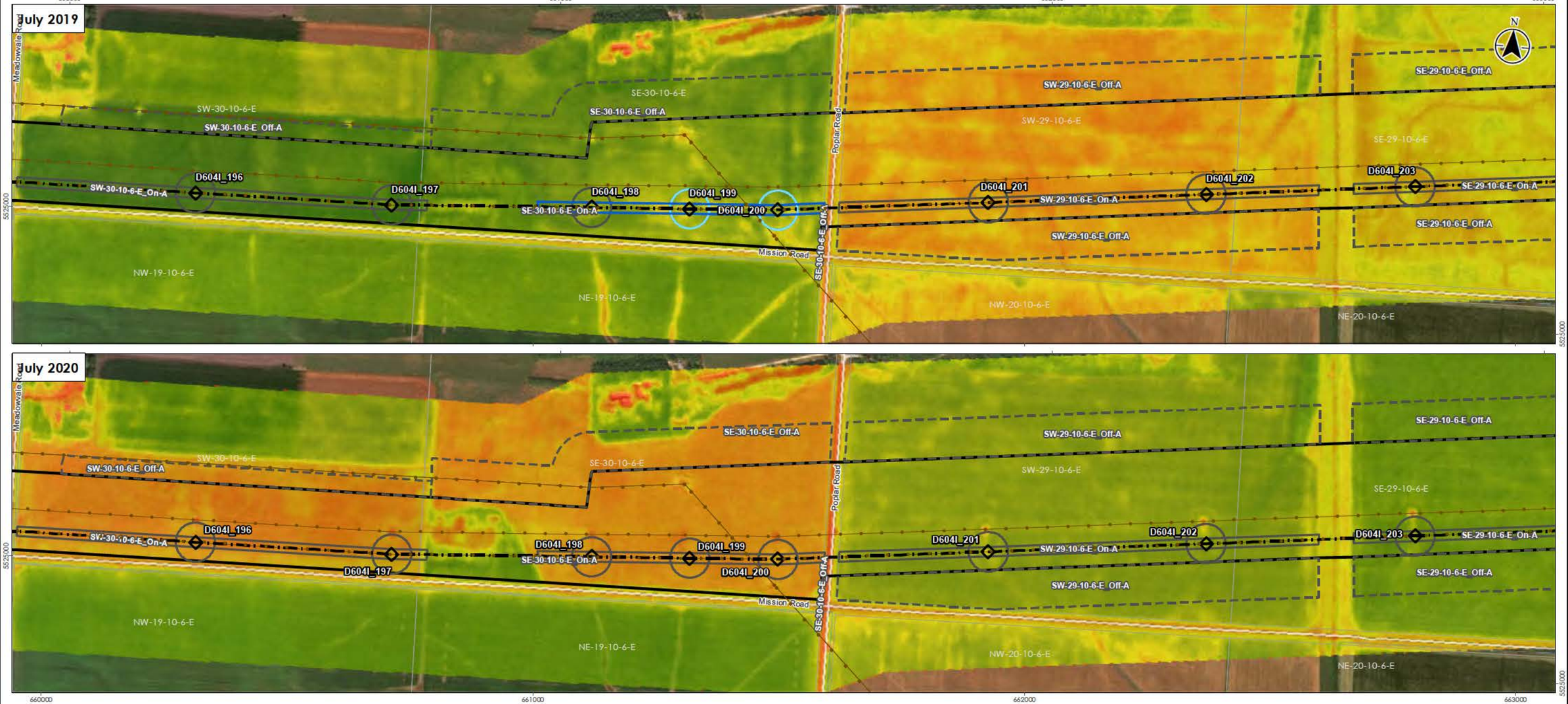

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Legend

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- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

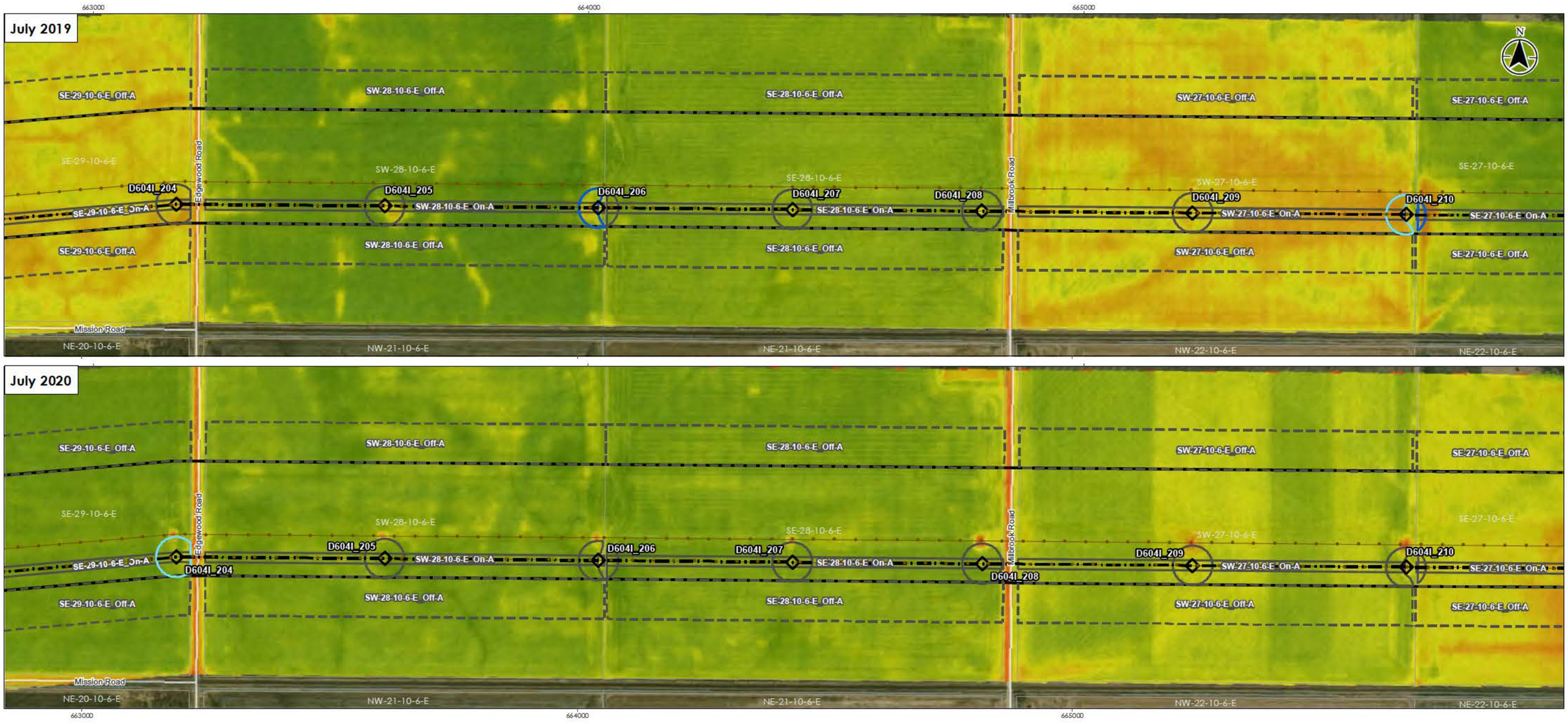
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

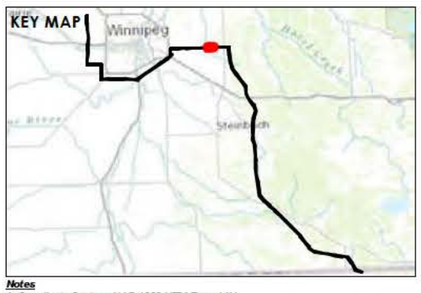
111477020-002-REVC

Map No.
C.2-28

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

G:\GIS_Project_Folder\00_Hydro\111477020_MMTP_Soil_Crop_Biosecurity_Monitoring\figures\111477020_002_REVC_NDVI_MapBook.mxd Revised: 2021-05-16 By: JHibbert





Notes
1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

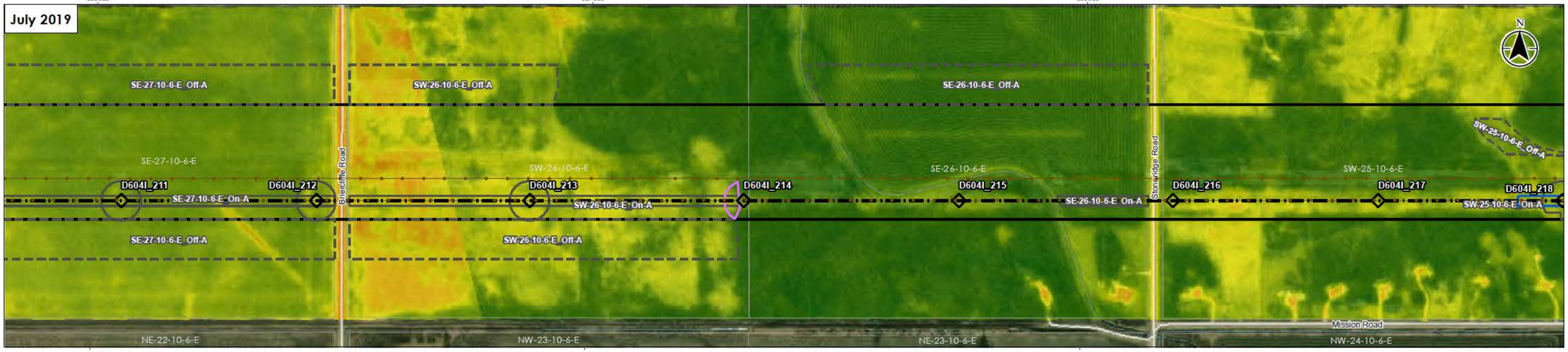
Map No.
C.2-29

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

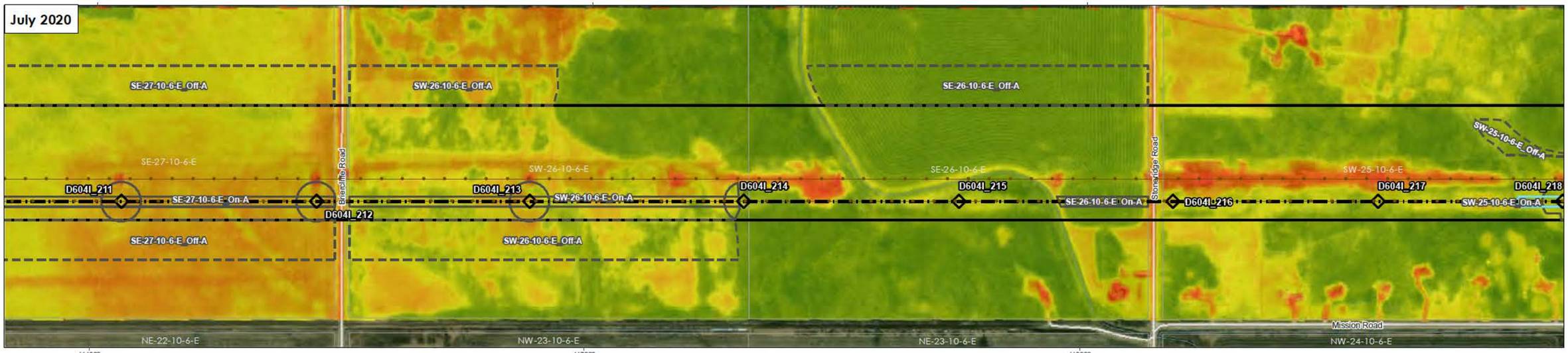
G:\GIS_Project_Folder\00_Hydro\111477020_MMTP_Soil_Crop_Biosecurity_Monitoring\figures\111477020_002_REVC_NDVI_Maybrook.mxd Revised: 2021-05-16 By: JHilbert

666000 667000 668000

July 2019



July 2020



666000 667000 668000

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-30

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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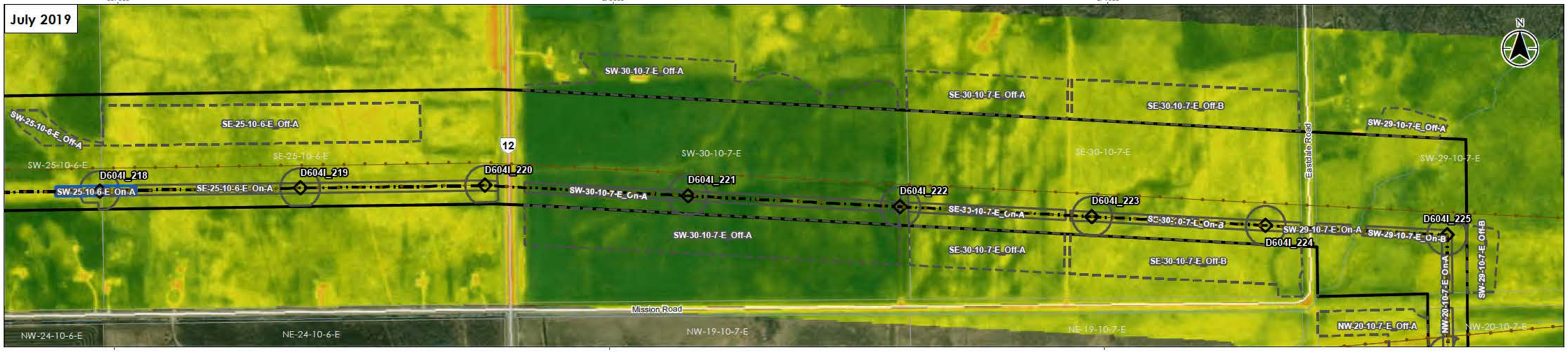
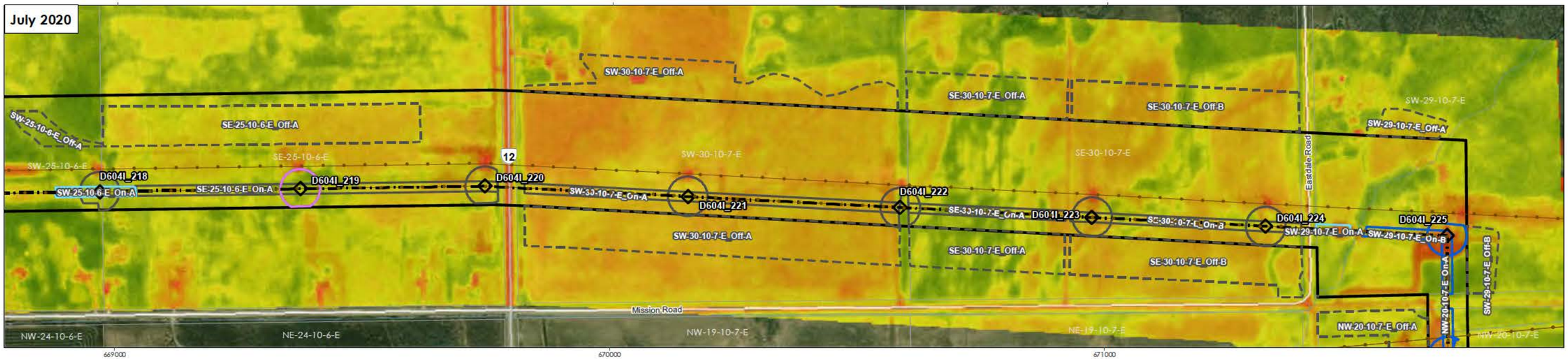
669000 670000 671000

July 2019



July 2020



669000 670000 671000

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-31

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

672000 5525000 5524000 5523000

July 2019

July 2020

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-32

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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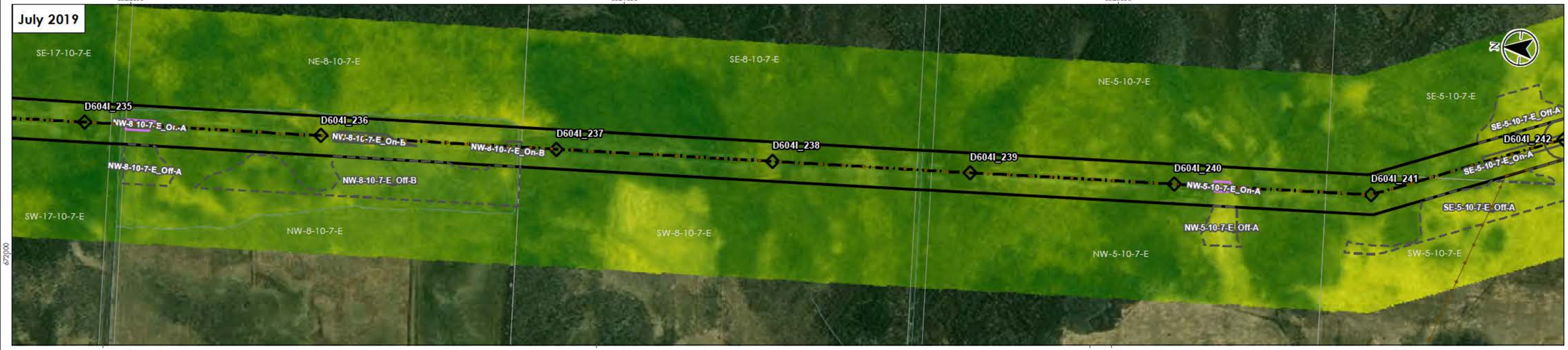

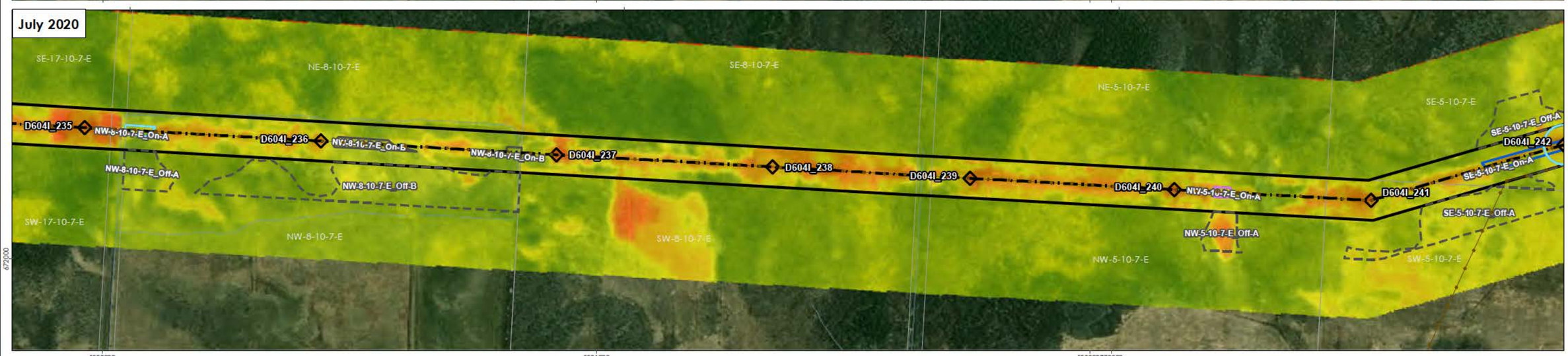

KEY MAP

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

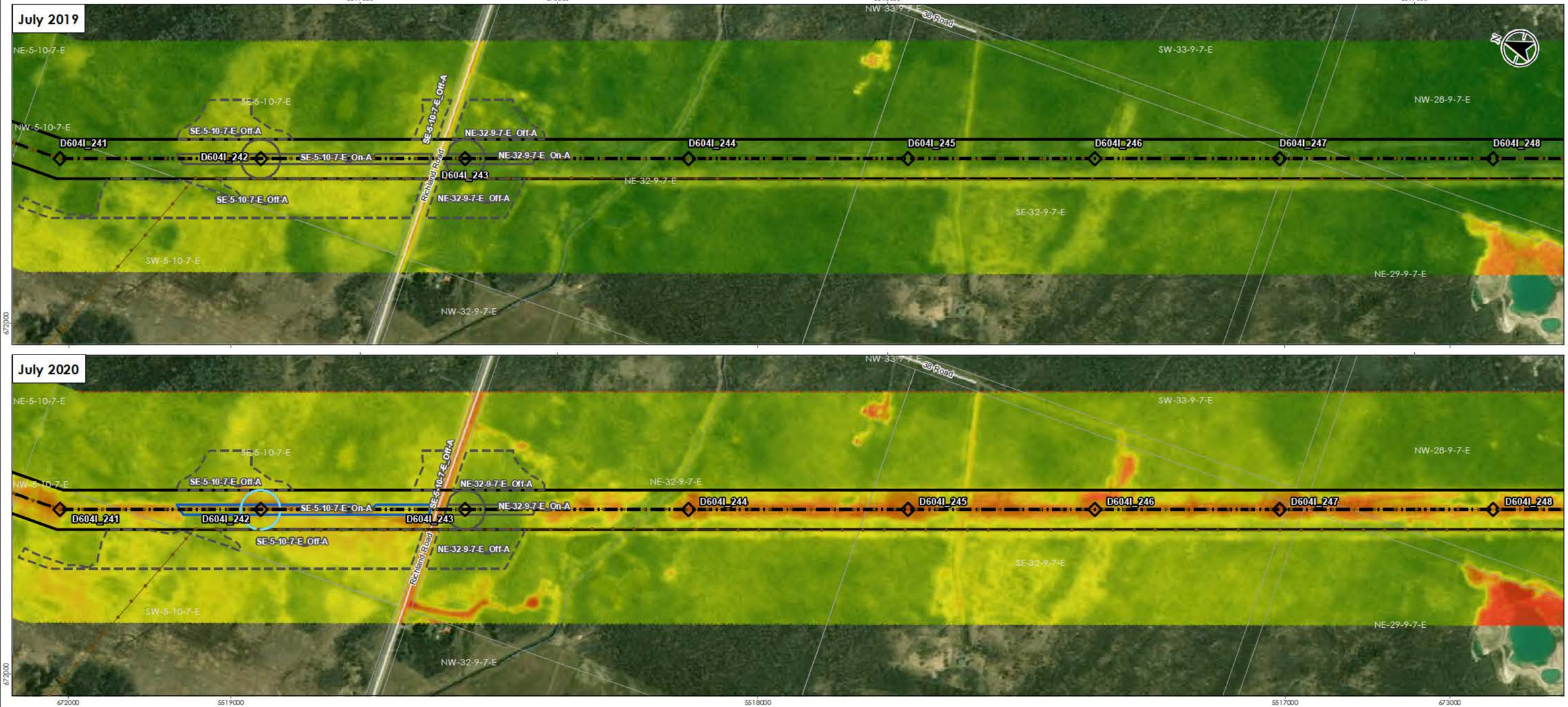
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

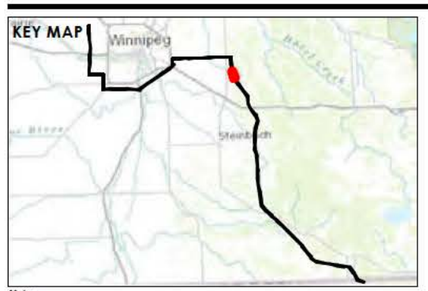
111477020-002-REVC

Map No.
C.2-33

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

G:\GIS_Project_Folder\00_Hydro\111477020_MMTP_Soil_Crop_Bioassurity_Monitoring\figures\111477020_002_REVC_NDVI_Maplook.mxd Revised: 2021-05-16 By: JHilbert





Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-34

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

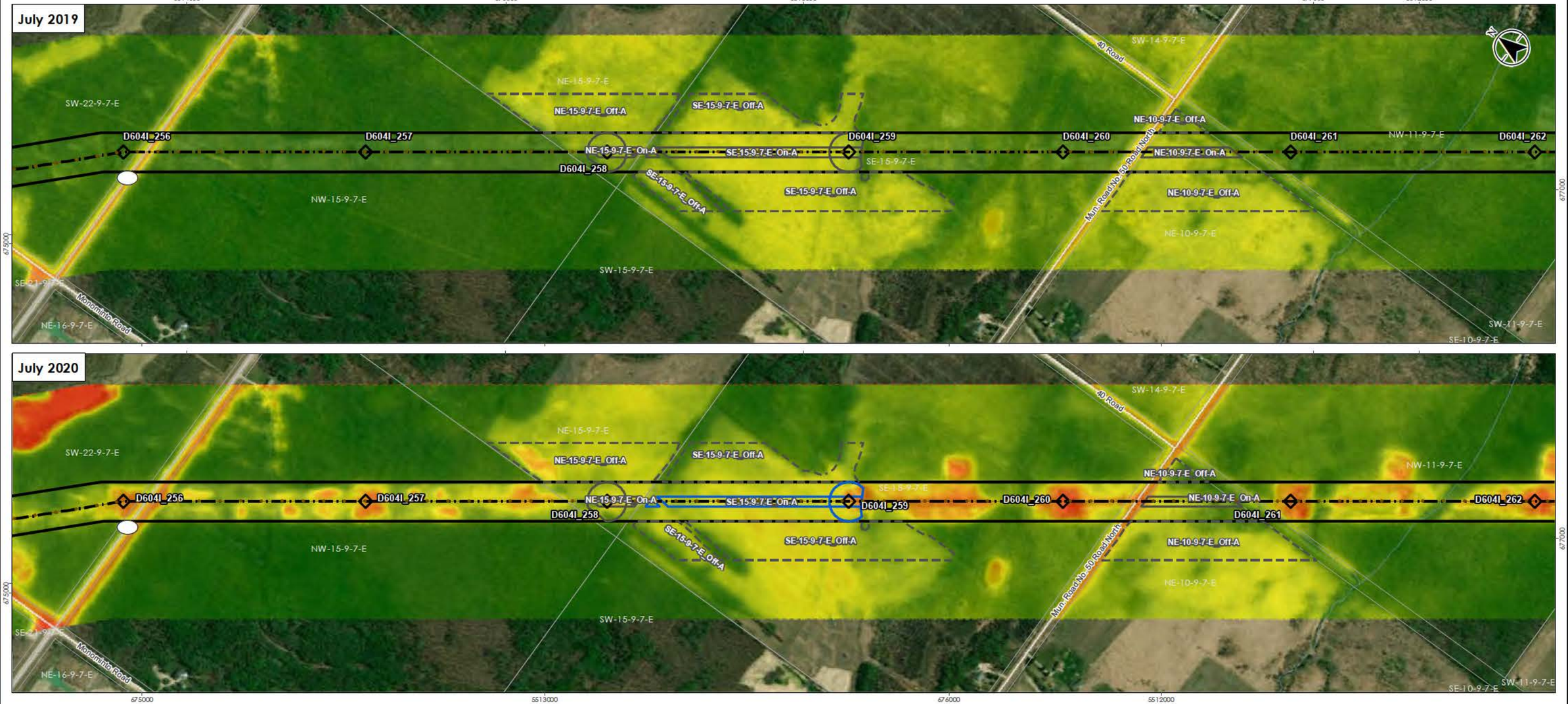
Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-35

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

High: 1.0

Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

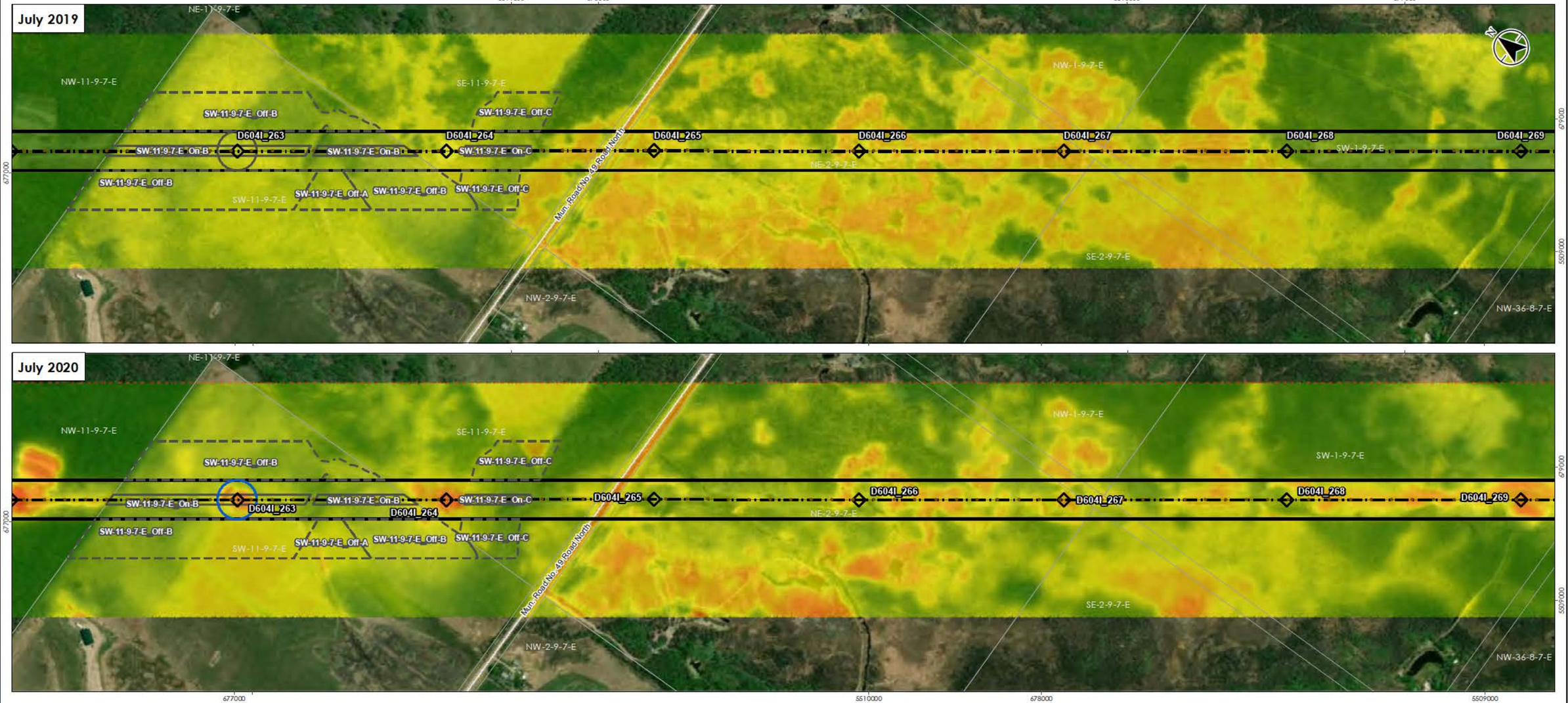
Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-36

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-37

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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5509000 5508000 5507000

July 2019

SE T 9 7 E NE-36-8-7-E SE-36-8-7-E NE-25-8-7-E SE-25-8-7-E

SW-1-9-7-E NW-36-8-7-E SW-36-8-7-E NW-25-8-7-E SW-25-8-7-E

D604I_269 D604I_270 D604I_271 D604I_272 D604I_273 D604I_274 D604I_275 D604I_276

679000

July 2020

SE T 9 7 E NE-36-8-7-E SE-36-8-7-E NE-25-8-7-E SE-25-8-7-E

SW-1-9-7-E NW-36-8-7-E SW-36-8-7-E NW-25-8-7-E SW-25-8-7-E

D604I_269 D604I_270 D604I_271 D604I_272 D604I_273 D604I_274 D604I_275 D604I_276

679000

5509000 5508000 5507000

KEY MAP

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

High: 1.0

Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project 111477020-002-REVC
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.
C.2-38

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

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2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-39

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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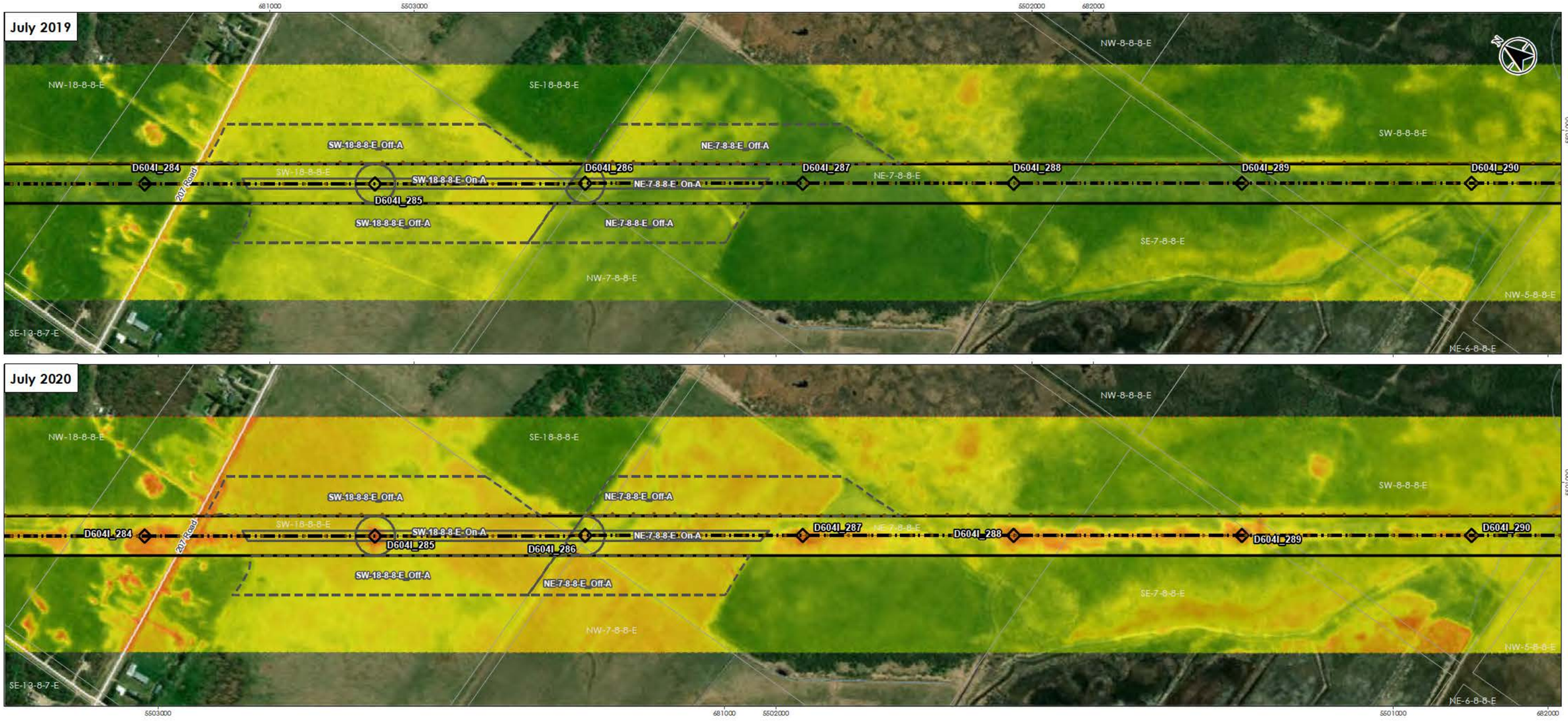

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
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3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-40

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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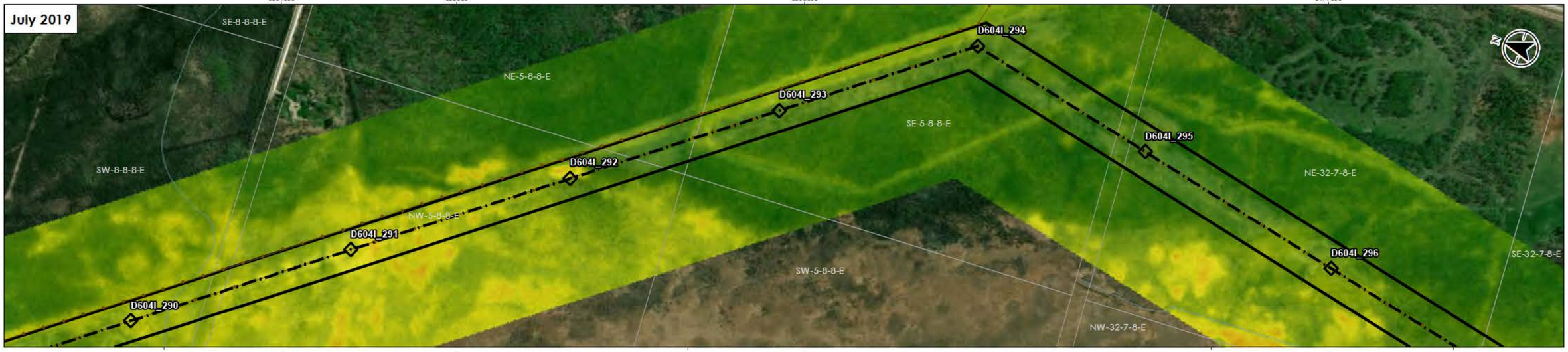

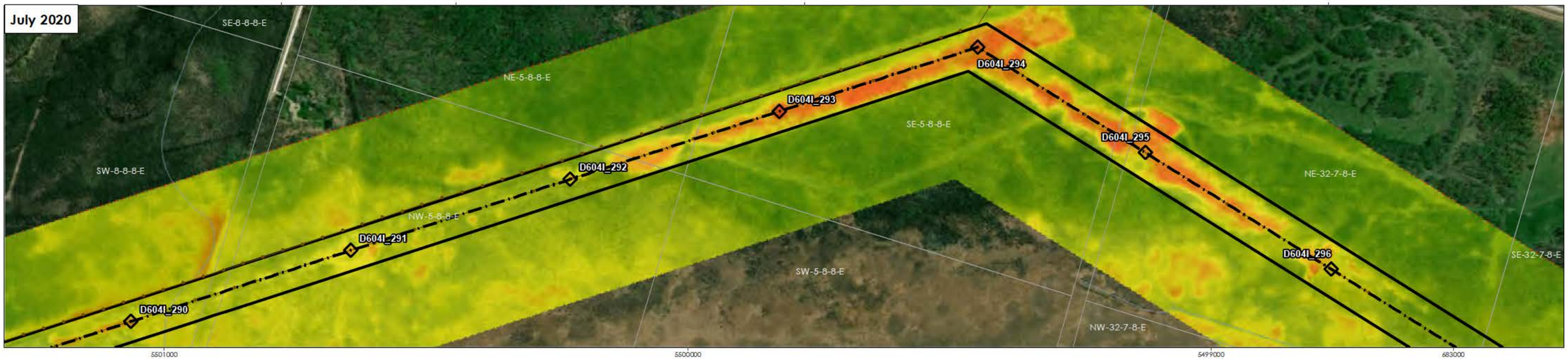

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
111477020-002-REVC
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.
C.2-41

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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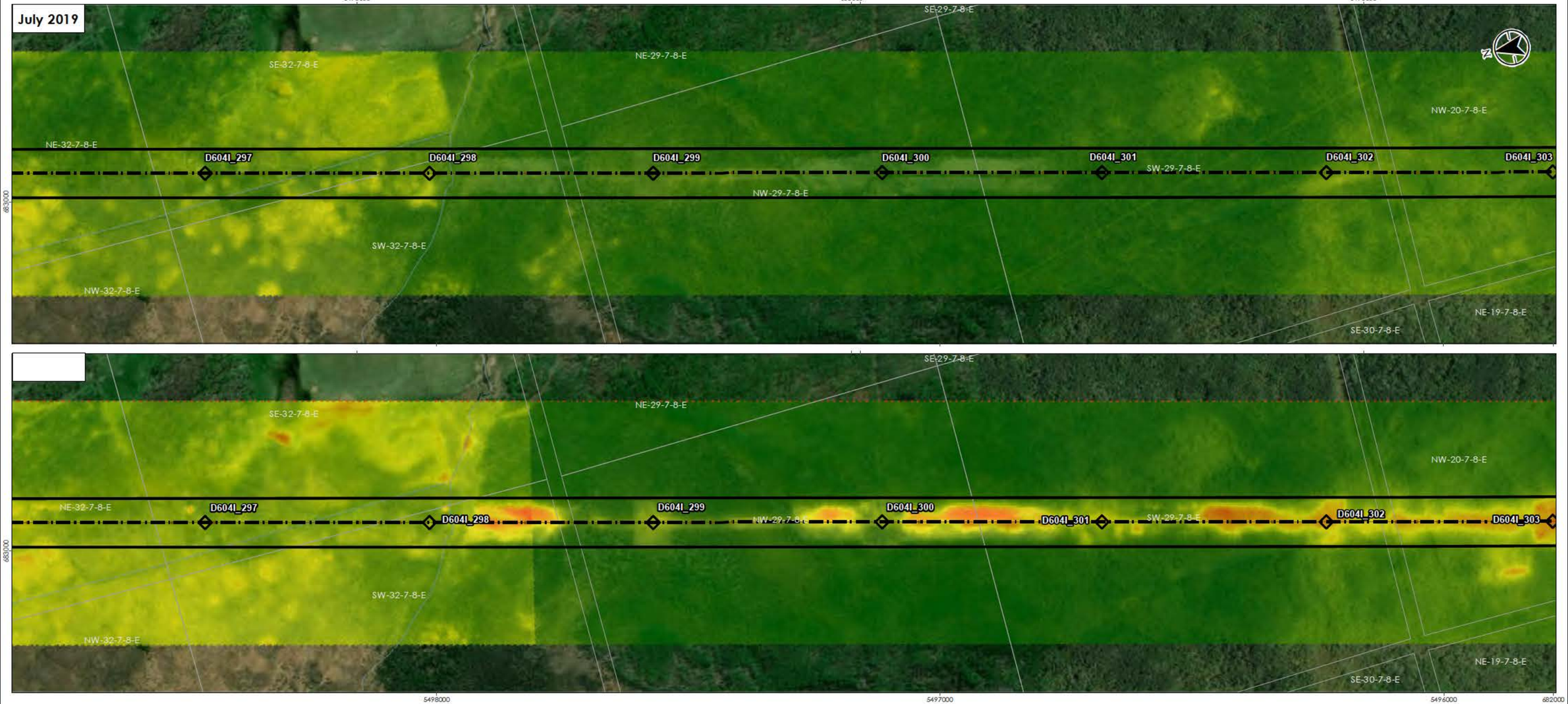

Notes

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project 111477020-002-REVC
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.
C.2-42

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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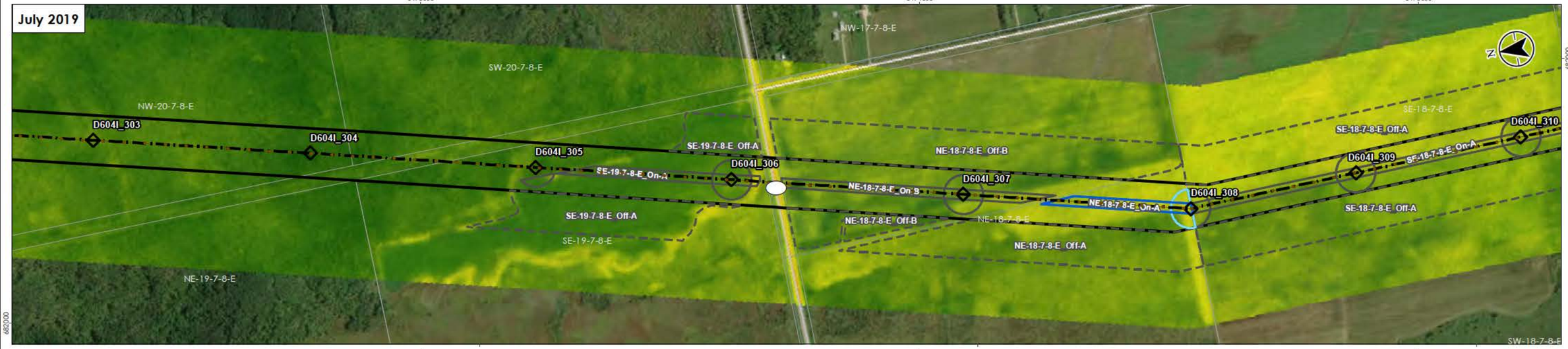

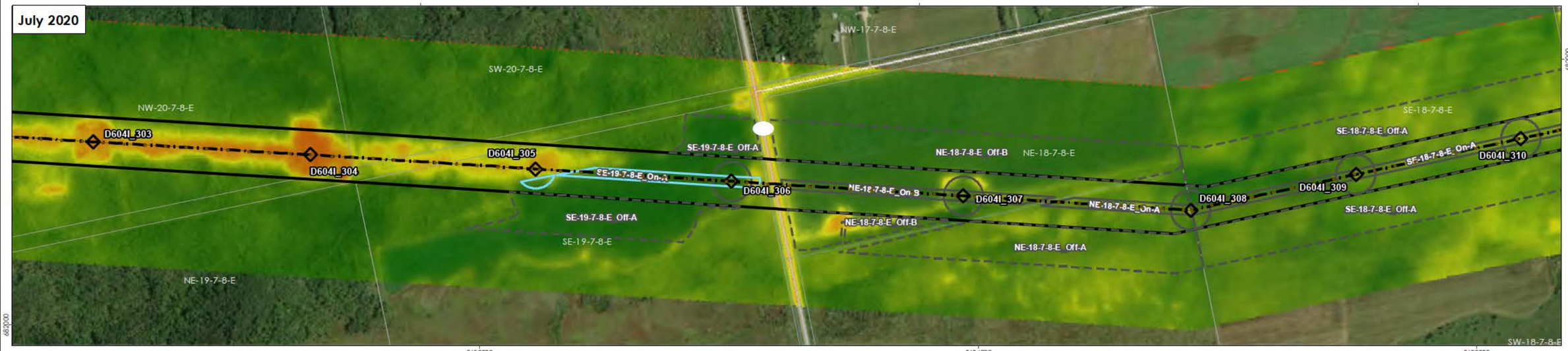

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-43

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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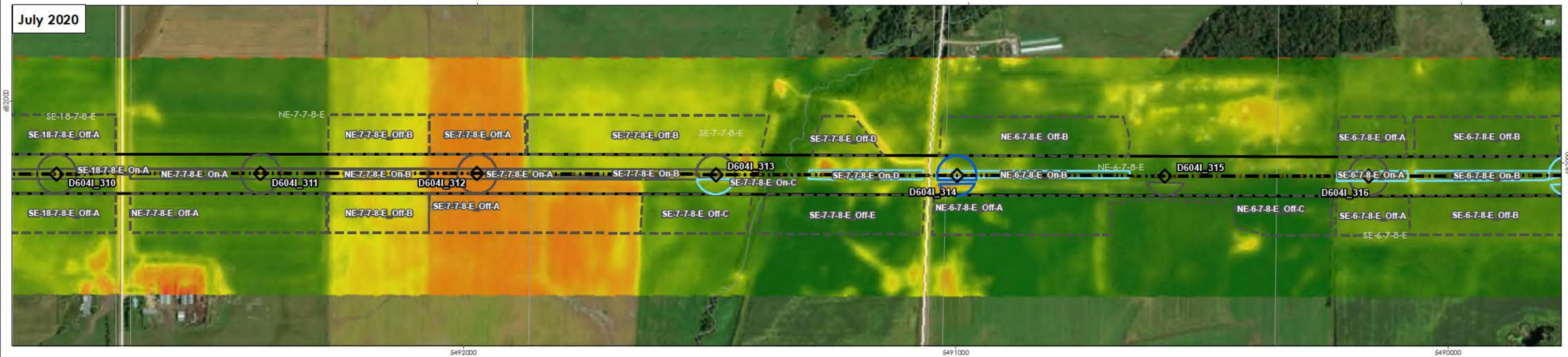

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-44

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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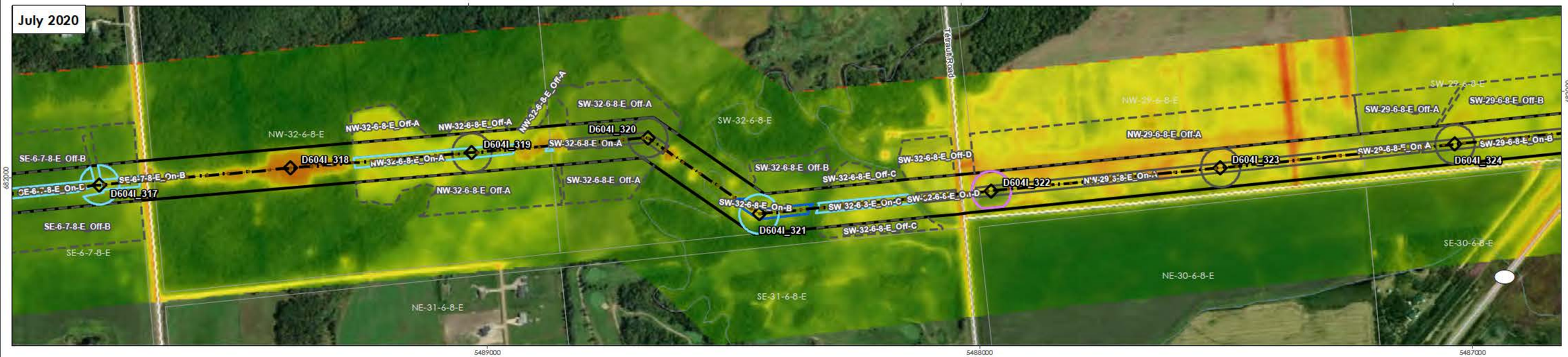

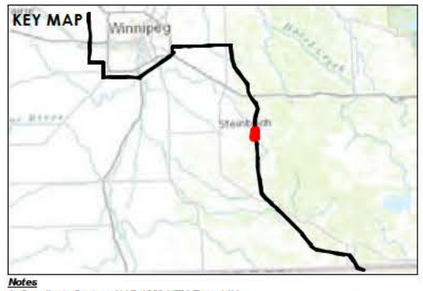

Notes

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-45

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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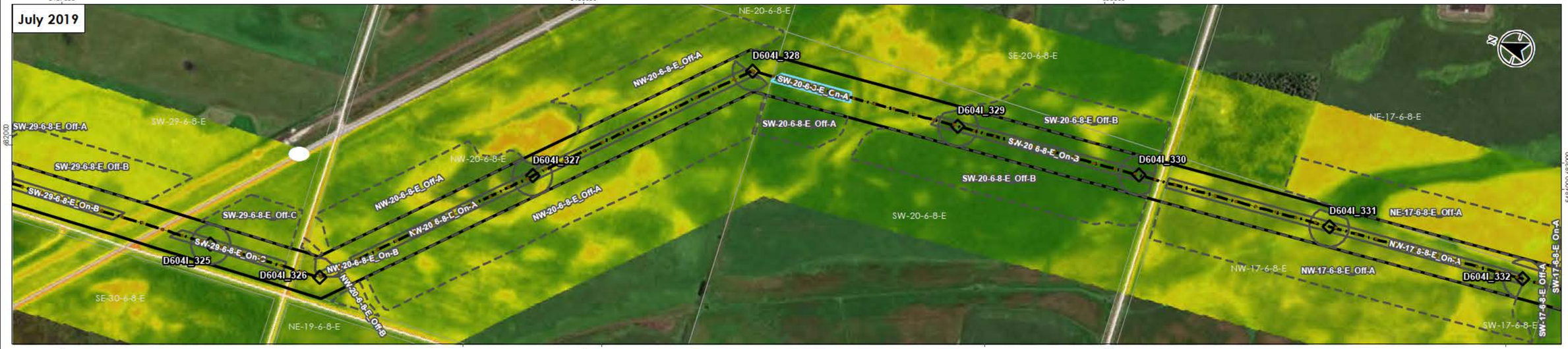
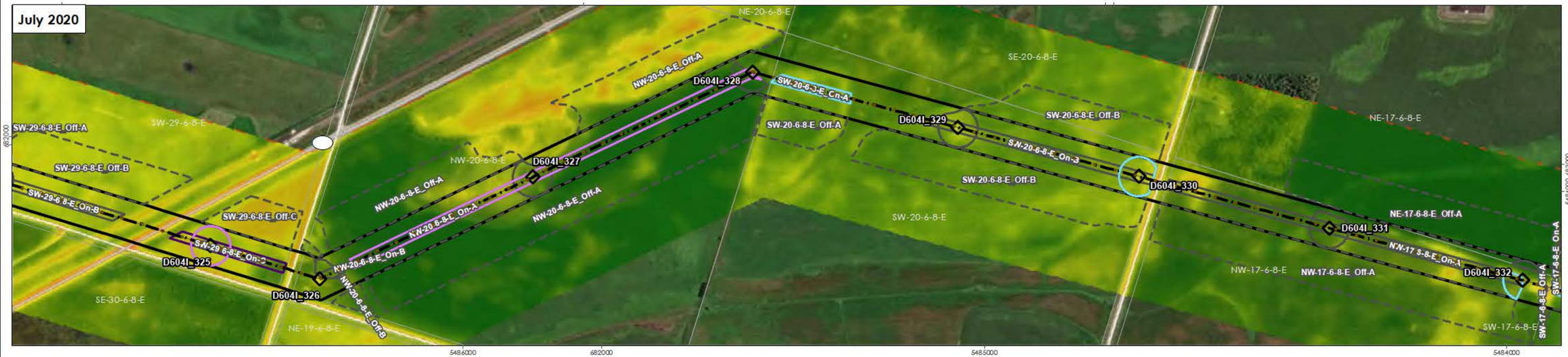
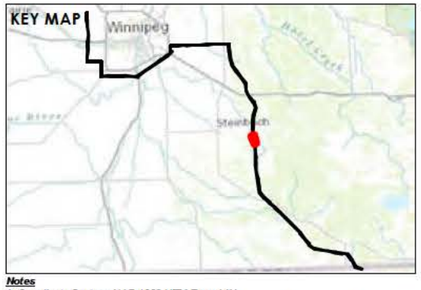




KEY MAP



Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

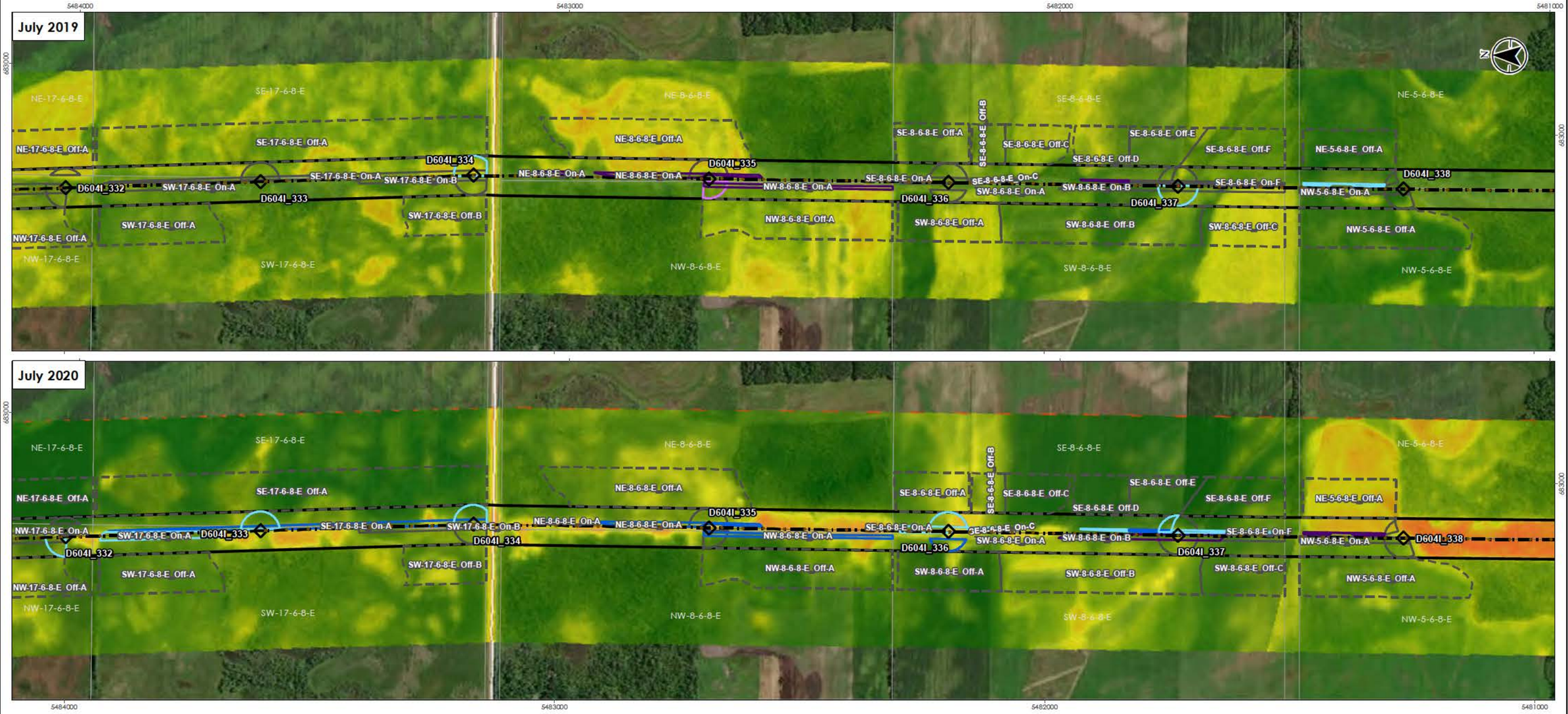
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

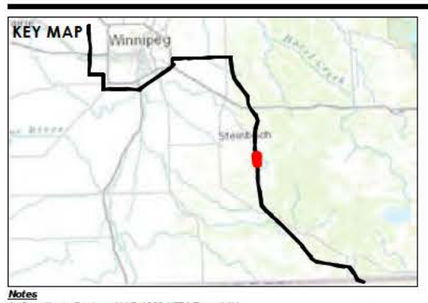
111477020-002-REVC

Map No.

C.2-46

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020





Notes

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-47

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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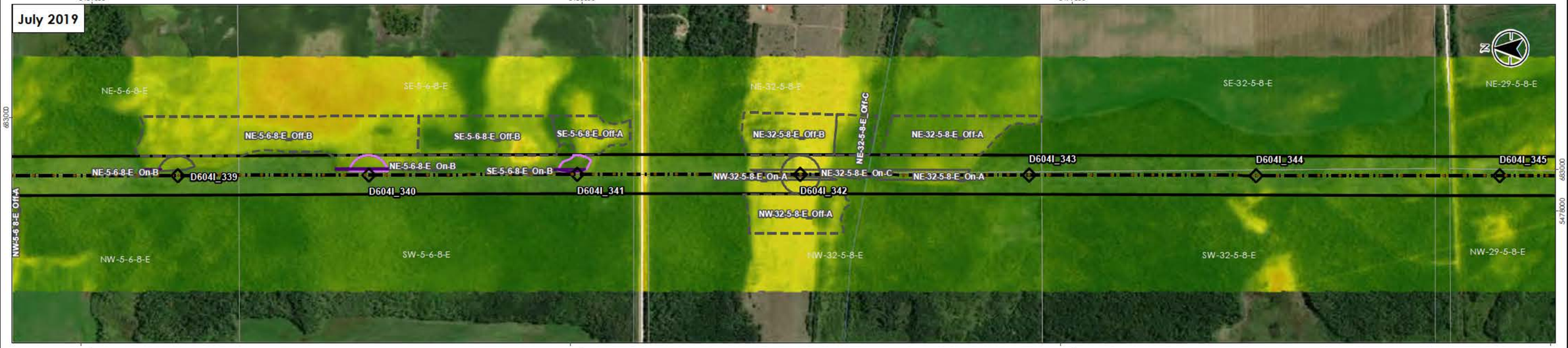

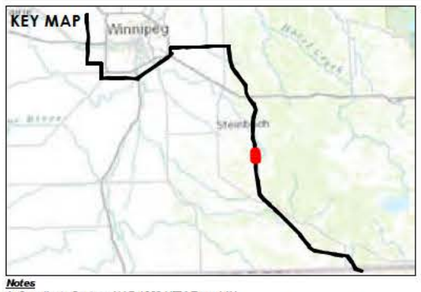

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

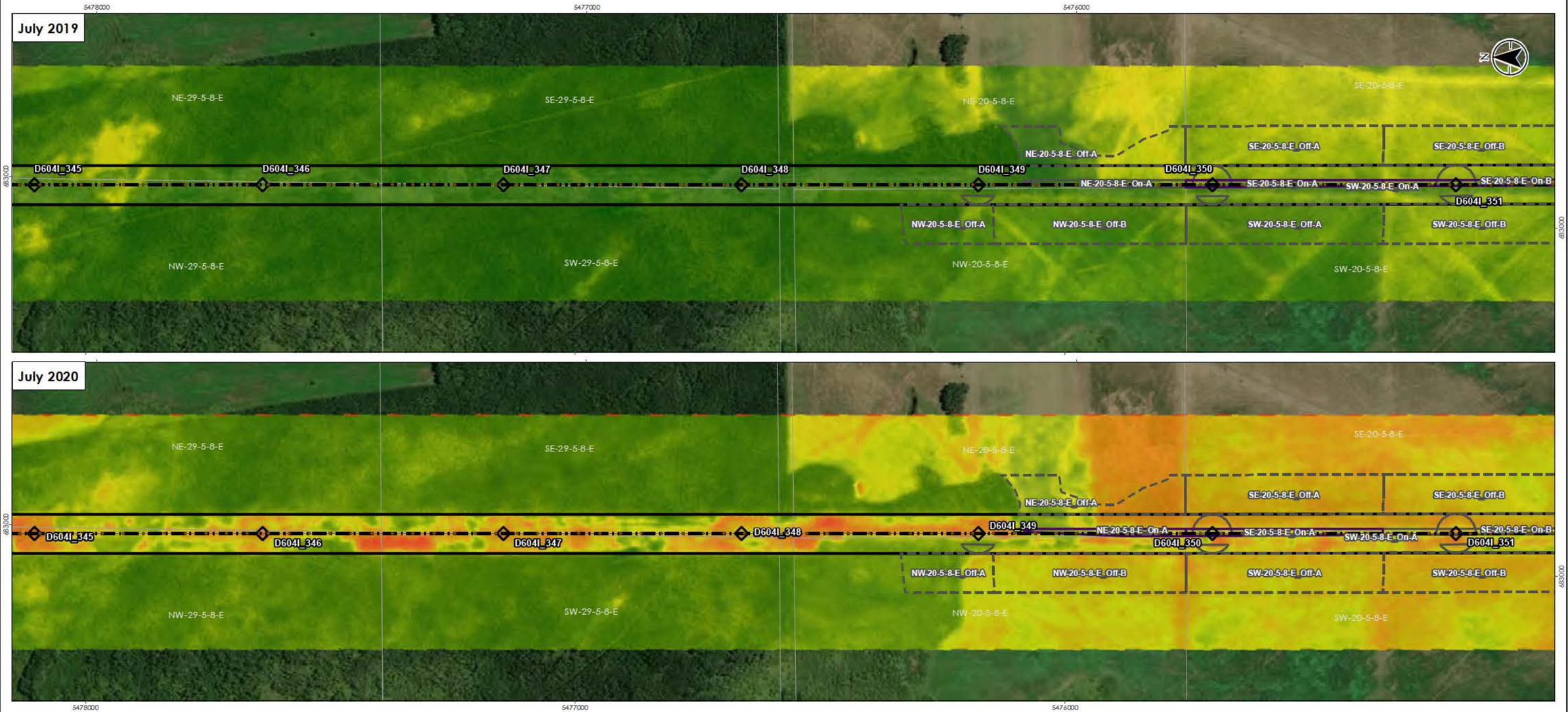
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.

C.2-48

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



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Legend

- Manitoba-Minnesota Transmission Line
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Evaluation Areas

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- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

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NDVI Difference Outliers for On RoW FMU and

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- Existing Transmission Lines
- Quarter Sections

0 125 250 metres

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
111477020-002-REVC

Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.
C.2-49

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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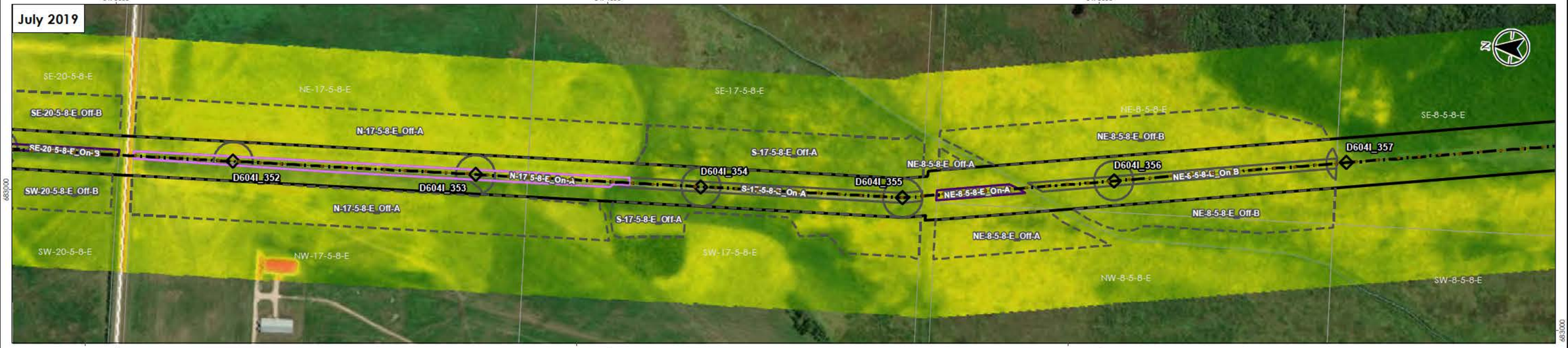

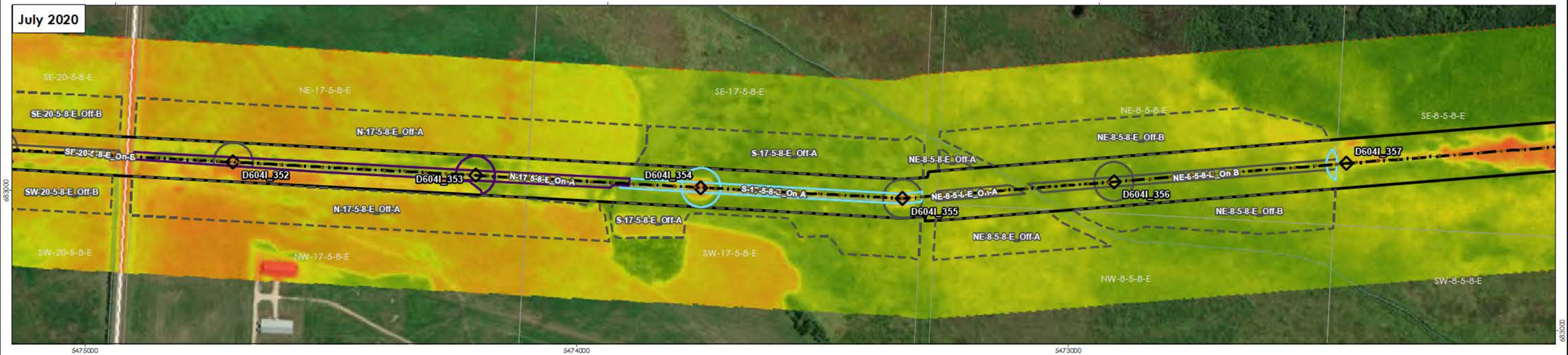

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

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- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

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- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

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Stantec

Project Location
Near Winnipeg
Manitoba

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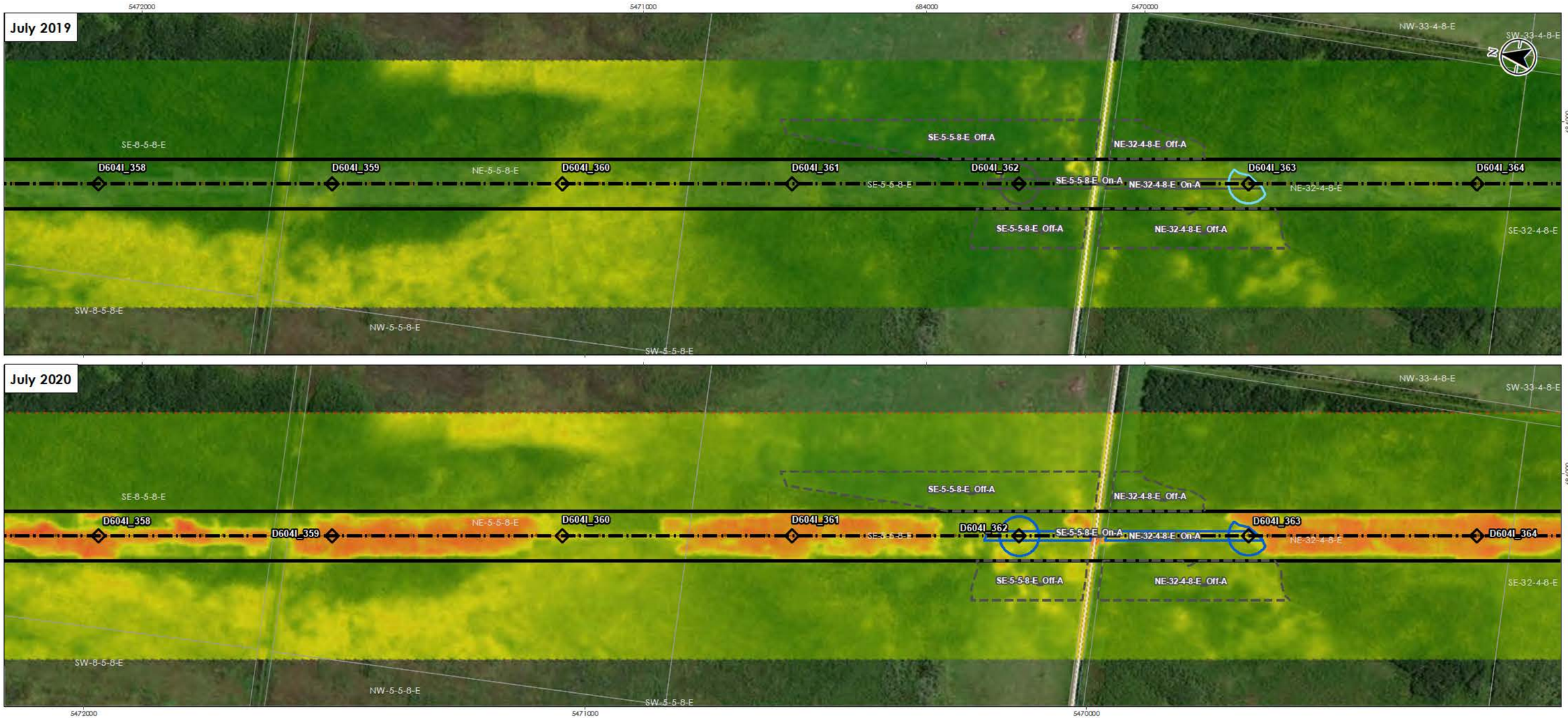
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-50

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

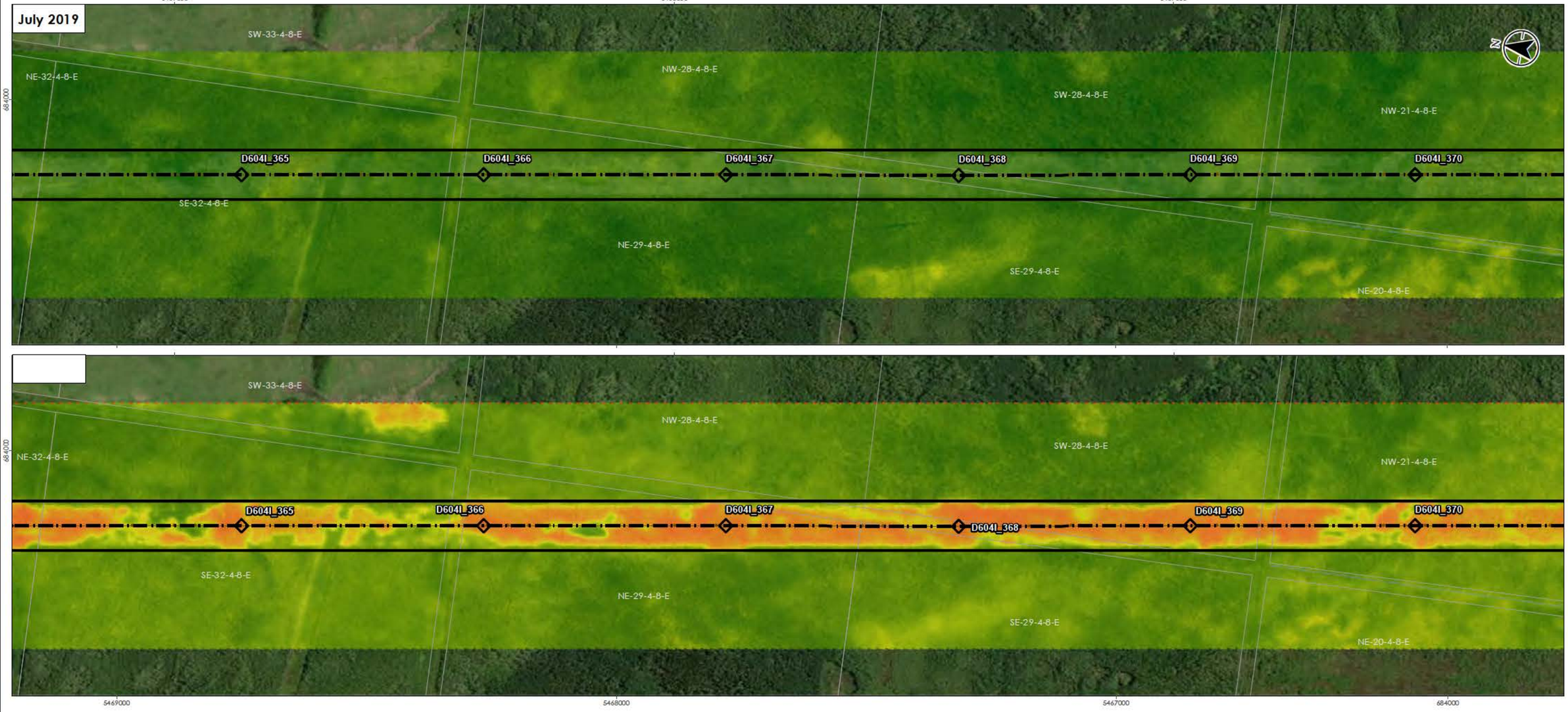
Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

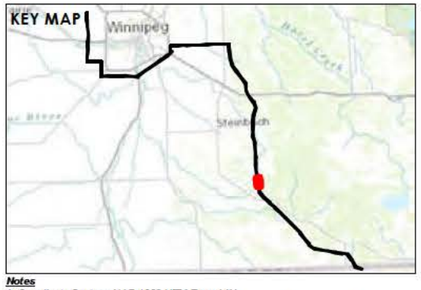
111477020-002-REVC

Map No.
C.2-51

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

G:\GIS_Project_Folder\00_Hydro\111477020_MMTP_Soil_Crop_Biosecurity_Monitoring\figures\111477020_002_REVC_NDVI_Maplook.mxd Revised: 2021-05-16 By: JHibbert





Notes
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2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-52

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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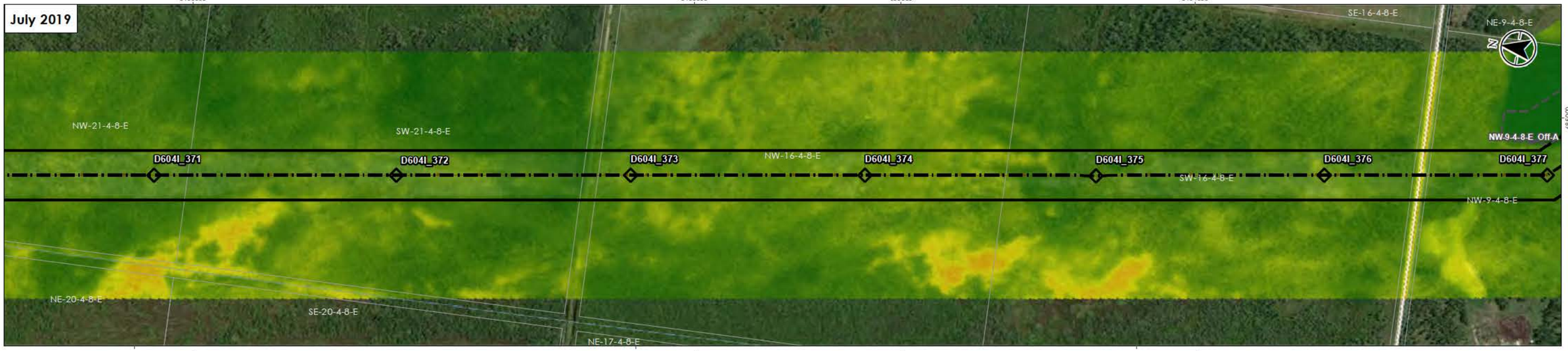
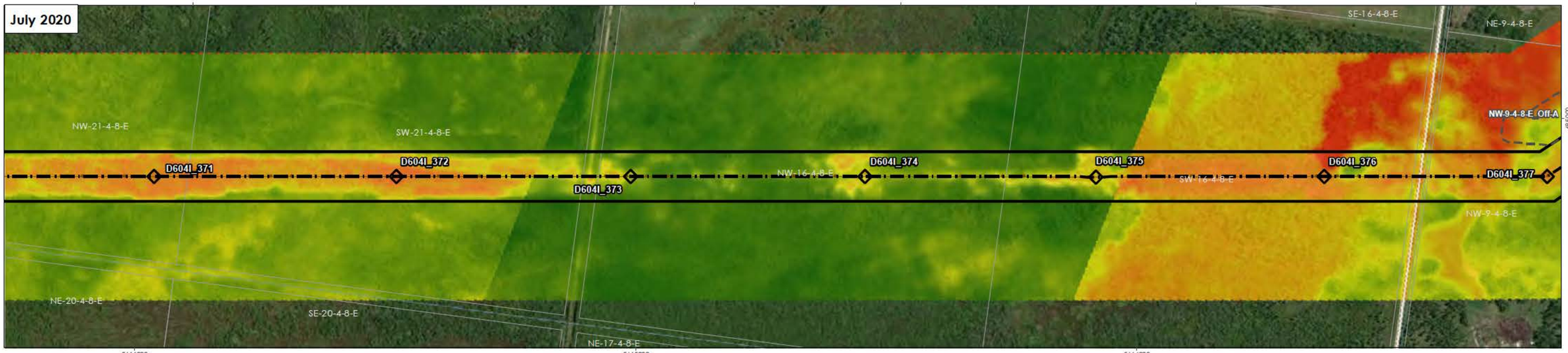
5466000 5465000 685000 5464000

July 2019



July 2020



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Notes

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2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-53

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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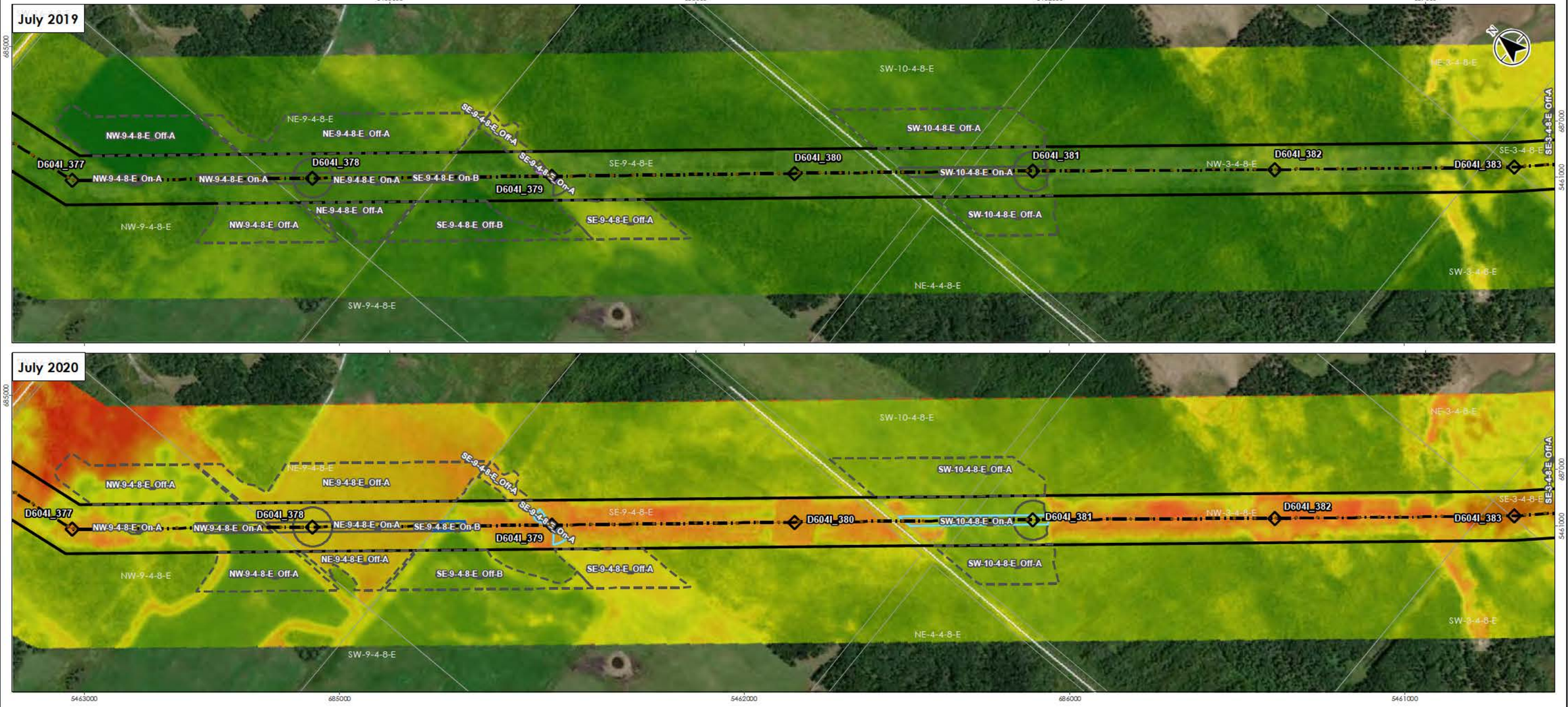

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-54

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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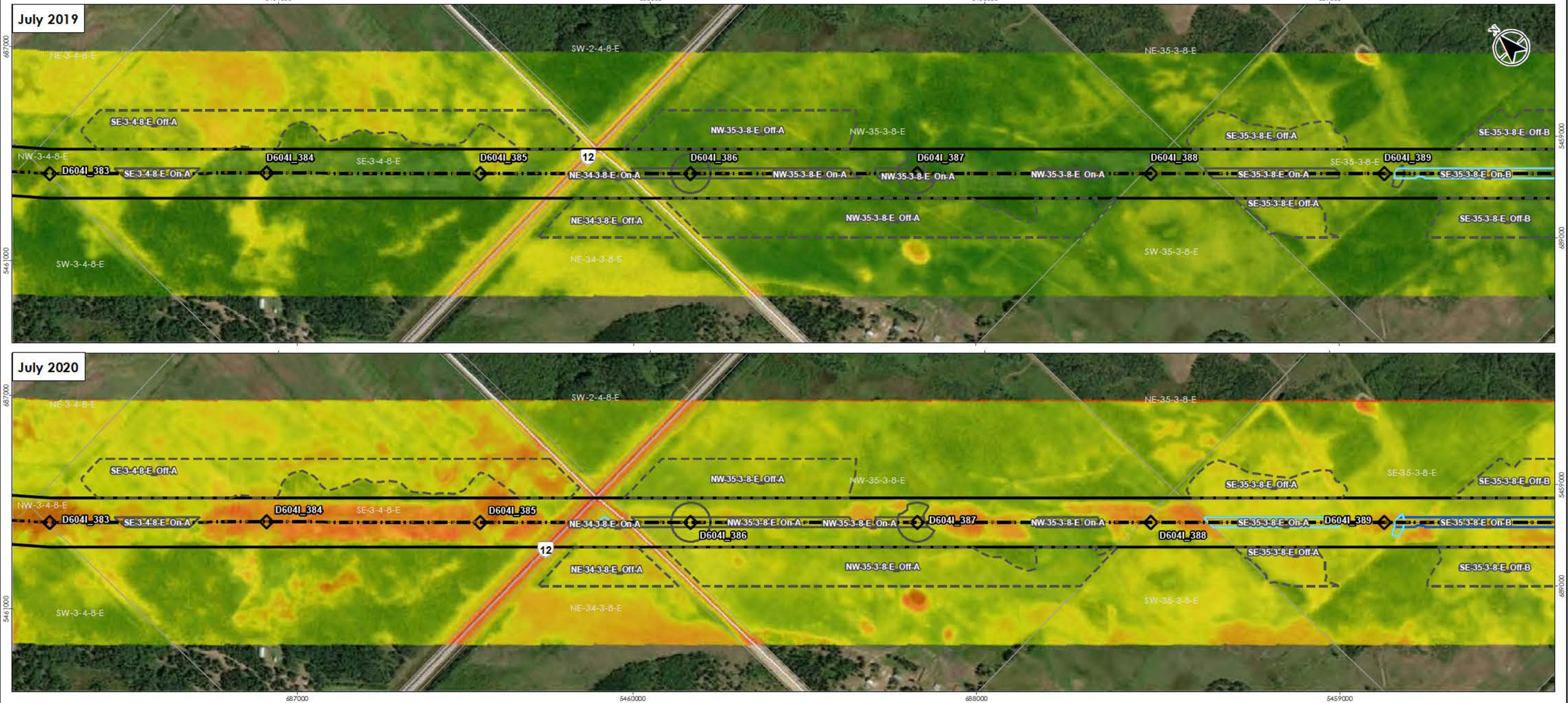

KEY MAP

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Highway
- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-55

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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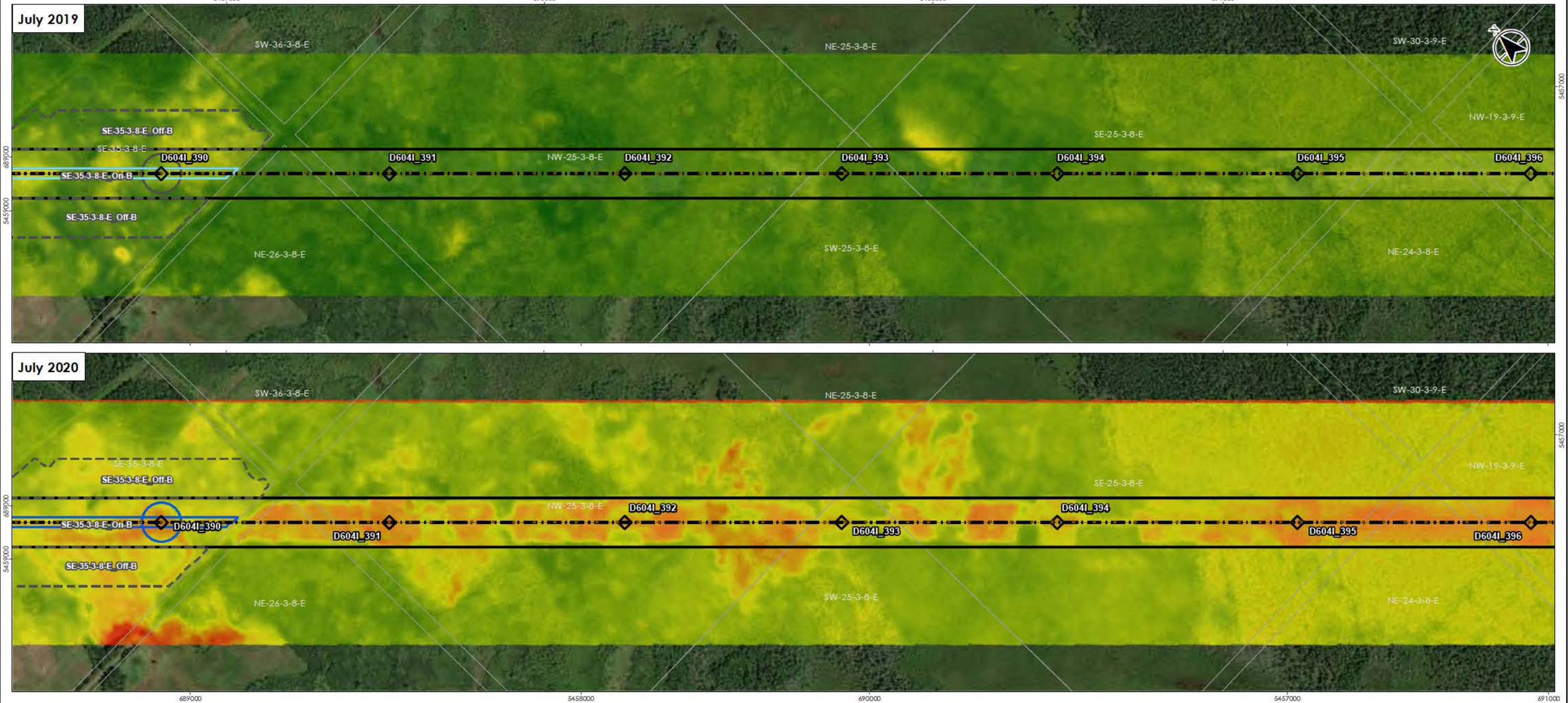

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

High: 1.0

Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Quarter Sections

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-56

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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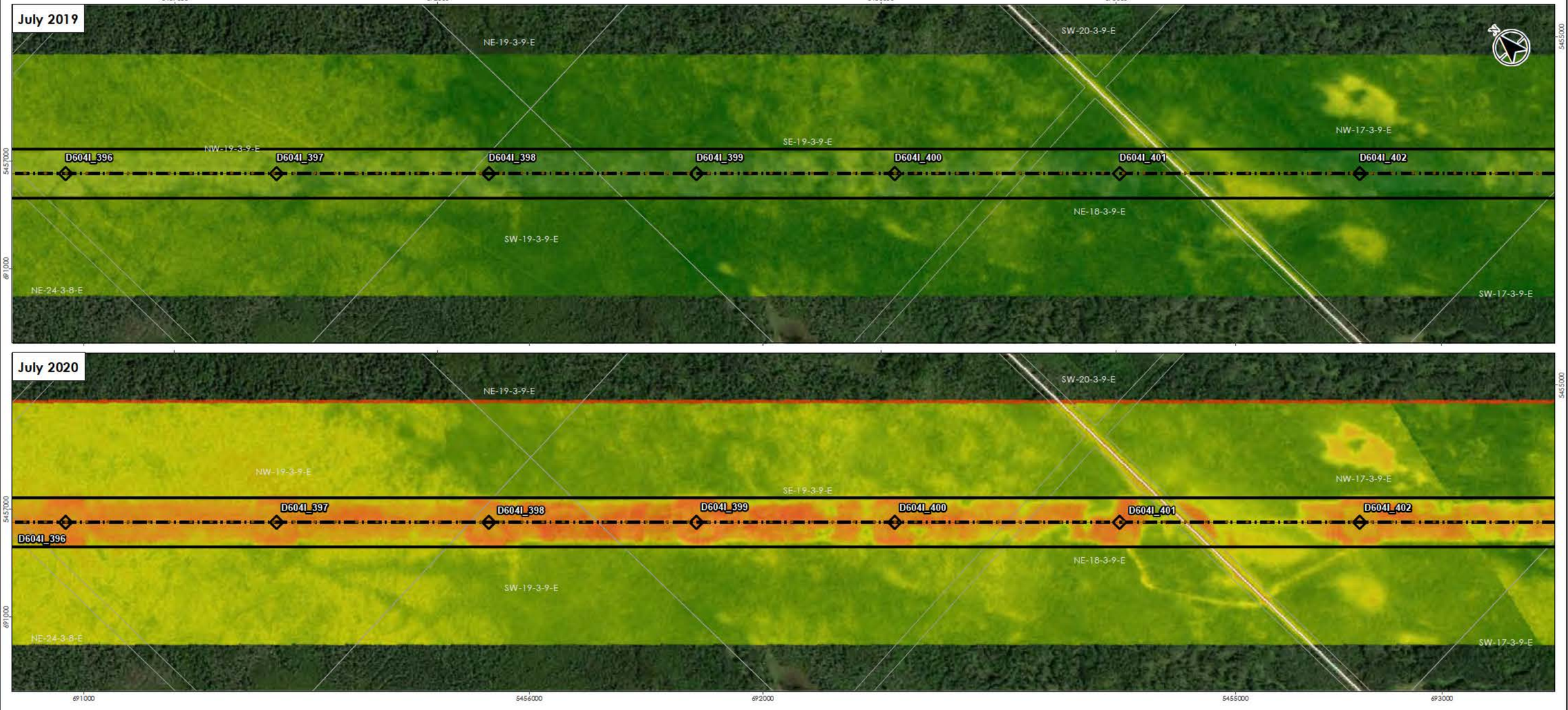

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

High: 1.0

Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
3. Background: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-57

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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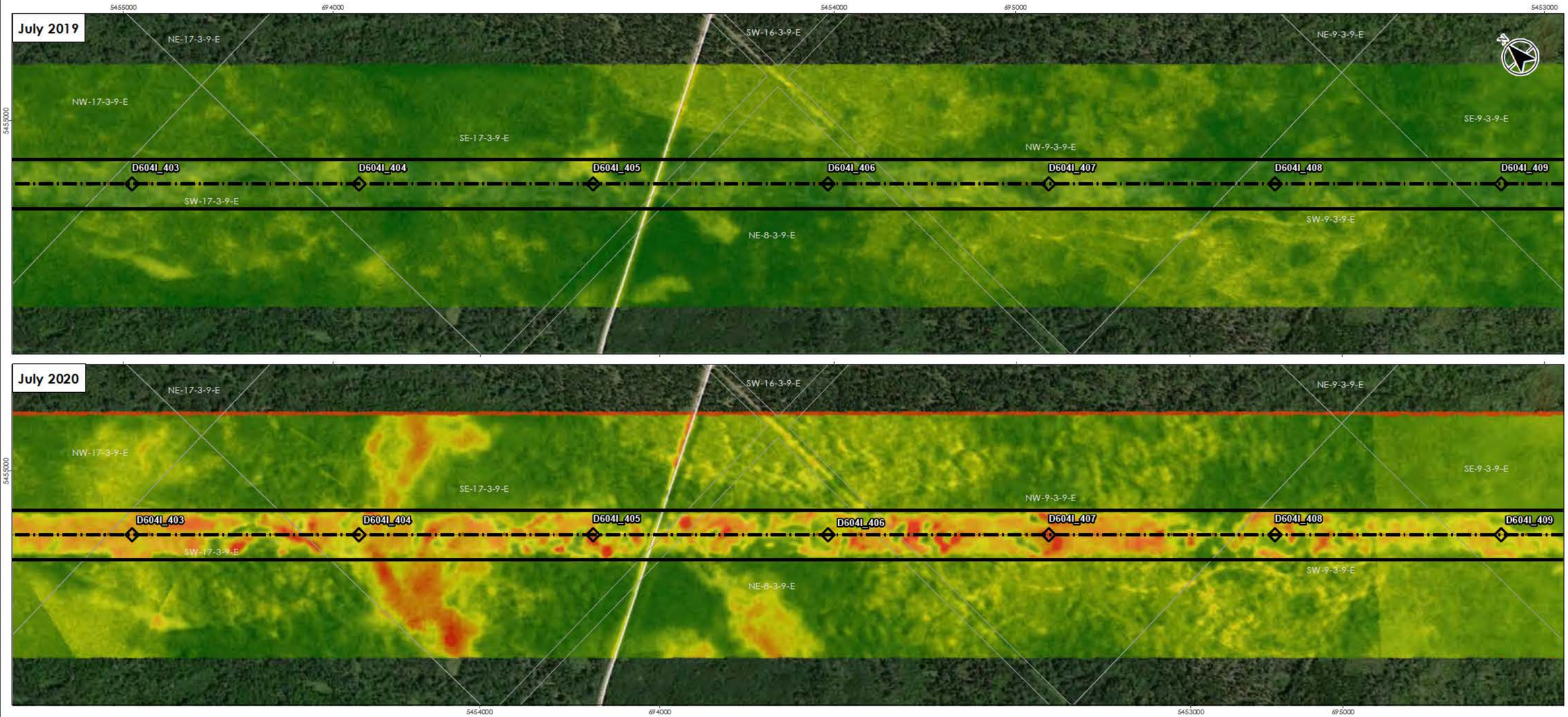

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-58

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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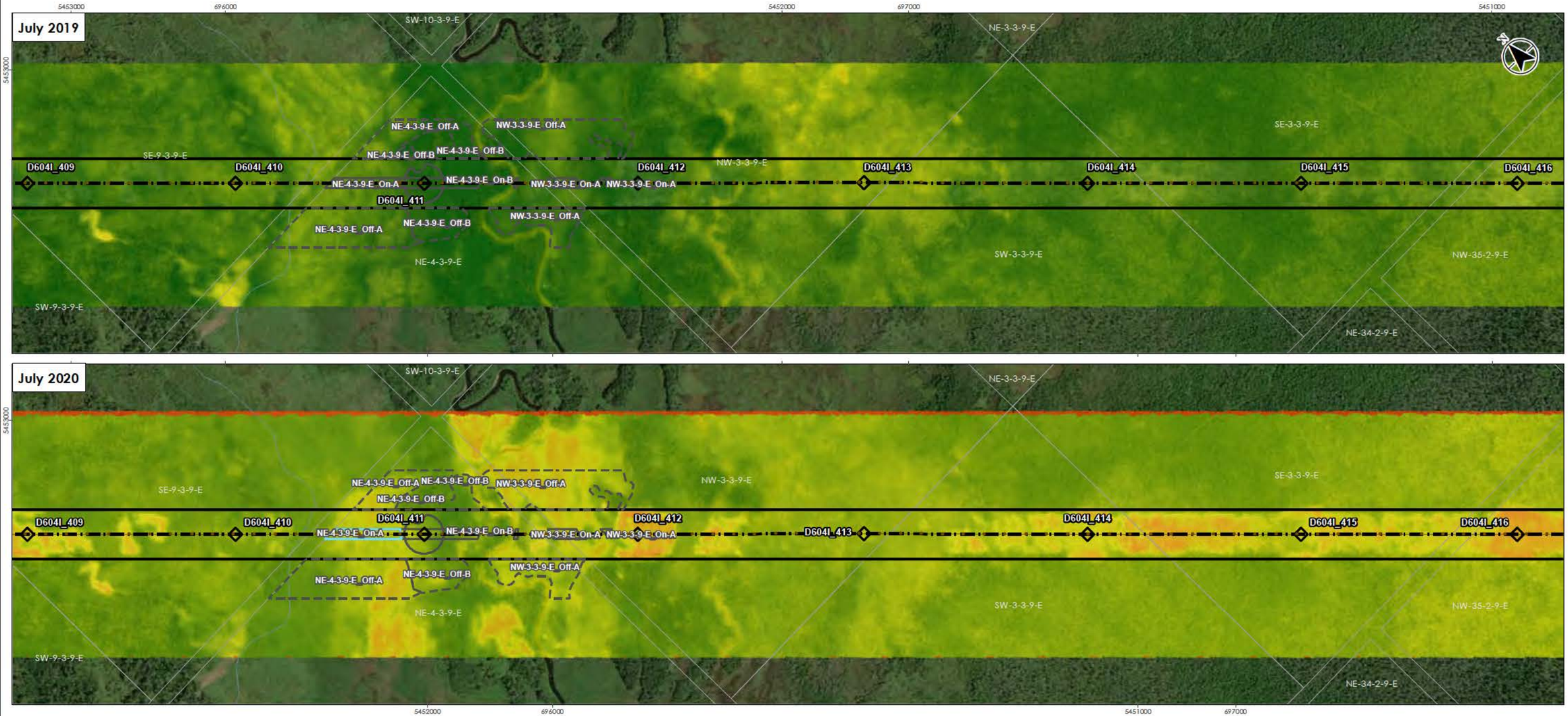

Notes

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2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-59

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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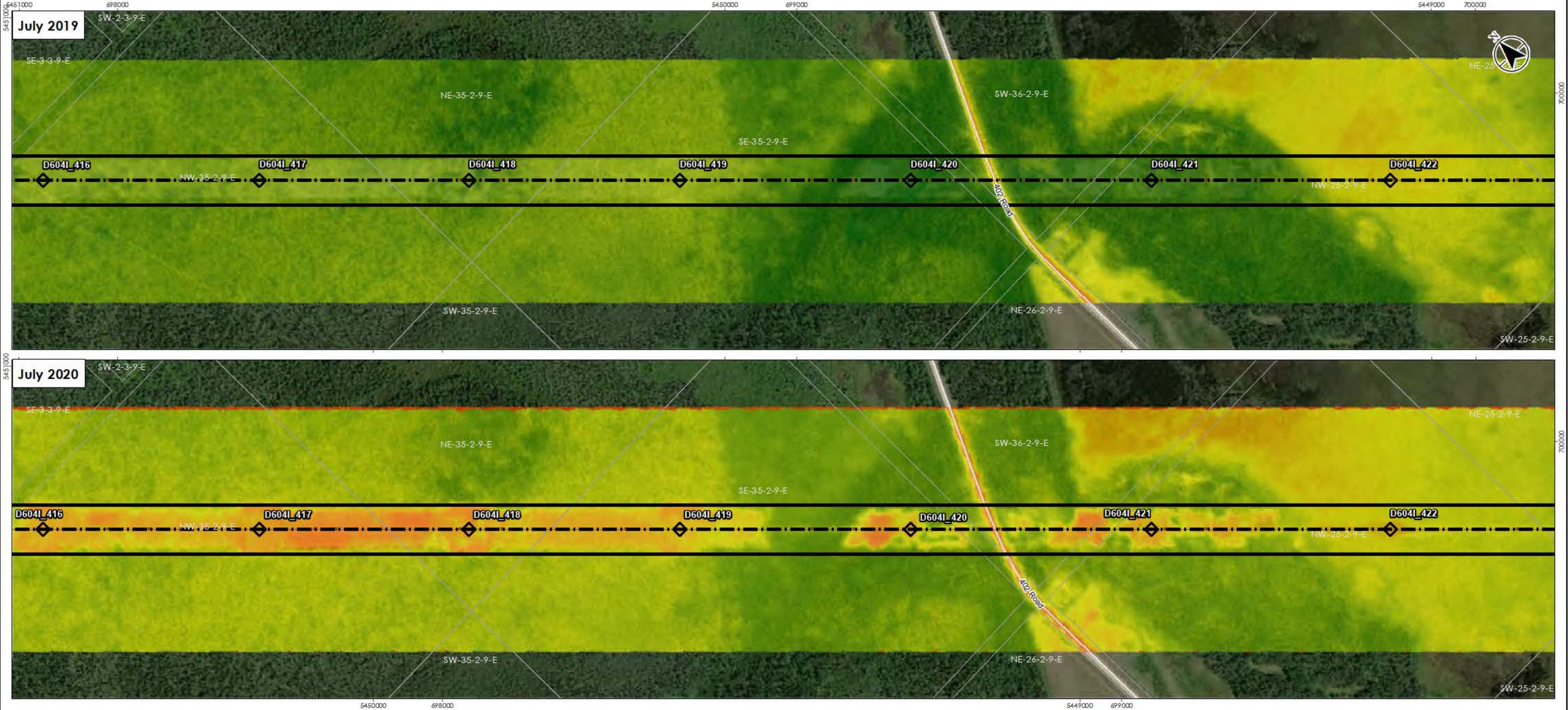

Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Major Road
- Quarter Sections

0 125 250 metres

1:8 000 (At original document size of 11x17)

Notes

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Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-60

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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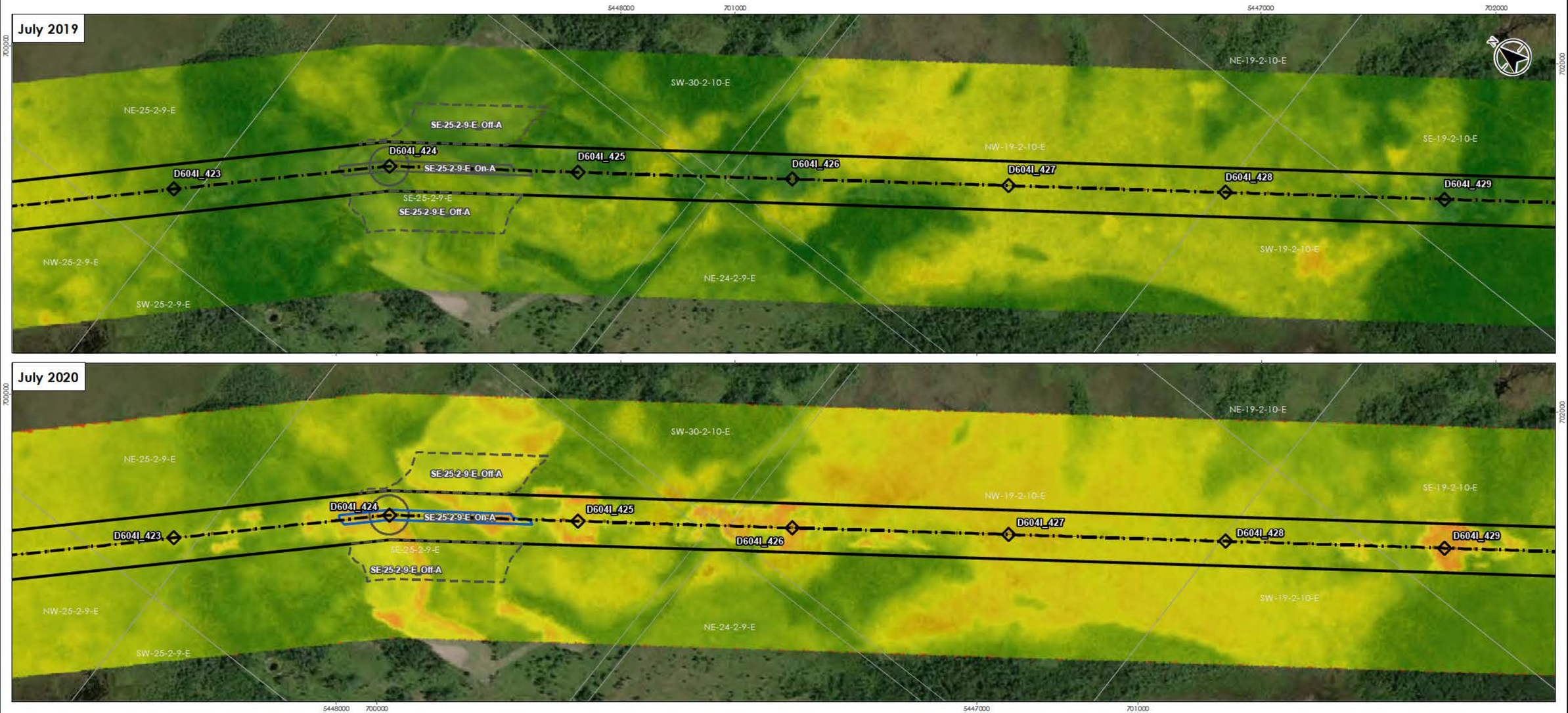

Notes

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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Quarter Sections

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-61

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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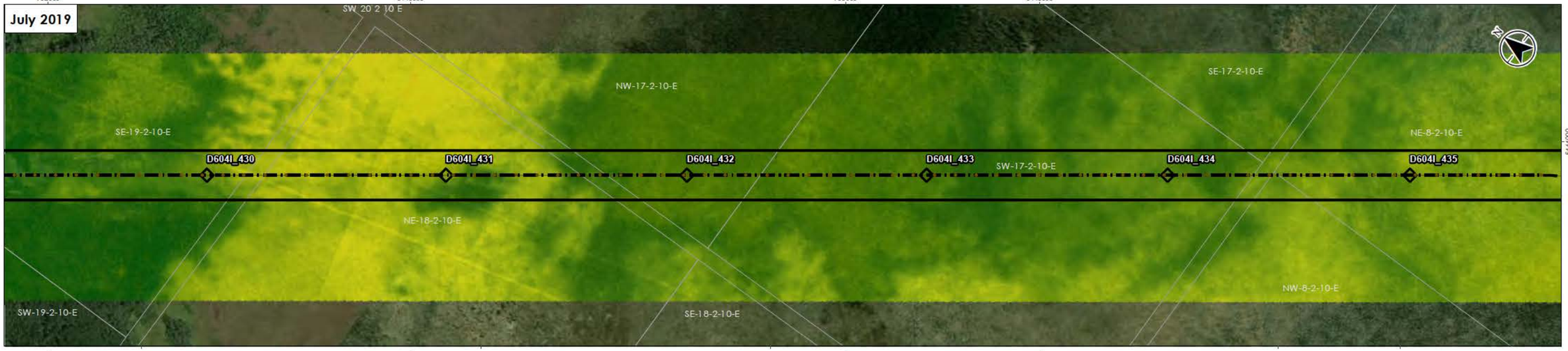

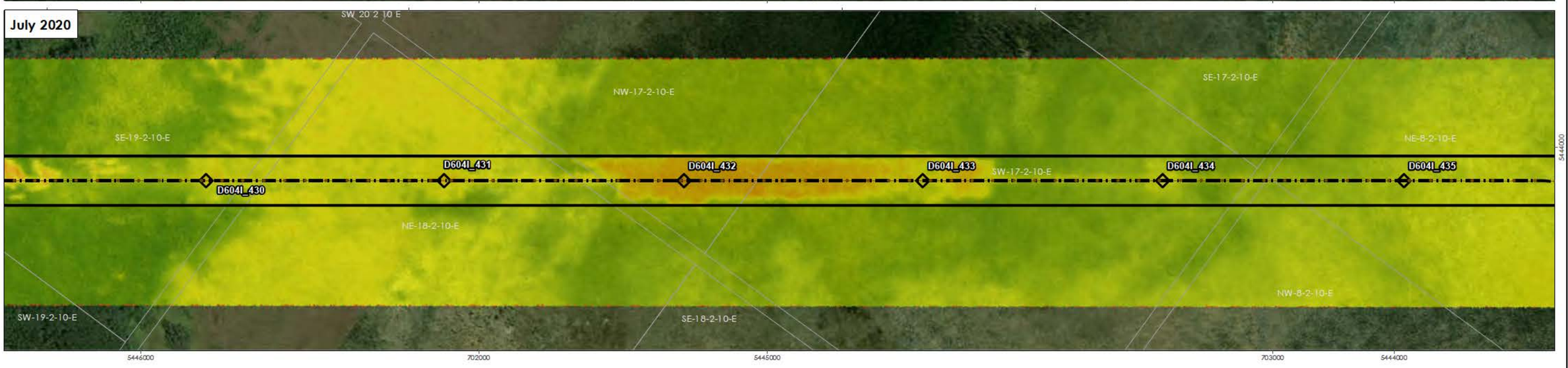

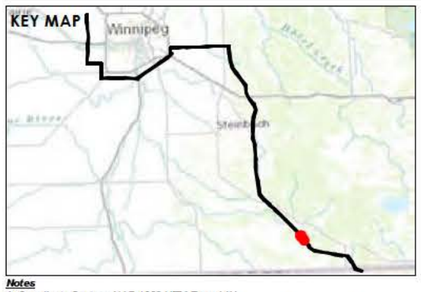

Notes

1. Coordinate System: NAD 1983 UTM Zone 14N
2. Data Sources: Data obtained from Government of Canada, Government of Manitoba, Manitoba Hydro, Stantec Consulting
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Legend

- Manitoba-Minnesota Transmission Line
- MMTP Tower
- Right-of-Way

Evaluation Areas

- On RoW Farm Management Unit (On RoW FMU)
- Tower Work Area
- Off RoW Comparison

Normalized Difference Vegetation Index (NDVI)

- High: 1.0
- Low: -1.0

NDVI Difference Outliers for On RoW FMU and

- Major Negative Outlier
- Minor Negative Outlier
- Minor Positive Outlier
- Major Positive Outlier

- Existing Transmission Lines
- Quarter Sections

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-62

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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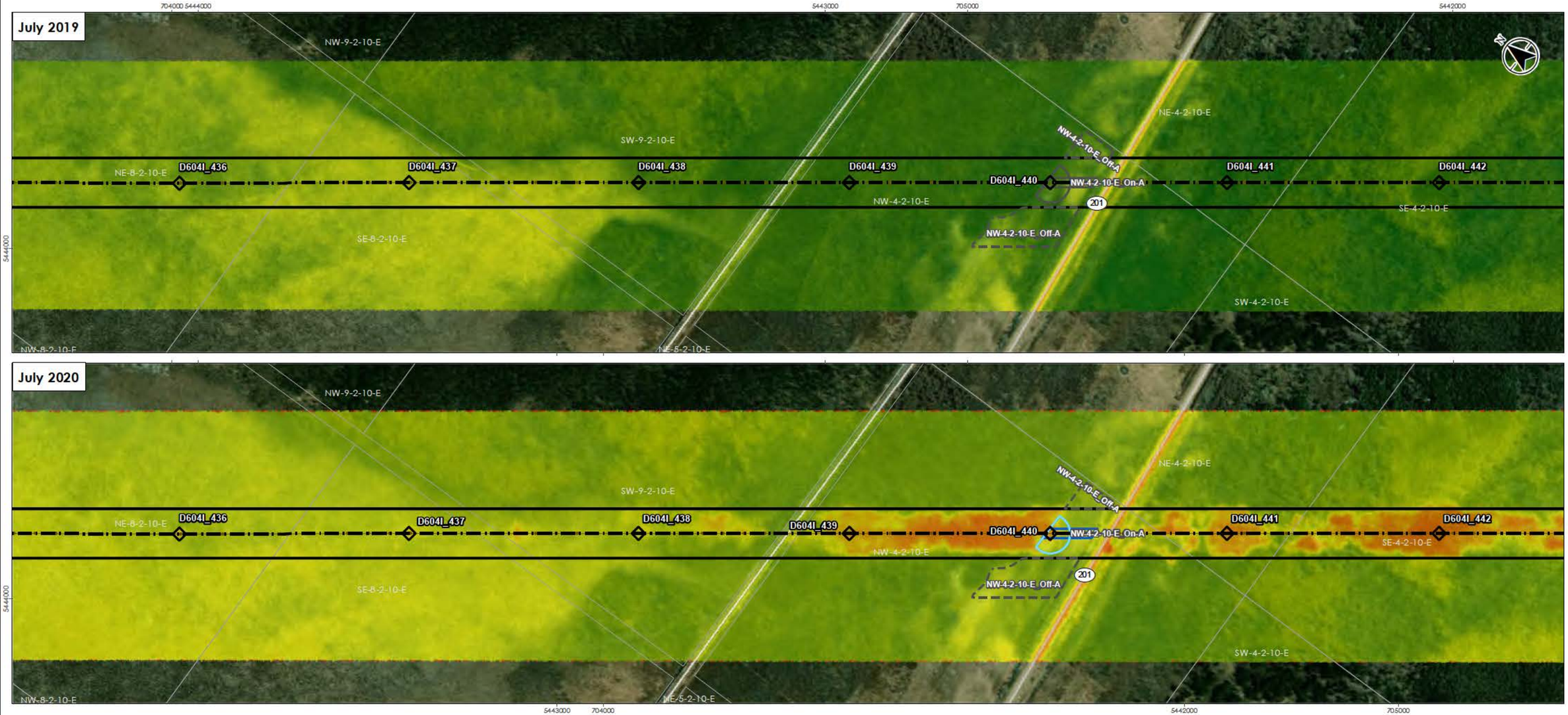

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Legend

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Evaluation Areas

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- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project 111477020-002-REVC
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.
C.2-63

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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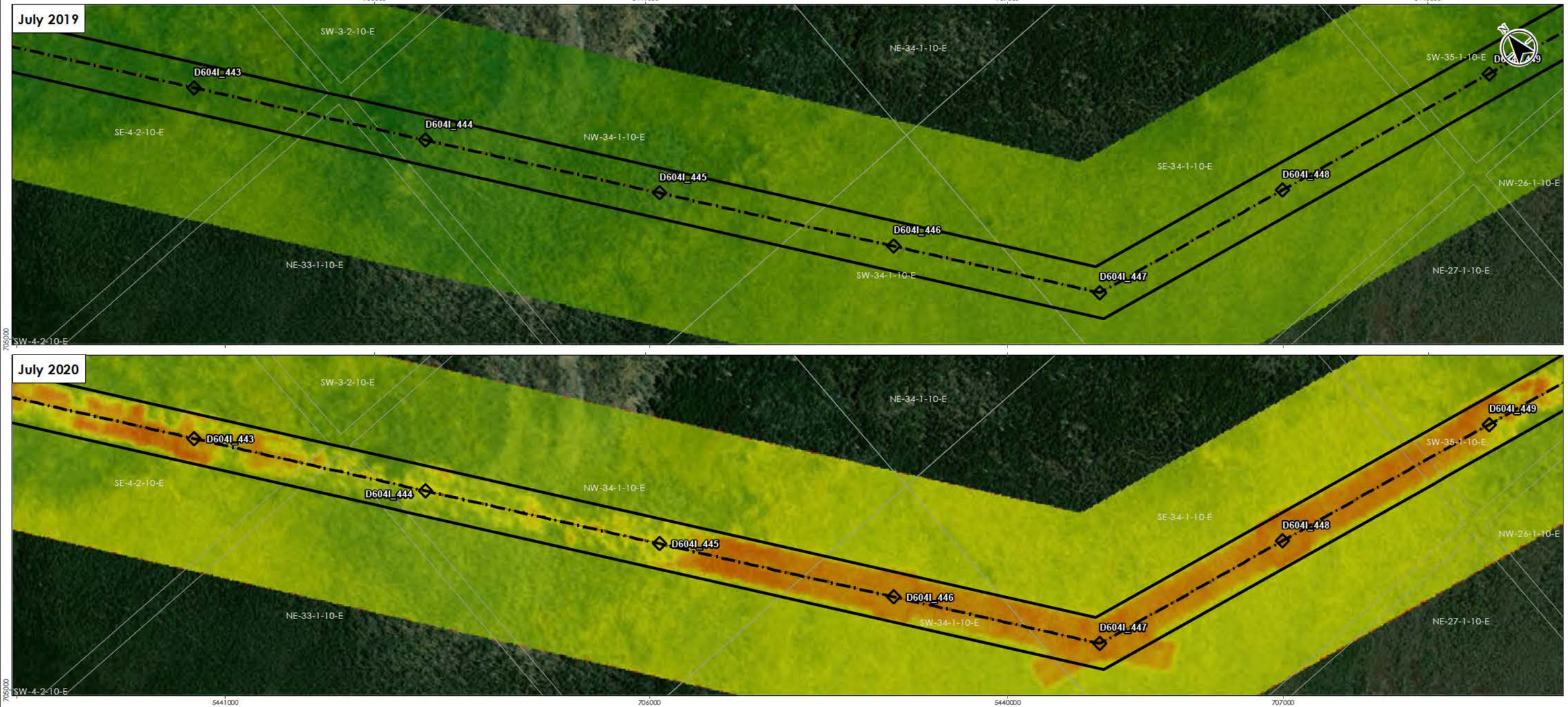

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- Quarter Sections

0 125 250 metres

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IR Review by GK on 2021-05-16

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Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

Map No.
C.2-64

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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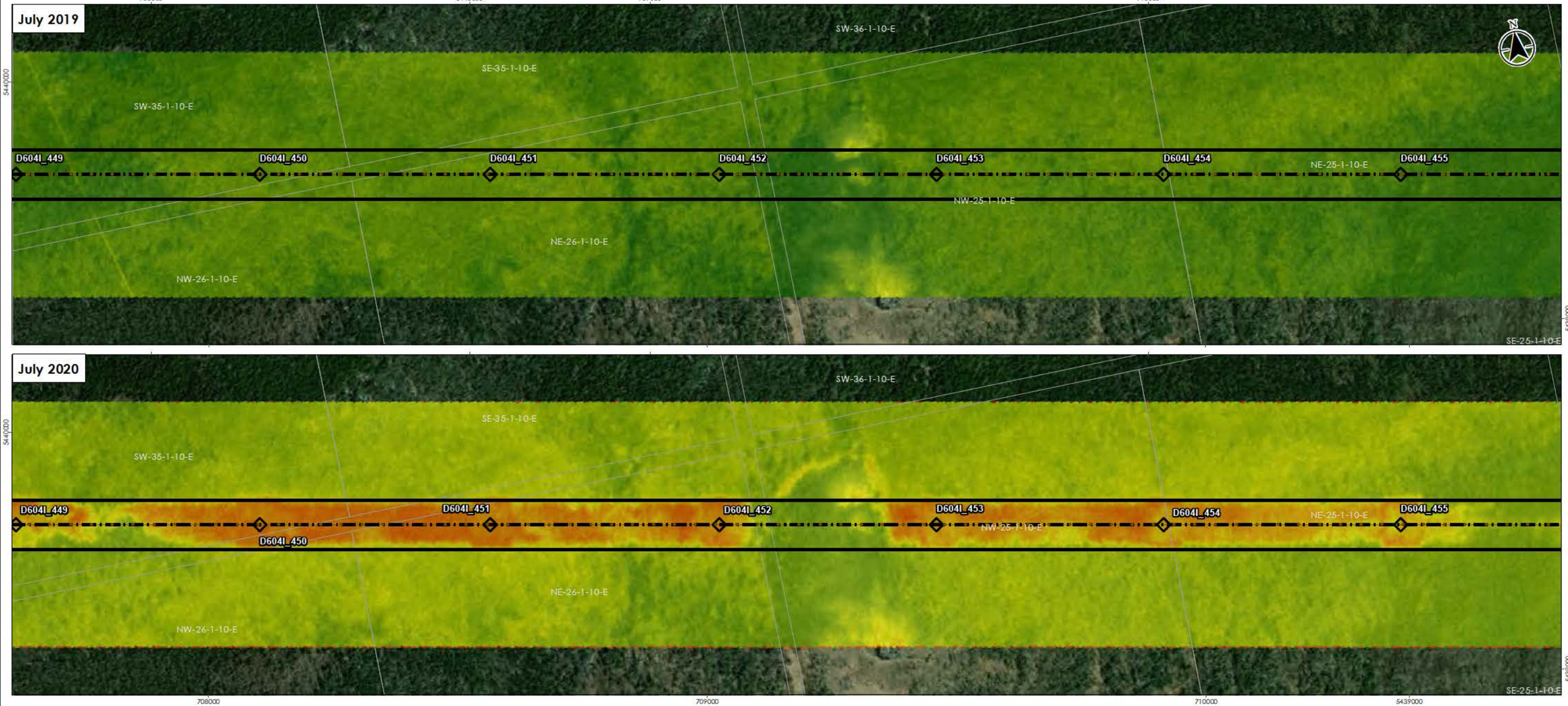

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Manitoba Hydro
Manitoba-Minnesota Transmission Line
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111477020-002-REVC

Map No.
C.2-65

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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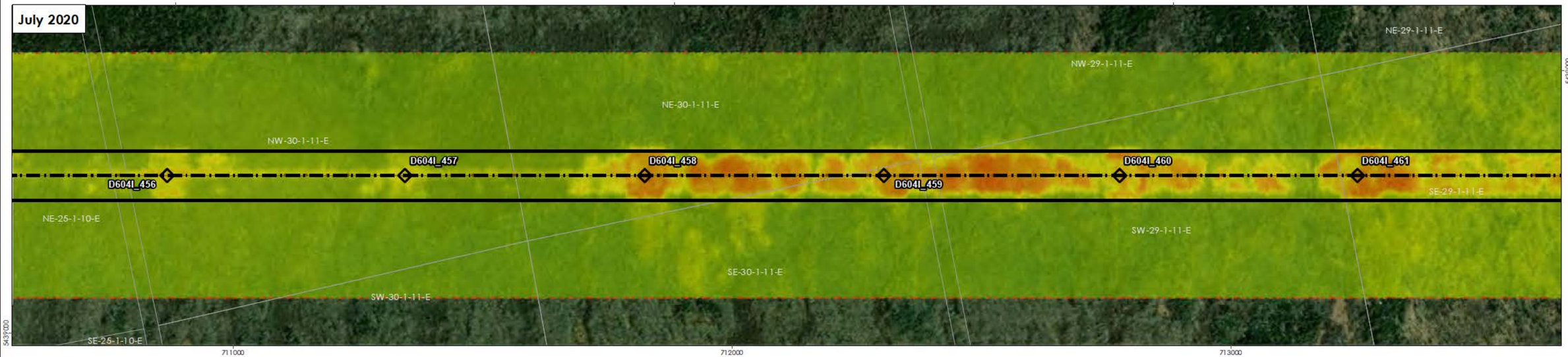
711000 712000 713000

July 2019

5439000

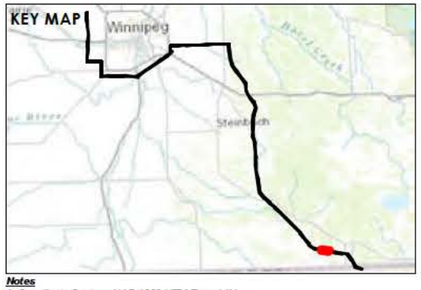
July 2020



5439000

711000 712000 713000

KEY MAP



Legend

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Near Winnipeg
Manitoba

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IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-66

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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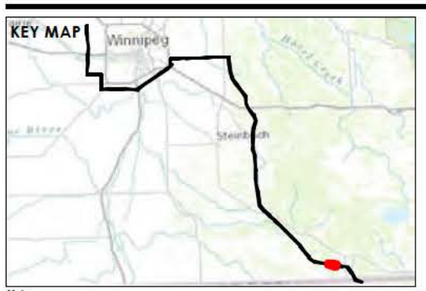
July 2019

5438000

July 2020

714000 715000 716000 5438000

KEY MAP



Legend

- Manitoba-Minnesota Transmission Line
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0 125 250 metres

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Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-67

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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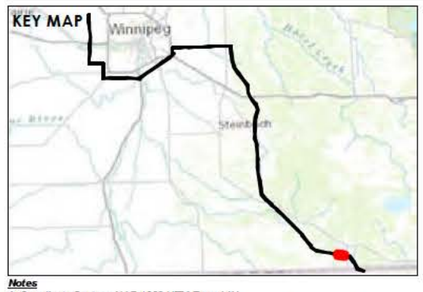

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Legend

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0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-68

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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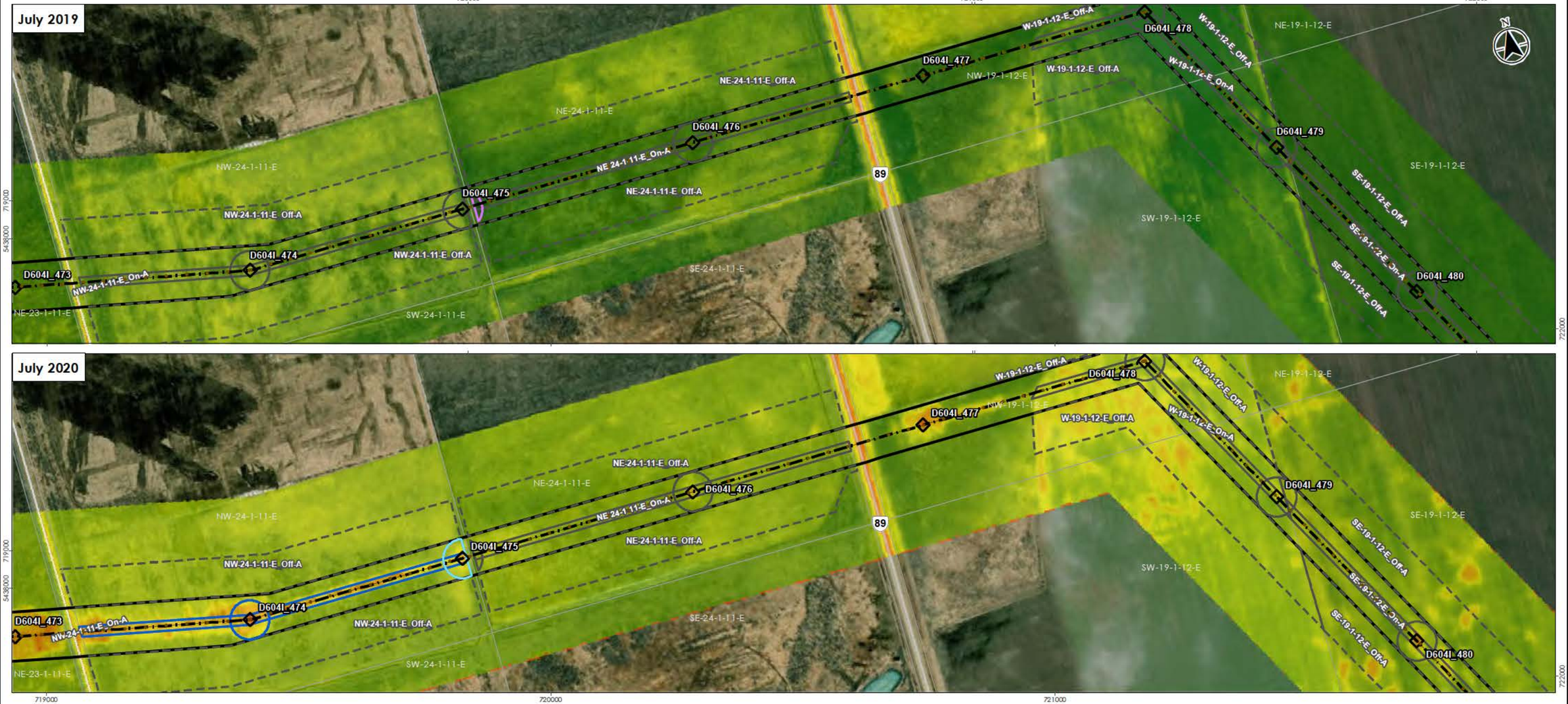

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Legend

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Evaluation Areas

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NDVI Difference Outliers for On RoW FMU and

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- Major Road
- Quarter Sections
- Watercourse

0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

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Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
TR by DW on 2021-05-16
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Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-69

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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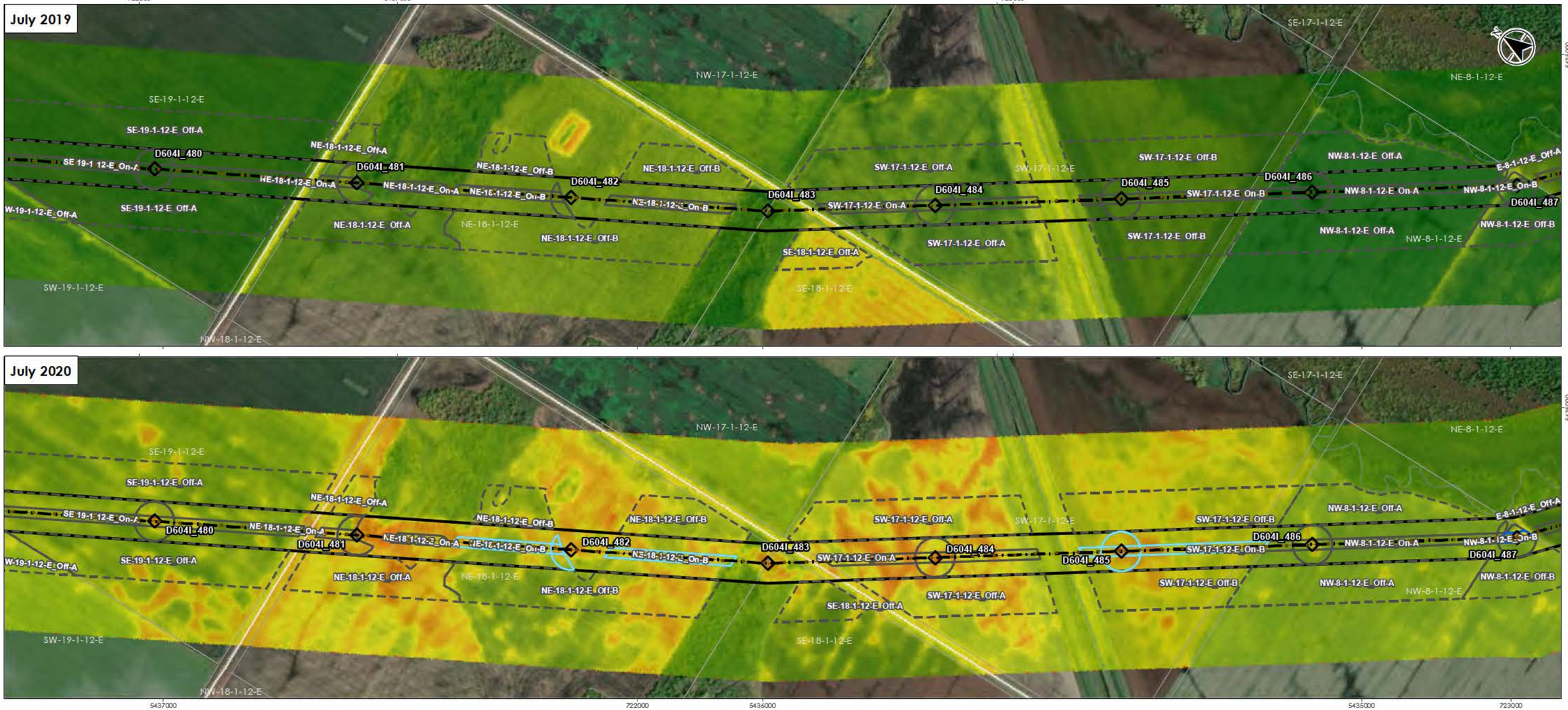

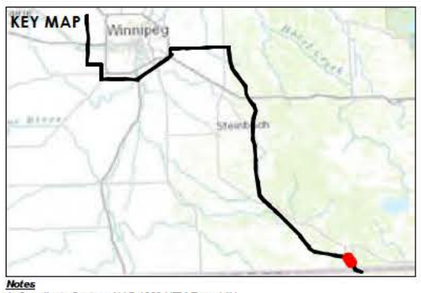

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Legend

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0 125 250 metres

1:8 000 (At original document size of 11x17)

Stantec

Project Location
Near Winnipeg
Manitoba

Prepared by JH on 2021-05-16
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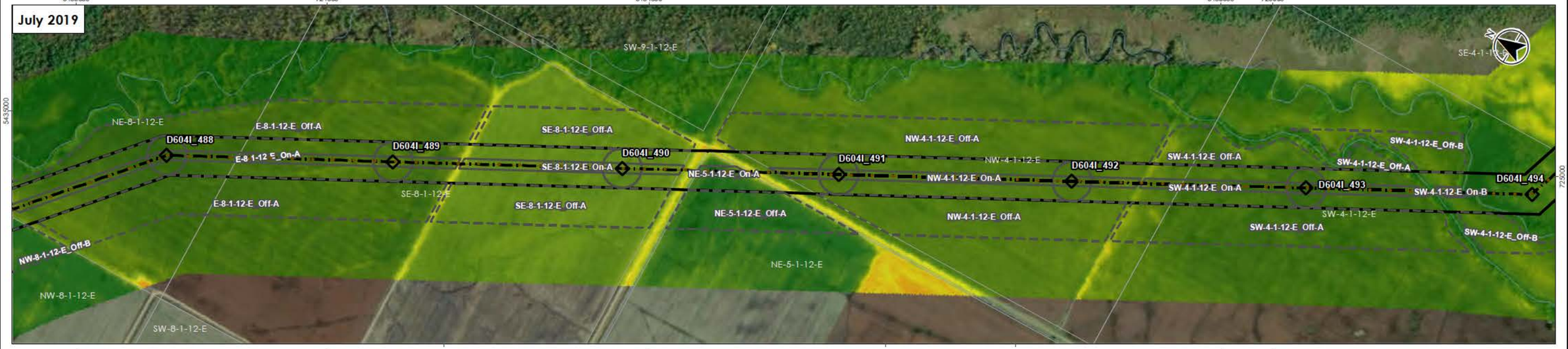
IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-70

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020



KEY MAP

Legend

- Manitoba-Minnesota Transmission Line
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Near Winnipeg
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Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-71

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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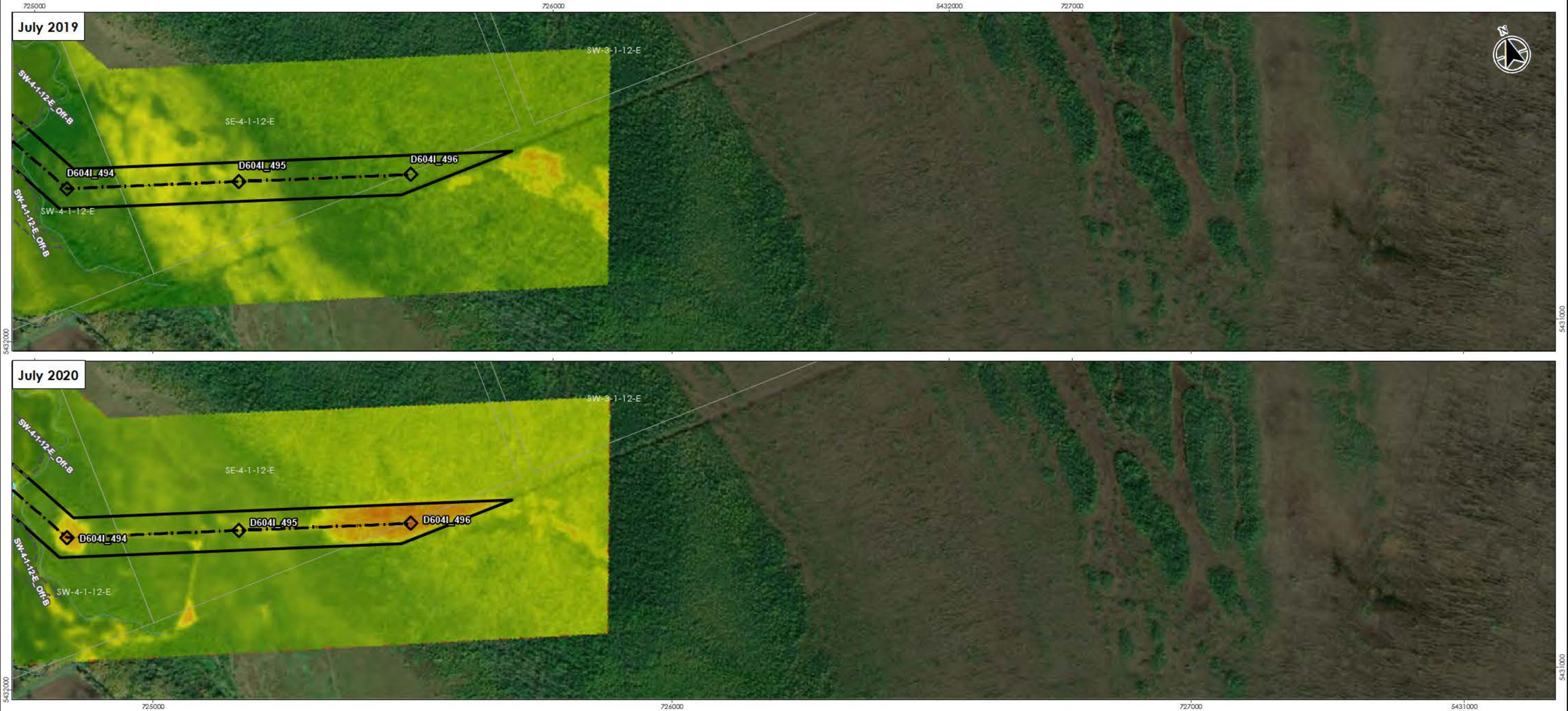

Legend

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IR Review by GK on 2021-05-16

Client/Project
Manitoba Hydro
Manitoba-Minnesota Transmission Line
Soil Productivity & Crop Performance Monitoring

111477020-002-REVC

Map No.
C.2-72

Normalized Difference Vegetation Index (NDVI) - July 2019 & July 2020

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APPENDIX K

To:	*J Matthewson* *Acting Department Manager* *Licensing and Environmental Assessment* *Manitoba Hydro*	From:	*J Wiens* *Environmental Specialist* *Licensing and Environmental Assessment* *Manitoba Hydro*
File:	*MMTP_CON_FA594* *MMTP_CON_FA595*	Date:	*November 30, 2021*

Reference: Field Survey Summary – MMTP Access Management

OBJECTIVE

A site visit was made of MMTP transmission project to inspect effectiveness of access controls in the post-construction phase. This was intended to fulfill requirements of Section 4.8.1 of the MMTP Environmental Monitoring Plan.

METHODS

A site visit was made by vehicle on October 26th and November 26th, 2021. The site was surveyed by vehicle and by foot, with photographs taken at relevant locations All health and safety protocols were adhered to including use of PPE. A review of the Operational Access Management Plan and MMTP landowner complaint registry was also conducted.

RESULTS

An MMTP Operational Access Management Plan was approved by the Province of Manitoba on April 14th, 2021 and permitted several access points on Crown Lands. A review of the MMTP landowner complaint registry showed all fences and access controls had been installed and that no outstanding landowner access concerns remained.

Access inspections were made of 35 sites. Inspection sites were focused on areas that made new or improved access. These were primarily in forested or natural areas. The following access management plan points were visited:

Access Management Point	Controls in place	Comments	Concerns
229	Gate installed		No concerns
230	Gate installed		No concerns
255	Boulders installed	Landowner has moved boulders to allow construction access.	No concerns
256	Fence and gate installed		No concerns
282	Gate installed		No concerns
283	No controls required	Wetland area. Little visible use.	No concerns
284	Gate installed		No concerns
285	Existing fence and gate		No concerns
294	Gate installed		No concerns
300	Gate installed		No concerns
305	Fence and gate installed		No concerns
306	Fence and gate installed		No concerns
317	Gate installed		No concerns
318	Fence and gate installed		No concerns

335	Cultivated field		No concerns
344	Fence and gate installed		No concerns
346	No change to pre-existing access		No concerns
351	Cultivated field		No concerns
352	Fence present		No concerns
359	Gate installed		No concerns
360	Gate installed		No concerns
380	Fence and gate installed		No concerns
381	Fence and gate installed		No concerns
385	Gate installed		No concerns
386	Gate installed		No concerns
401	No controls required	Little visible use	No concerns
402	No controls required	Little visible use	No concerns
405	No controls required	Some vehicle traffic present	No concerns
406	No controls required	Some vehicle traffic present	No concerns
420	No controls required	Little visible use	No concerns
421	Gate and fence installed		No concerns
440	Fence installed		No concerns
441	No controls required	Landowner manages approach	No concerns
473	No controls required	Little visible use	No concerns
474	No controls required	No visible use	No concerns

RECOMMENDATIONS AND CHANGES

As there are no concerns identified, no further access related work is required. Photos of sites are included below.

PHOTOS

Access Management Point 229

Access Management Point 230

Access Management Point 255

Access Management Point 256

Access Management Point 282

Access Management Point 283

Access Management Point 284

Access Management Point 285

Access Management Point 294

Access Management Point 300

Access Management Point 305

Access Management Point 306

Access Management Point 317

Access Management Point 318

Access Management Point 335

Access Management Point 344

Access Management Point 346

Access Management Point 351

Access Management Point 352

Access Management Point 359

Access Management Point 360

Access Management Point 380

Access Management Point 381

Access Management Point 385

Access Management Point 386

Access Management Point 401

Access Management Point 402

Access Management Point 405

Access Management Point 406

Access Management Point 420

Access Management Point 421

Access Management Point 440

Access Management Point 441

Access Management Point 473

Access Management Point 474