
To: Canadian National Railway Company (CN) From: Laura Marshall
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File: 160960844 Date: March 30, 2023

**Reference: Canadian National Railway Company (CN)
2022 Follow-Up Monitoring Program Results:
Monarch Replacement Habitat**

INTRODUCTION

Canadian National Railway Company (CN) retained Stantec Consulting Ltd. (Stantec) to conduct a Monarch follow-up program (FUP) for the Milton Logistics Hub (the Project) in the Town of Milton, within the Regional Municipality of Halton (Halton Region), Ontario.

This report documents the implementation of the Monarch component of the CN Milton Logistic Hub: Wildlife Management and Connectivity Plan” (WMCP) (Stantec 2022) for construction during the 2022 construction period.

Condition 8.25 of the Minister of Environment and Climate Change’s (2021) Decision Statement states that the Proponent, CN, shall implement a FUP to verify the accuracy of the environmental assessment and determine the effectiveness of mitigation measures as it pertains to the adverse environmental effects of the Milton Logistics Hub (the Project) on monarch butterfly.

Condition 8.25.1 of the Decision Statement requires monitoring of the 40.7 hectares of off-site replacement habitat for use of Monarch, while Condition 8.25.2 requires monitoring of the 18.8 hectares of on-site replacement habitat within the Project Development Area (PDA). If the results of the monitoring find that additional measures are required to mitigate Project-attributed adverse environmental effects on the species, CN is to develop and implement modified or additional mitigation measures, in accordance with Condition 8.25.3 of the Decision Statement.

On-site Monarch habitat has not been established; as such, monitoring requirements under Condition 8.25.2 of the Decision Statement will be completed in future years.

MONITORING REQUIREMENTS

The WMCP was developed to ensure consistency and efficiencies in monitoring throughout the lifespan of the Project. It prescribes the habitat creation and management, outlines the FUP monitoring protocol and identifies indicators of effectiveness of the mitigation measures for Monarch.

Wildlife monitoring requirements were developed to comply with the conditions of approval in the Decision Statement. In accordance with the WMCP, the off-site habitat will be monitored using the following components:

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- **Off-site Vegetation Monitoring:** Vegetation monitoring will occur in conjunction with the 20-year Bobolink and Eastern Meadowlark FUP monitoring. Cover of milkweed and other nectaring wildflowers will be documented during annual habitat assessments.
- **Butterfly and Caterpillar Monitoring:** CN has committed to monitoring Monarch at the off-site replacement habitat within the Luther Marsh Wildlife Management Area. Annual monitoring will be undertaken between July and September of each year during the 20-year monitoring period. Surveys will be completed by walking transects through Monarch habitat. The number of adults observed flying or foraging in the habitats will be recorded, along with observations of caterpillars and eggs on the leaves of milkweed plants along the transects.

In accordance with the WMCP, CN will develop and implement modified or additional mitigation measure(s), if milkweed and nectaring flowers have not established or if evidence of Monarch use (adults, caterpillars or eggs) has not been identified. A qualified biologist will review the site conditions and possible causes of the habitat not attracting Monarch. Corrective measures will be prescribed by the qualified biologist and implemented by CN.

METHODS

In 2018, Ducks Unlimited Canada (DUC) was retained by CN to create, manage and monitor the 40.7 hectares of off-site replacement Monarch habitat, in conjunction with grassland habitat for Bobolink and Eastern Meadowlark. The off-site replacement Monarch habitat was prepared and seeded in 2018-2019, within the Luther Marsh Wildlife Management Area. Once the off-site replacement habitat was established, the FUP monitoring began in 2021.

In 2022, transects were walked between grassland bird survey point count locations during each of the three grassland breeding bird surveys. All adult Monarchs observed flying or foraging within approximately 50 feet on either side of the transect line were recorded. Two additional surveys were conducted at the off-site replacement habitat on July 15 and September 6, 2022, to document Monarch larvae and egg presence and leaf predation on milkweed plants along the transect line. Nodes (clumps) of 10 or more milkweed stalks found along the transect were examined for caterpillars, eggs, and evidence of predation.

RESULTS

The current year, 2022, represented the second year of monitoring undertaken within the off-site replacement Monarch habitat. Methods and results of the monitoring are provided in Grassland Bird and Monarch Butterfly Survey Report (Bluestem Consulting and Ducks Unlimited Canada October 11, 2022) which is provided in **Appendix A**. This memo summarizes the results of the monitoring and analysis.

Results from the three Monarch surveys conducted in conjunction with the grassland breeding bird surveys are summarized in **Table 1** below.

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Table 1: Monarch Survey Dates, Weather Conditions and Observations

Date and Times	Weather Conditions	Sightings		Distance to Tall Object
June 6, 2022	Overcast, 12 °C, Wind East, variable	None		Trees on field border – 100m
June 15, 2022	90% cloud, 17 °C	None		Trees on field border – 100m
June 22, 2022	10% cloud, 25 °C, Wind West, light	Point Count Locations	# of Adults Observed	Trees on field border – 100m
		Between 3 and 4	1	
		Between 9 and 10	1	
		Between 12 and 13	1	
		Between 13 and 14	1	

Results from the two additional surveys conducted to determine the presence of larvae, eggs and predation on milkweed nodes along the transect are summarized in **Table 2** below.

Table 2: Monarch Larvae and Egg Survey Results

Date	Weather Conditions	# of Adults Observed	Total Milkweed Nodes Assessed	# of Larval Caterpillars Observed	% Leaves with Eggs Present	% Leaf Predation
July 15, 2022	Overcast, 12 °C, Wind West, variable.	28	5	19	10-20%	20-30%
September 6, 2022	Clear, 25° C, Wind Variable.	13	5	29	20%	40%

DISCUSSION AND RECOMMENDATIONS

The off-site grassland replacement habitat appears to be capable of supporting populations of Monarch. Adult butterflies were observed throughout the habitat during the peak warm season. However, Bluestem Consulting and DUC noted that Monarch was not as abundant in 2022, compared to the first year of monitoring in 2021. Milkweed nodes were not common along the transect but were more abundant along the perimeter of the field where it is likely that milkweed has established through recruitment from outside sources.

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Presence of milkweed and nectaring flowers in the off-site replacement habitat, as well as use of the habitat by Monarch, were documented in the 2022 FUP monitoring. As such, no modified or additional mitigation measures were required. However, Bluestem Consulting and DUC (2022) recommends supplemental hand planting of milkweed seed to increase overall establishment throughout the replacement habitat. Milkweed requires bare soil not populated by other species to germinate (Hopwood 2013; Kurzejeski et al. 2020). Many areas of bare soil exist within the habitat and DUC recommended hand planting of seed at a rate of 125 grams per acre (approximately 16,000 seeds per acre), which could increase establishment and abundance of milkweed within the habitat. CN will implement the recommended seeding in the spring of 2023 during the grassland breeding bird surveys.

Stantec Consulting Ltd.

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Attachments: Attachment A: Grassland Bird and Monarch Butterfly Survey Report - Bluestem Consulting and Ducks Unlimited Canada
October 11, 2022

Reference: Canadian National Railway Company (CN)
2022 Follow-Up Monitoring Program Results:
Monarch Replacement Habitat

REFERENCES

- Bluestem Consulting and Ducks Unlimited Canada (DUC). 2022. Grassland Bird and Monarch Butterfly Survey Report. Prepared for Canadian National Railway Company (CN). Luther Marsh Grassland Restoration Project. Prepared by Kyle Breault. October 11, 2022.
- Hopwood, J. 2013. Roadsides as Habitat for Pollinators: Management to Support Bees and Butterflies. Conference proceedings of the 7th International Conference on Ecology and Transportation (IOECT): Canyons, Crossroads, Connections. Scottsdale, Arizona, USA. Available online: https://www.researchgate.net/publication/286066214_ROADSIDES_AS_HABITAT_FOR_POLLINATORS_MANAGEMENT_TO_SUPPORT_BEES_AND_BUTTERFLIES
- Kurzejeski, E. Vangilder, L. D., Saltgaver, N. L., Hannks, W. A. 2020. Milkweed Establishment in Restored Central Missouri Prairie. Wildlife Society Bulletin. Vol. 44, Issue 3. August 5, 2020. Available online: <https://doi.org/10.1002/wsb.1109>
- Stantec Consulting Ltd. 2022. CN Milton Logistics Hub: Wildlife Management and Connectivity Plan. February 14, 2022.

Reference: Canadian National Railway Company (CN)
2022 Follow-Up Monitoring Program Results:
Monarch Replacement Habitat

ATTACHEMENT

Grassland Bird and Monarch Butterfly Survey Report - Bluestem Consulting and Ducks Unlimited Canada October 11, 2022

Grassland Bird and Monarch Butterfly Survey Report

Prepared for

Canadian National Railway Company (CN)

Luther Marsh
Grassland Restoration Project

Report prepared by

Kyle Breault
Bluestem Consulting and
Ducks Unlimited Canada
October 11, 2022

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Introduction

Ducks Unlimited Canada (DUC) was engaged by the Canadian National Railway Company (CN) in 2017 to create, manage and monitor 40ha of native grassland habitat for monarch butterfly, (*Danaus plexippus*), bobolink (*Dolichonyx oryzivorus*) and eastern meadowlark (*Sturnella magna*). This habitat restoration project and follow up monitoring work is being undertaken as a condition of the MECP approval (Conditions 8.12 and 8.13) for the CN Milton Logistics Hub. The project site chosen was previously-leased farmland within the Luther Marsh Wildlife Management Area near Monticello, Ontario. The location of this plot is highlighted in Figs 1 and 2. This plot is located within the 1784 Haldimand Treaty Areas (Six Nations of the Grand) (Fig 3). Plot boundaries and survey points are shown in Figure 4. See Appendix 1 for landowner information and survey point location data.

The site was an agricultural field and was previously planted in soybeans. The field was seeded using broadcast seeders in the late fall of 2018 and Brillion seed drills during the spring of 2019.

The seed mix (native grasses, clumping tame grasses and native forb seed) was blended with cracked corn (as a spreading agent) and the seed was drilled or spread at a rate of approximately 40 seeds per square foot. As list of species seeded at the site, and their seeding rates, can be found in Appendix 2.

As per the instruction of CN, DUC undertook a grassland bird and monarch butterfly survey during the spring and summer of 2022.

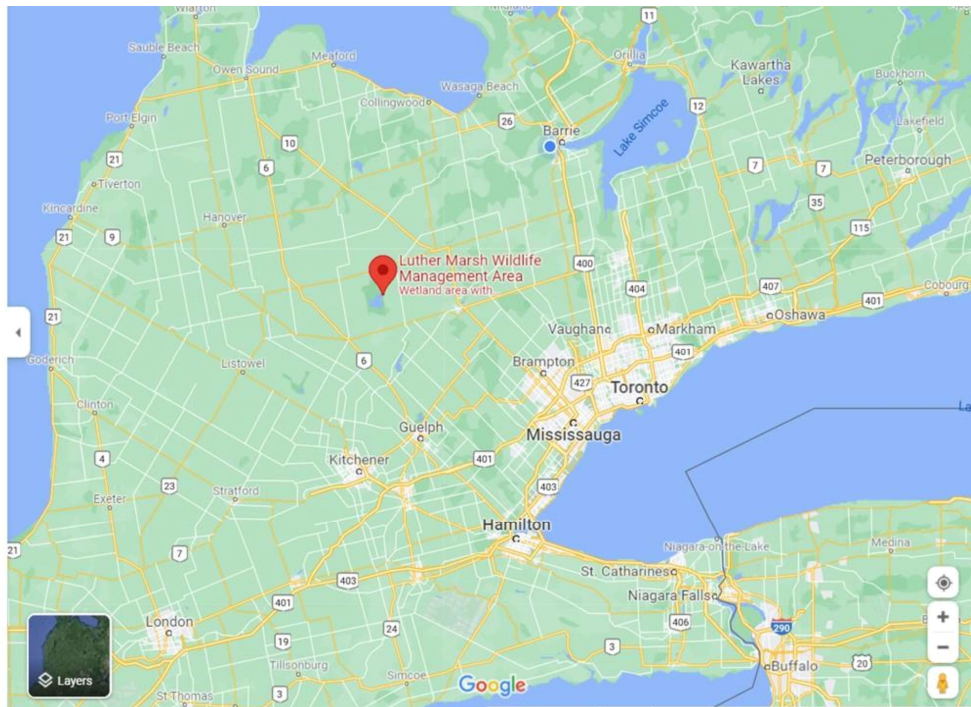


Figure 1: Location of Luther Marsh Wildlife Management Area (WMA)

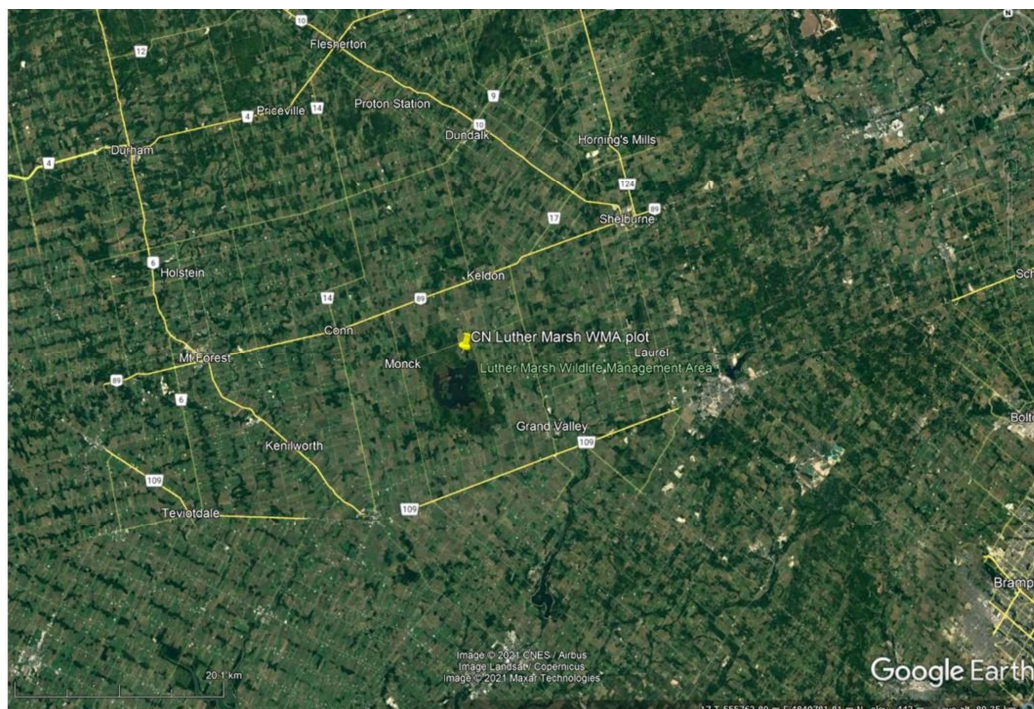


Figure 2: Location of CN grassland plot within the Luther Marsh WMA

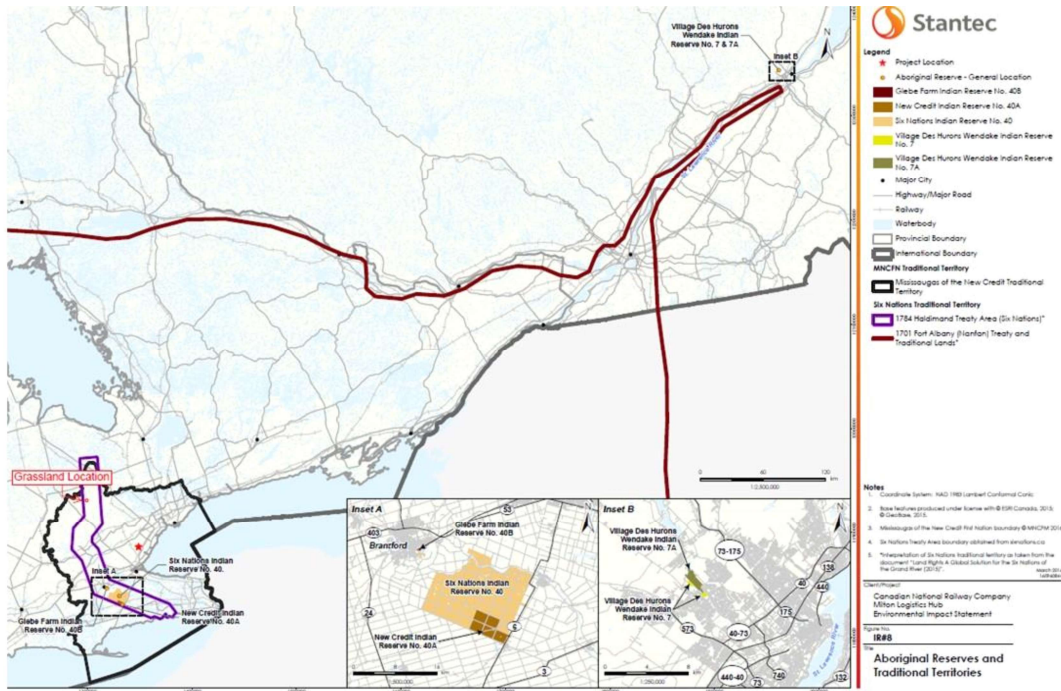


Figure 3: Location of CN grassland plot in relation to Six Nations of the Grand boundary



Figure 4: CN grassland plot boundaries and grassland bird survey point locations

Habitat Assessment 2022

Luther Marsh CN Plot

Observations over the summer of 2022 indicate that this grassland plot continues to mature nicely. The tame grasses such as orchard grass and timothy that comprise the majority of cover for nesting grassland birds continues to fill in more each year. The habitat is a blend of leafy mid-height grasses that provide optimal breeding habitat for bobolink and other grassland birds. The forbs that were planted are beginning to establish as well and considerable evidence of last year's plants and newly germinated plants was present. At the time of this survey, the grass component was about 70% of the cover while forbs and other broadleaf plants made up 30% of the cover. The grasses will likely continue to dominate over the coming years given the heavy clay soils on the site. This site also has an abundance of temporary and permanent wetland habitat in the vicinity, which further enhances foraging opportunities for these and other insectivorous grassland birds.

There is evidence of some woody stem growth, but it is not yet becoming dominant. Mowing may be beneficial in the fall of 2023 or 2024 to ensure that woody stems do not become too large and pervasive.

The follow up site visits for the monarch butterfly survey shows that there are abundant plant species for foraging by butterflies. This includes many of the forbs that were included in the seed mix, and also native meadow species like goldenrods (*Solidago spp*) and asters (*Aster spp.*). Foraging and nectar plants are not a limiting factor for this site, however, milkweed (*Asclepias spp.*) density (especially in denser clumps), is low.

Grassland Bird Survey

Grassland bird surveys were conducted on the CN Luther Marsh plot during the spring of 2022. Surveys were conducted as per the protocol provided by the Ontario Ministry of Natural Resources under their 2011 guidelines.

Grassland Bird Survey Results

Three surveys were conducted in June of 2022. Surveys were completed using point surveys and were conducted by Kyle Breault of Bluestem Consulting. The results of the surveys can be found in Tables 1-3 below.

Table 1. Grassland Bird Survey Results, CN Luther Marsh

Survey Date #1 June 6, 2022

Date	Property	Point #	Time	Weather	Sightings	Distance to Tall Object
June 6, 2022	CN Luther	1	7:30 am	Overcast 12C, Lite E wind	bobolink 2 mp, mp. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	2	7:44 am	Overcast 12C, Lite E wind	bobolink 4 mp, mp,mfl, mfl. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	3	7:56 am	Overcast 12C, Lite E wind	bobolink 4 mfl, mfl, ffl, mp. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	4	8:10 am	Overcast 12C, Lite E wind	bobolink 5 mp, mp, mp, mfl, mfl. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	5	8:22 am	Overcast 12C, Lite E wind	bobolink 1 ffl. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	6	8:36 am	Overcast 12C, Lite E wind	bobolink 2 ffl, mp. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	7	8:50 am	Overcast 12C, Lite E wind	bobolink 2 mp, mp. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	8	9:04am	Overcast 12C,	bobolink 1.	Trees on field border 100m

				Lite E wind	mfl. No meadowlark	
June 6, 2022	CN Luther	9	9:18am	Overcast 12C, Lite E wind	bobolink 1 mfl. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	10	9:30am	Overcast 12C, Lite E wind	bobolink 1 mp. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	11	9:42am	Overcast 12C, Lite E wind	bobolink 2 mp, mfl. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	12	9:54am	Overcast 12C, Lite E wind	bobolink 3 mp, ffl, mfl. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	13	10:06am	Overcast 12C, Lite E wind	bobolink 3 mp, mp, mfl. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	14	10:20am	Overcast 12C, Lite E wind	bobolink 4 mp, mp, mp, ffl. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	15	10:34am	Overcast 12C, Lite E wind	bobolink 2 mp, mp. No meadowlark	Trees on field border 100m
June 6, 2022	CN Luther	16	10:48am	Overcast 12C, Lite E wind	bobolink 3 mp, mp, mfl. No meadowlark	Trees on field border 100m

m=male f=female fl=flying p=perching

Table 2. Grassland Bird Survey Results, CN Luther Marsh

Survey Date #2 June 15, 2022

Date	Property	Point #	Time	Weather	Sightings	Distance to Tall Object
June 15, 2022	CN Luther	1	7:00 am	90% cloud, no wind, no precip 17C.	bobolink 2 mp, mp. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	2	7:14 am	90% cloud, no wind, no precip 17C.	bobolink 3 mp, mfl, ffl. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	3	7:26 am	90% cloud, no wind, no precip 17C.	bobolink 2 mp, mp. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	4	7:38 am	90% cloud, no wind, no precip 17C.	bobolink 5 mp, mp, mfl, mfl, ffl. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	5	7:50 am	90% cloud, no wind, no precip 17C.	bobolink 1 mp. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	6	8:02 am	90% cloud, no wind, no precip 17C.	bobolink 2 mp. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	7	8:14 am	90% cloud, no wind, no precip 17C.	No grassland birds	Trees on field border 100m
June 15, 2022	CN Luther	8	8:26	90% cloud, no wind, no precip 17C.	bobolink 1 mp. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	9	8:38	90% cloud, no wind, no precip 17C.	bobolink 2 mp, mfl. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	10	8:50	90% cloud, no wind, no precip 17C.	bobolink 1 mp. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	11	9:04	90% cloud, no wind, no precip 17C.	bobolink 3 mp, mfl, ffl. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	12	9:16	90% cloud, no wind, no precip 17C.	bobolink 4 mp, mp, mfl, mfl. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	13	9:28	90% cloud, no wind, no precip 17C.	bobolink 2 mp, mp	Trees on field border 100m
June 15, 2022	CN Luther	14	9:40	90% cloud, no wind, no precip 17C.	bobolink 4 mp, mp, mp, mp. No meadowlark	Trees on field border 100m

June 15, 2022	CN Luther	15	9:52	90% cloud, no wind, no precip 17C.	bobolink 3mp, mp, mfl. No meadowlark	Trees on field border 100m
June 15, 2022	CN Luther	16	10:04	90% cloud, no wind, no precip 17C.	bobolink 1 mfl. No meadowlark	Trees on field border 100m

m=male f=female fl=flying p=perching

Table 3. Grassland Bird Survey Results, CN Luther Marsh

Survey Date #3 June 22, 2022

Date	Property	Point	Time	Weather	Sightings	Distance to Tall Object
June 22, 2022	CN Luther	1	7:00 am	10% cloud, 25C, , Lite West wind	bobolink 4 mp, mp, mp, mfl. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	2	7:15 am	10% cloud, 25C, , Lite West wind	bobolink 5 mp, mp, mfl, mfl, ffl. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	3	7:27 am	10% cloud, 25C, , Lite West wind	bobolink 3 mp, mp, mfl. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	4	7:39 am	10% cloud, 25C, , Lite West wind	bobolink 3 mo, mp, ffl. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	5	7:51 am	10% cloud, 25C, , Lite West wind	bobolink 1 mp. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	6	8:03 am	10% cloud, 25C, , Lite West wind	bobolink 1 mp. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	7	8:15 am	10% cloud, 25C, , Lite West wind	bobolink 2 mp, mp. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	8	8:27	10% cloud, 25C, , Lite West wind	No grassland birds	Trees on field border 100m
June 22, 2022	CN Luther	9	8:39	10% cloud, 25C, , Lite West wind	bobolink 1 mfl. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	10	8:51	10% cloud, 25C, , Lite West wind	No grassland birds	Trees on field border 100m
June 22, 2022	CN Luther	11	9:05	10% cloud, 25C, , Lite West wind	bobolink 3 mfl, mp, mfl. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	12	9:17	10% cloud, 25C, , Lite West wind	bobolink 4 mp, mp, mp, mfl. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	13	9:29	10% cloud, 25C, , Lite West wind	bobolink 5 mp, mp, mp, mfl, mfl. No meadowlark	Trees on field border 100m

June 22, 2022	CN Luther	14	9:41	10% cloud, 25C, , Lite West wind	bobolink 2 mp, mp. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	15	9:54	10% cloud, 25C, , Lite West wind	bobolink 2 mp, mp. No meadowlark	Trees on field border 100m
June 22, 2022	CN Luther	16	10:06	10% cloud, 25C, , Lite West wind	bobolink 2 mp, mfl. No meadowlark	Trees on field border 100m

m=male f=female fl=flying p=perching

Grassland Bird Survey Summary and Recommendations

Bobolink are very abundant throughout the site during breeding season and their calls could be heard almost on a continual basis while in the field. The population of bobolink is so high across the site that it becomes difficult to get an accurate count of the number of individuals and suspected breeding pairs.

No meadowlarks were observed on the transect route, however, one male meadowlark was observed flying over the adjacent field east of Point 6. This area of the plot has slightly more shrub cover amongst the grass, which meadowlark prefer.

The north field continues to hold more bobolink than the smaller south field. This has been typical for all the surveys completed to date although habitats are very similar in both fields.

This plot is maturing nicely and is becoming an excellent habitat for bobolink (see Figs. 5-9). There is a very nice mix of grasses and forbs. Some of the native grasses that were planted are beginning to show up. The tame grasses that were planted are doing very well and are providing the bulk of the habitat for grassland birds. At present, the ratio of grasses to forbs is roughly 70:30 .

The planted forbs are appearing as expected although the heavy soils have slowed their establishment. The early successional forbs like black-eyed susan are scattered throughout the site. More species are expected to appear over the next few years.

Woody growth is minimal but beginning to appear throughout the site. **Mowing should be considered in the fall of 2023 or 2024** to keep the woody stems from becoming dominant.



Figure 5: Typical habitat across the site with perched male bobolink



Figure 6: View from Point 2 looking west



Figure 7: View from Point 3 looking south



Figure 8: View from area between Pt 15 and 16 Looking NE



Figure 9: View from Point 5 Looking South

Monarch Butterfly Surveys

Adult Monarch Butterfly Survey Results

To adequately cover the plot, survey transects were walked between the grassland bird survey points (Fig. 4). All adult monarch butterfly observed flying or feeding within 100 feet (approximately 50 ft either side) of the transect line were recorded.

Tables 4 – 6 below show the observations for all adult monarch butterflies recorded during the surveys.

Adult monarch butterfly surveys were completed during all 3 Grassland Bird Surveys in the spring of 2022. In addition, two separate visits were made to the fields in the summer of 2022, once on July 15 and a follow up visit on September 6.

As expected, no monarch butterflies were observed during the first two June Grassland Bird Surveys. Temperatures and early timing of the surveys were not conducive to observing monarch butterflies. There were some observations of monarch butterflies in the final Grassland Bird Survey on June 22. Temperatures were very warm, however, butterfly forage plants were just coming into bloom at that time.

Monarch Butterfly Larvae/Egg Survey Results

See Tables 7 and 8 below for the results of the larval/egg surveys. Nodes (clumps) of milkweed found along the transect with 10 stems or more were examined for both caterpillars and eggs. The July 15th survey had near perfect conditions with clear skies and warm temperatures. The survey showed that although monarch butterflies could be found across the site, they were not considered to be abundant. Blooming flowers (foraging plants for adult monarchs) of multiple species were abundant, however, milkweed was not as abundant as hoped or expected. Most of the milkweed that was observed in the field was found at the field edges and not along the transect line used for the survey.

The September 6th survey had perfect conditions with warm temperatures and clear skies. Again, while adult monarch Butterflies were observed, they were not considered to be abundant. Observations of both caterpillars and eggs were made during both surveys, but neither could be considered abundant. Percent of milkweed leaves with predation was also recorded.

Table 4. Monarch Butterfly Survey #1 Results, CN Luther Marsh

Survey Date: June 6, 2022

Date	Between Points	Weather	Sightings	Distance to Tall Object
June 6, 2022	1-2	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	2-3	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	3-4	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	5-6	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	6-7	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	8-9	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	9-10	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	11-12	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	12-13	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	13-14	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 6, 2022	14-15	Overcast 12C, Lite E wind	none	Trees on field border 100m

June 6, 2022	15-16	Overcast 12C, Lite E wind	none	Trees on field border 100m
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Table 5. Monarch Butterfly #2 Survey Results, CN Luther Marsh

Survey Date: June 15, 2022

Date	Between Points	Weather	Sightings	Distance to Tall Object
June 15, 2022	1-2	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	2-3	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	3-4	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	5-6	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	6-7	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	8-9	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	9-10	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	11-12	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	12-13	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	13-14	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	14-15	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m
June 15, 2022	15-16	10% cloud, 25C, , Lite West wind	none	Trees on field border 100m

Table 6. Monarch Butterfly #3 Survey Results, CN Luther Marsh

Survey Date: June 22, 2022

Date	Points	Weather	Sightings	Distance to Tall Object
June 22, 2022	1-2	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 22, 2022	2-3	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 22, 2022	3-4	Overcast 12C, Lite E wind	1 adult	Trees on field border 100m
June 22, 2022	5-6	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 22, 2022	6-7	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 22, 2022	8-9	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 22, 2022	9-10	Overcast 12C, Lite E wind	1 adult	Trees on field border 100m
June 22, 2022	11-12	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 22, 2022	12-13	Overcast 12C, Lite E wind	1 adult	Trees on field border 100m
June 22, 2022	13-14	Overcast 12C, Lite E wind	1 adult	Trees on field border 100m
June 22, 2022	14-15	Overcast 12C, Lite E wind	none	Trees on field border 100m
June 22, 2022	15-16	Overcast 12C, Lite E wind	none	Trees on field border 100m

Table 7. Monarch Butterfly Larval/Egg Survey #1 Results, CN Luther Marsh

Table Definitions

Milkweed Nodes = 10 individual stems or more

Leaves with eggs present = percent of leaves in the stand where eggs were observed

Leaf predation = percent of leaves where obvious signs that caterpillars had been feeding or where frass was present

Survey Date: July 15, 2022

Date	Points	Weather	Adults	Milkweed Nodes Assessed	Larval Caterpillars observed	Leaves with eggs present	Leaf Predation
July 15, 2022	1-2	Overcast 12C, Lite E wind	3	0	0	0	0
July 15, 2022	2-3	Overcast 12C, Lite E wind	2	0	0	0	0
July 15, 2022	3-4	Overcast 12C, Lite E wind	2	1	4	10%	20%
July 15, 2022	5-6	Overcast 12C, Lite E wind	2	0	0	0	0
July 15, 2022	6-7	Overcast 12C, Lite E wind	1	1	3	10%	30%
July 15, 2022	8-9	Overcast 12C, Lite E wind	3	0	0	0	0
July 15, 2022	9-10	Overcast 12C, Lite E wind	2	0	0	0	0
July 15, 2022	11-12	Overcast 12C, Lite E wind	1	1	5	10%	20%
July 15, 2022	12-13	Overcast 12C, Lite E wind	3	1	4	20%	20%
July 15, 2022	13-14	Overcast 12C, Lite E wind	2	0	0	0	0
July 15, 2022	14-15	Overcast 12C, Lite E wind	3	0	0	0	0
July 15, 2022	15-16	Overcast 12C, Lite E wind	4	1	3	10%	20%

Table 8. Monarch Butterfly Larval/Egg Survey #2 Results, CN Luther Marsh

Table Definitions

Milkweed Nodes = 10 individual stems or more

Leaves with eggs present = percent of leaves in the stand where eggs were observed

Leaf predation = percent of leaves where obvious signs that caterpillars had been feeding or where frass was present

Survey Date: September 6, 2022

Date	Points	Weather	Adults	Milkweed Nodes Assessed	Larval Caterpillars observed	Leaves with eggs present	Leaf Predation
Sept 6, 2022	1-2	Clear, 25 C, light breeze	2	0	0	0	0
Sept 6, 2022	2-3	Clear, 25 C, light breeze	2	0	0	0	0
Sept 6, 2022	3-4	Clear, 25 C, light breeze	1	1	8	20%	40%
Sept 6, 2022	5-6	Clear, 25 C, light breeze	1	0	0	0	0
Sept 6, 2022	6-7	Clear, 25 C, light breeze	1	1	5	20%	40%
Sept 6, 2022	8-9	Clear, 25 C, light breeze	1	0	0	0	0
Sept 6, 2022	9-10	Clear, 25 C, light breeze	0	0	0	0	0
Sept 6, 2022	11-12	Clear, 25 C, light breeze	2	1	7	20%	40%
Sept 6, 2022	12-13	Clear, 25 C, light breeze	1	1	5	20%	40%
Sept 6, 2022	13-14	Clear, 25 C, light breeze	0	0	0	0	0
Sept 6, 2022	14-15	Clear, 25 C, light breeze	0	0	0	0	0
Sept 6, 2022	15-16	Clear, 25 C, light breeze	2	1	4	20%	40%

Monarch Butterfly Survey Results and Recommendations

Adult monarch butterflies were observed across the site during the peak warm season survey periods although they were not as abundant as in the 2021 survey.

Nodes (or clumps) of milkweed were not common, at least not along the transect lines (Fig 10). Milkweed nodes (Fig. 11) can be found along the field perimeter, indicating that milkweed has been established through recruitment from old stands outside the planting area.

Field observations show that monarchs tend to prefer utilizing larger clumps or nodes of milkweed for egg laying, however we did record, some eggs on individual or sparse clumps of milkweed plants (Fig. 14).

Of the milkweed plants within the survey plot, few had evidence of predation (Fig. 12) or frass left by larval caterpillars and few caterpillars were observed (Fig. 13). This is likely due to the relatively high amount of milkweed plants outside the survey area that are attracting egg-laying monarchs.

This site will take a bit more time to provide better monarch habitat due to the heavy clay soils. Milkweed will do very well on the site once it is established, however, large stands of milkweed plants will likely take several years to appear.

A supplemental hand planting of milkweed seeds could potentially speed up the establishment of nodes. Milkweed seeds require open bare ground to germinate and there are ample areas where bare soil can be found throughout the site and a simple hand planting of seed at a rate of about 125 grams per acre (about 16000 seeds per acre) may be helpful. This seeding can be completed during the spring grassland bird surveys in 2023.



Figure 10: Abundant butterfly forage species were present throughout the site, but milkweed density was low



Figure 11: Example of milkweed node consisting of clumps of plants with multiple stems.



Figure 12: Evidence of leaf predation by monarch larvae



Figure 13: Various stages of larvae were observed, although not in high abundance



Figure 14: Some monarch eggs were recorded and a hand lens was used to determine if they were hatched or not.

Appendix 1 - Landowner Information and grassland bird survey point coordinates

Luther Marsh Wildlife Management area – owned by the Ministry of Natural Resources and Forestry

Survey Points

Point 1	Lat 43-58-21-77	Long 80-25-09-73
Point 2	Lat 43-58-16-39	Long 80-25-08-32
Point 3	Lat 43-58-09-55	Long 80-25-06-11
Point 4	Lat 43-58-04-34	Long 80-25-03-72
Point 5	Lat 43-57-58-25	Long 80-24-52-97
Point 6	Lat 43-57-51-58	Long 80-24-50-96
Point 7	Lat 43-57-45-15	Long 80-24-49-35
Point 8	Lat 43-57-43-78	Long 80-24-52-16
Point 9	Lat 43-57-51-44	Long 80-24-54-73
Point 10	Lat 43-57-58-23	Long 80-24-56-61
Point 11	Lat 43-58-03-30	Long 80-25-09-83
Point 12	Lat 43-58-08-84	Long 80-25-13-05
Point 13	Lat 43-58-14-61	Long 80-25-14-37
Point 14	Lat 43-58-12-96	Long 80-25-19-17
Point 15	Lat 43-58-18-62	Long 80-25-21-04
Point 16	Lat 43-58-24-43	Long 80-25-15-50

Note: Latitudes and Longitudes are approximate.

Appendix 2 - Seed Mix List of Species and Ratios

Species (Common name)	Seeds per oz	seeds per lb	oz per acre	seeds/sq ft
Grasses:				
Big Bluestem	9000	144000	14	2.88
Canada Wild rye	7125	114000	6	0.98
Virginia Wild Rye	4562.5	73000	8	0.83
Switchgrass	16187.5	259000	8	2.96
Little Bluestem	12500	200000	6	1.71
Indiangrass	10937.5	175000	12	3.00
orchardgrass	26000	416000	4	2.38
timothy	76875	1230000	4	7.03
Sand Dropseed	350000	5600000	1	8.00
Rough Dropseed	331250	5300000	1	7.57
			64	37.33
Forbs:				
		lbs/acre	4	
Black eyed susan	9300	148800	16	3.40
Ohio Spiderwort	8000	128000	0.1	0.02
Common milkweed	4375	70000	0.1	0.01
Butterfly milkweed	4375	70000	0.1	0.01
New england aster	68750	1100000	0	0.00
Heath Aster	43750	700000	0.1	0.10
Flat topped white	67000	1072000	0	0.00
Showy Tickseed sunflower	8125	130000	1	0.19
Lanceleaf coreopsis	13812.5	221000	1	0.32
tall coreopsis	12500	200000	1	0.29
show tick trefoil	5000	80000	1	0.11
Pale purple coneflower	6625	106000	0.25	0.04
Purple Coneflower	7250	116000	2	0.33
Boneset	180000	2880000	0.1	0.41
Sneezeweed	91500	1464000	0.1	0.21
Sweet Oxeye	6375	102000	2	0.29
Round headed bushclover	17187.5	275000	1	0.39
Bergamot	79500	1272000	1	1.82
Beardtongue	25000	400000	0.5	0.29
Grey Headed coneflower	26718.75	427500	0.5	0.31
Hoary vervain	29437.5	471000	0.5	0.34
blue vervain	87500	1400000	0.5	1.00
wild senna	1500	24000	0.5	0.02
virginia mtn mint	176000	2816000	0.05	0.20
thimbleweed	28000	448000	0.1	0.06
Swamp Milkweed	4500	72000	0.1	0.01
Canada Milkvetch	16875	270000	0.1	0.04
Partridge Pea	3875	62000	0.5	0.04
Fox sedge	75000	1200000	0.5	0.86
golden alexanders	10750	172000	0.2	0.05
rough blazing star	14750	236000	0.05	0.02
cardinal flower	400000	6400000	0.05	0.46
great blue lobelia	485000	7760000	0.05	0.55
beebalm	42562.5	681000	0.2	0.19
primrose	86000	1376000	0.2	0.39
			31.45	12.75
		lbs/ac	1.965625	