DANCE ENVIRONMENTAL INC.

DE-382
September 30, 2024

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Township of Puslinch
7404 Wellington Rd.34
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Response to Peer Review by Aboud & Associates Inc. for the Township of Puslinch Regarding the 2023 Ecological and Aquatic Monitoring Report, Roszell Pit, License No. 625189 and Associated Addendum Report Dated April 8, 2024.

We have received and considered the comments from the review by Aboud & Associates Inc. regarding the 2023 Roszell Pit Monitoring Report (Dance Environmental Inc. 2023). Herein we provide clarification to relevant questions raised in the letter from Aboud & Associates, dated February 26, 2024.

Aboud & Associates Inc. have asked that more discussion and analysis of the data in the annual report be provided. We have been instructed by CBM to provide more detail and offer the following as an addendum to the 2023 Ecological and Aquatic Monitoring Report, prepared by Dance Environmental Inc. (December 22, 2023) and to the addendum report dated April 8, 2024.

Peer review comments from Aboud and Associates Inc. are provided on pages 2 to 4 in the February 26, 2024 letter are below in bold with responses provided below the comment.

In general, discussion of all monitoring results should compare current vegetation monitoring to pre-extraction conditions, as well as the previous year's post extraction monitoring effort.

As provided in our 2023 response to peer review comments on the 2022 monitoring year report, discussion regarding the variances noted in Vegetation Plots A and B have been noted in past annual monitoring reports. There are outside influences on Plot A and B, namely that the landowner allows his cattle to graze in the area of the plots. For several years discussion took place with the landowner and CBM staff to try to have him stop that practice, in that area. Those discussions were unsuccessful and Plots A and B have continued to experience varying levels of annual disturbance by cattle. This has resulted in deep depressions caused by cattle hooves in the soft, damp soils in that area, which in turn creates new colonizing areas where trampled vegetation becomes buried in the mud or if deep enough, the depressions collect standing water, and changes in colonizing species in these plots varies year by year as a result.

Also, cattle in Plots A and B has resulted in the occasional stake being knocked over or broken by the time of the next survey, so slight changes may result at these sites attributed to slight variances in where the replacement stake is placed.

Herbaceous vegetation in the plots may experience change periodically as cattle use the area, but the tree and shrubs of the plots are not so affected and continue to provide indicators of whether significant changes are occurring. The tree and shrub numbers and species occurrence in Plots A and B have not significantly changed from pre-extraction survey dates or from 2019 to 2023 when lower than average precipitation has taken place (Groundwater Science Corp. 2024). No significant declines in health of the trees or shrubs has been noted either.
This peer review comment is answered further below on pages 7 to 12.

Comments on Soil Moisture Measurements:
While the methods state soil moisture levels will be sampled for each plot using a soil moisture meter, as was noted in our 2021 and 2022 reviews, the results of the soil moisture sampling are not included in the report for 2023. Please update these results or update methods to reflect what is currently used to assess soil moisture.

A response to this was clearly provided in the 2022 response to the peer review comments from Aboud & Associates Inc. To clarify this again, soil moisture measurements from a soil meter probe were taken as a supplementary data at the vegetation plots, at the suggestion of Dance Environmental Staff, and not at the request of review agencies. The soil probe data provides a soil moisture measure in the top 90mm of the soil layer. The soil moisture measurement are collected at the North, East, South, West and plot center stakes, compared to Notheast, Southeast, Southwest, and Northwest stakes where vegetation plots are located, in order to not disturb vegetation in the plots monitored. This supplemental data has not been collected as a primary source of data for identifying vegetation community change or significant species presence changes. Soil moisture data within the top soil layer was considered to have value for use in understanding change if there was ever a point when significant changes have been noted, and hydrological changes are anticipated to be the cause of the impact. There has been no indication based on the vegetation composition in the vegetation plots that significant changes due to soil moisture regimes has occurred. Providing all the soil moisture data, therefore has not been seen as warranted to assess and include to date. Aboud & Associates Inc. have not in their peer reviews raised concern that a significant impact is occurring to the vegetation communities, which would warrant such additional assessment.

Despite this, we have provided in Table 1 the range and mean for all vegetation plots. In 2012 qualitative descriptions of water in soils were recorded, but from 2013 onward any standing water was described, and a soil moisture meter was also used to determine percentage soil moisture in 5 locations within each plot (in the top 90mm of soil). It must be noted that it is impossible to sample the exact same location every year, yet samples are taken within ±30cm of the plot corners that are sampled, but the sloped terrain, rocks, varying soil types all can influence the measurements based on exactly where they are taken.

Table 1 provides the range of soil moisture conditions at the six vegetation plots. The range of moisture percentages measured within the plot and the mean of the measurements are presented for the years 2013 to 2023, inclusive for the Spring and Fall seasons. The Fall

means for plots in 2023 show continued lower than historical values, to which we attribute to the continued drought conditions, and that in 2023 increased precipitation did not occur until late Fall (after the surveys were completed).

Table 1. Range of Soil Moisture Conditions at the Six Vegetation Plots, 2012-2023.

Veg. Plot	2012	2013				2014			
	Fall Comments	Spring (%)		Fall (%)		Spring (%)		Fall (%)	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean
A	Subplot SE: 3cm of water in cattle hoof print. Subplot SW: soil is saturated.	79-85	**82.0**	36-94	**74.8**	49-86	**77.4**	89-93	**91.2**
B	No standing water; soil is saturated.	70-80	**76.0**	81-91	**86.6**	26-90	**74.0**	85-95	**91.4**
C	Subplot SE: 1mm of standing water to soil is saturated.	18-79	**42.7**	32-91	**70.6**	29-93	**68.8**	60-92	**84.5**
D	No standing water.	11-76	**51.7**	9-90	**59.2**	33-85	**67.1**	40-90	**70.4**
E	Subplot NW: no standing water; soil very moist.	45-82	**65.8**	12-79	**55.4**	70-78	**74.4**	77-91	**84.4**
F	Subplot SE: 2mm of standing water in corner of quadrat.	7-72	**37.3**	46-95	**81.0**	43-88	**69.8**	64-89	**81.4**

Table 1. cont'd. Range of Soil Moisture Conditions at the Six Vegetation Plots, 2012-2023.

Veg. Plot	2015				2016				2017			
	Spring (%)		Fall (%)		Spring (%)		Fall (%)		Spring (%)		Fall (%)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
A	67-98	**85.0**	49-96	**78.8**	1 to 2cm standing water & saturated soil.	**---**	91-98	**94.4**	8-98	**95.8**	92-99	**95.2**
B	21-92	**74.4**	81-97	**92.6**	1 to 4cm standing water & saturated soil.	**---**	88-98	**94.2**	40-98	**84.2**	86-98	**93.2**
C	26-98	**69.4**	43-97	**72.6**	67-98	**85.7**	42-98	**81.7**	58-97	**84.0**	37-98	**79.3**
D	25-98	**64.8**	17-98	**76.8**	25-92	**74.2**	31-98	**85.5**	42-94	**85.2**	27-98	**81.8**
E	13-79	**51.7**	24-92	**73.3**	45-95	**73.0**	83-96	88.8	42-98	**74.4**	69-95	**85.8**
F	30-91	**68.9**	73-93	**85.2**	70-87	**79.6**	75-94	90.0	49-98	**76.3**	82-94	**90.2**

Table 1. cont'd. Range of Soil Moisture Conditions at the Six Vegetation Plots, 2012-2023.

Veg. Plot	2018				2019				2020			
	Spring (%)		Fall (%)		Spring (%)		Fall (%)		Spring (%)		Fall (%)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
A	10-98	**77.2**	97-98	**97.8**	45-98	**84**	44-96	**83.2**	82-95	**90.2**	81-98	**93**
B	35-98	**81.8**	84-98	**94.2**	63-95	**84.2**	40-96	**71.6**	75-92	**86.4**	12-98	**72.75**
C	20-98	**80.4**	45-98	**87.4**	53-95	**76.5**	42-98	**85**	45-95	**70.93**	8-95	**66.6**
D	77-98	**91.4**	11-98	**79.2**	3-96	**73.8**	81-98	**92.2**	20-95	**63**	45-98	**76**
E	9-96	**72**	40-96	**80.4**	27-91	**72.2**	9-93	**63**	51-93	**72.8**	32-93	**67.1**
F	80-96	**86.8**	83-98	**92.6**	87-98	**91.2**	87-94	**90.4**	21-94	**77.3**	63-92	**82.7**

Table 1. cont'd. Range of Soil Moisture Conditions at the Six Vegetation Plots, 2012-2023.

Veg. Plot	2021				2022				2023			
	Spring (%)		Fall (%)		Spring (%)		Fall (%)		Spring (%)		Fall (%)	
	Range	Mean*	Range	Mean*	Range	Mean*	Range	Mean*	Range	Mean*	Range	Mean*
A	45-88	**76.8**	NA	**NA**	8-99	**79**	76-99	**92.8**	45-99	**88**	58-99	**83.4**
B	30-95	**63.1**	NA	**NA**	44-99	**85.2**	9-99	**60.4**	26-99	**83.8**	12-99	**64**
C	22-98	**73.5**	38-99	**83**	31-99	**78.8**	40-99	**81**	45-99	**83.8**	49-99	**72.4**
D	30-96	**68**	5-99	**78.8**	12-99	**77.2**	5-99	**69.8**	39-99	**83.8**	15-99	**66**
E	33-95	**61.8**	46-99	**81.4**	40-96	**77.8**	27-99	**83**	17-99	**66.4**	42-99	**74.6**
F	70-95	**84.8**	70-99	**92**	88-99	**95.8**	92-99	**94.8**	88-99	**94**	84-99	**88.2**

*Mean was calculated using the lowest values from % ranges for 5 measurement locations at each survey plot. Some sample locations have high and dry spots and low and wet in same location so a range of values are recorded (minimum and maximum).

In Section 4.1 soil moisture is indicated as "damp", "dry", and "saturated" in several instances. The soil moisture measurement methods or sampling technique used to determine these results should be stated.

The following is provided as clarification to the peer review comment on Section 4.1 referring to soils as "dry, damp or saturated", as requested by the peer reviewer:

- Saturated soils refer to soils that contain enough water when compressed between fingers water can be pressed out of the soil.
- Damp soils refer to soil conditions where when compressed soil may hold their compressed state, create the feeling of moisture on the fingers but no water is expressed by compressing the soils in hand.
- Dry soils refer to soils in hand being crumbly and not retaining their compressed state when pressed between fingers, and no water is expressed from the soil when compressed between fingers.

These are qualitative tests to understand general soil moisture conditions within the plot having three category ranges that soils can fit into, this has been the consistent method used since the start of the study and this allows for comparison between years.

In section 4.1, soil moisture and standing water levels is not described for all plots. We must disagree with this comment, as it is inaccurate. For each vegetation plot, any of the subplots with standing water were noted specifically in the report, and were compared to

recent years and other historical years data to indicate if 2023 data was similar to historical data or has changed negatively.

- Page 11 of the 2023 Roszell Road Pit Ecological and Aquatic Monitoring report, paragraph 1 of vegetation Plot A, indicates surface water presence or absence.
- Page 12 of the 2023 Roszell Road Pit Ecological and Aquatic Monitoring report, paragraph 2 of vegetation Plot B, indicates surface water presence or absence.
- Page 13 of the 2023 Roszell Road Pit Ecological and Aquatic Monitoring report, paragraph 1 of vegetation Plot C, indicates surface water presence or absence.
- Page 13 of the 2023 Roszell Road Pit Ecological and Aquatic Monitoring report, paragraph 1 of vegetation Plot D, indicates surface water presence or absence.
- Page 14 of the 2023 Roszell Road Pit Ecological and Aquatic Monitoring report, paragraph 1 of vegetation Plot E, indicates surface water presence or absence.
- Page 15 of the 2023 Roszell Road Pit Ecological and Aquatic Monitoring report, paragraph 2 of vegetation Plot F, indicates surface water presence or absence.

As can be extrapolated by our assessment, each Vegetation plot showed that 2023 findings were comparable to other years within the11 years of monitoring. The slightly wetter year of 2023 resulted in most subplots having more surface water noted in 2023 than in 2021 and 2022. These findings make sense with the Groundwater Science Corp. 2024 Hydrogeology report for the Roszell Pit, which indicated 2023 showed some recovery with Spring and Fall water levels being closer to historical ranges compared with 2021 and 2022. With the vegetation plots showing similar percent cover data results to what has been found historically over the study period and most subplots showing greater surface water and soil moisture then recent years (of drought), there is no suggestion in the findings necessitating the need to examine soil moisture probe data, therefore it was not included in the 2023 monitoring report.

Section 4.1 does not include any discussion of changes in dominant taxa or a summary of the herbaceous cover present within vegetation subplots compared to pre-extraction conditions. While efforts have been made to compare vegetation monitoring data with early extraction years, the 2023 data was not compared with baseline year data collected during the pre-extraction conditions. For Spring vegetation monitoring the baseline year was 2013 while autumn monitoring it is 2012. Instead the 2023 data were compared to 2014/15 data after the pit had been established. In reviewing appendix 3, several dominant species listed area at <1% cover in a plot, if new species have filled those areas, they should be included in the dominant taxa list if it is bare earth this should be noted.

<u>Comments on Herbaceous Vegetation Monitoring Plots:</u>
The peer reviewer appears to question the approach that has been taken since the start of the study, with the agreement of the initial peer reviewer, and the scales at which significant change is considered to occur. We have attempted here to clarify this approach.

The approach that has been taken based on our professional opinion is that change at the scale of tree and shrubs is the indicator of significant change. Trees and shrubs have deeper root systems (obtaining water from deeper below ground), comprise the broader vegetation community level (ELC community types), and are not as susceptible to short-term weather variations. In contrast herbaceous vegetation presence/absence and abundance can change due to a much wider range of uncontrollable variables, due to their ease of damage from

weather, wildlife trampling or being eaten. Their shallower root systems make them much more susceptible to impact from the volume of annual precipitation and temperatures (which affect numbers and size or both). Weather can strongly influence the extent of plant seed germination as well. Herbaceous vegetation species are also always in a state of flux (they are not static), as soil minerals/nutrients, moisture, shade, wind, fallen wood debris, and wildlife browsing are just some of the natural influences which change herbaceous vegetation presence.

We have provided analysis of the herbaceous vegetation since the second year of data was collected, but it is much more of a micro scale impact assessment as it focuses on changes in a small patch of habitat within a larger overall vegetation community. Significant impacts would be a rapid change of vegetation community type. This has not been found to be the case within the Roszell Wetland, where the vegetation plot monitoring has been taking place since 2012.

It is important to remember that changes between one percent cover category and another can mean an estimated change of just 1%. Therefore, changes in more than 4 percent cover categories (from category "1-5%" and up) are potentially more suggestive of changes occurring in the plot.

We provide the following as clarification of our assessment of the pre-extraction years data compared with 2023 data:

Spring Vegetation Plot Data:

Plot A and B:

- In some subplots of Plot A and B the species present in 2013 were no longer present or comprised a much smaller percent cover when compared with 2023 data.
- As indicated in the 2023 Annual report (Dance 2023) due to the high level of disturbance from cattle within Plot A and B (trampling, rutted soils, browsing), comparison with the 2013 pre-extraction data is not possible to clearly establish whether changes are due to extraction or cattle grazing impacts.
- Cattle have caused loss of corner stakes in some years also resulting in potential slight changes in location of the subplots.

With these two plots being located in edge habitat of the Cedar Swamp vegetation community compared to interior habitat, it is logical for these areas to undergo more change in the vegetation as the locations transition into habitat with more mature Cedars (as the trees mature they will also require increased uptake of water, nutrients and minerals, and change shade and sun conditions below them). When this is coupled with the significant damage to vegetation and soils by grazing cattle, it is logical that the level of change noted is due to these factors.

Plot C:

- 66% of the species assessed in Appendix 5 & 6 for Plot C have shown no change or change by only one category, while 34% showed a change by two percent categories. This is not a significant change over a >10 year span of time and when you recognize the percent cover was likely the low value of the percent category in 2013 (ie. for 16-30%, the species was present at 16%).

- Of note is that 2014 showed decreases in percent cover for most species assessed for Plot C compared to 2013, and 2023 results are more in line with those of 2014 than 2013.
- Field horsetail shows a wide variety of change in percent cover over all years and in some years in Plot C is not present at all, and yet returns another year.
- Each subplot that showed decreases between 2013 and 2023 of 2 percent cover categories had different species that showed change, and in other subplots those same species did not show the same degree of change. Indicating those changes in percent cover were not seen in the overall entire plot area for specific species (extremely micro scale changes only).

Plot D:

- In plot D, 83% of species listed in Appendix 4 and 5 showed no change or only decrease of one percent cover category from 2013 compared to 2023 data.
- Two subplots showed an increase in wetland indicator species making up 17% of species listed in Appendix 4 and 5.
- Plot D shows no significant negative trends in sub plot data based on the comparison of 2013 pre-extraction data to the 2023 data.

Plot E:

- In Plot E, 58% of the species listed in Appendix 4 and 5 show no change or only a decrease of one percent cover category from 2013 compared to 2023 data.
- 33% of the species reviewed in Plot E (Appendix 4 and 5) showed a decrease in percent cover by 2 categories. These species in the pre-extraction year already had limited presence, only changed from 5% cover or less.
- Only one of the species, *Agrostis stolinifera*, in Plot E in one subplot showed the greatest change of those species assessed, where it decreased 16-30% based on its percent cover category. When all years are considered (Appendix 5) this species shows varying presence and absence within the subplot, and its lack of presence in 2023 does not automatically mean is will no longer be present in the subplot in the future.
- Comparison of the pre-extraction 2013 data and 2023 data does not indicate any large scale significant change within Plot E as a whole.

Plot F:

- In Plot F, 75% of the species listed in Appendix 4 and 5 show no change or only a decrease of one percent cover category from 2013 compared to 2023 data.
- 17% of the species reviewed in Plot E (Appendix 4 and 5) showed a decrease in percent cover by 2 categories. One of the species showed only a change of 5% maximum in percent cover, and the other had a percent cover change of 15-30%.
- Common Buckthorn in one of the subplots was noted to have increased in percent cover from 2013 to 2023, by 1-5% cover, which for over a 10 year period is not a significant increase. This is positive as this invasive species does not appear to be rapidly overtaking native species in the plot.
- With only one of the 12 species assessed for Plot F in Appendix 4 and 5, showing change the pre-extraction 2013 data and 2023 data does not indicate any large scale significant change within Plot E as a whole.

Autumn Vegetation Plot Data:

As requested additional discussion is provided below comparing 2012 data to 2023:

Plot A:

- In most subplots of Plot A the species present in 2012 were no longer present or comprised a much smaller percent cover in 2023.
- As Appendix 6 shows species used for assessment changed in 2013. This was the result of changes with the subplots due to significant cattle grazing causing trampling, ruts and browsing by cattle, along with causing removal of quadrat stakes used to ensure consistent monitoring.
- Overall some subplots, despite the cattle impacts, showed limited change by only 1% category or none at all from 2012 compared with 2023 and declines were likely in the 1% change between categories (so minimal change).
- Page 12 of the Annual Roszell Pit Hydrogeology Report from Groundwater science Corp. (GSC) (2024) indicates no measurable water level changes have been observed in discharge areas west of Lake 1, based on data from DP2 and DP8.
- As indicated in the 2023 Annual Monitoring report (Dance Environmental Inc. 2023) due to the high level of disturbance from cattle within Plot A, changes also included Ash tree removal by the farmer. The farmer also removed cedars that had died naturally in nearby areas, and occasional trees or branches fall naturally due to wind storms in the plots. Despite all of this the 2012 pre-extraction data does not indicate vegetation community changes. The plot area is still edge habitat of White Cedar swamp and over the 11 years has been maturing (at the tree and shrub level). The increasing growth of Cedar/Buckthorn shrubs logically also results in changes to soil moisture through root uptake by the growing trees and shrubs, nutrient removal and increasing extents of shading.
- There are some variances in percent cover in Plot A between pre-extraction and 2023 data, and the limited changes from 2013 data with the fluctuations being only 1 or 2 percent cover categories between years or in some species no change has occurred. The changes are logically influenced by the natural factors identified and cattle grazing impacts.
- No significant impact to the herbaceous vegetation on Plot A is considered to have occurred when all of the variables influencing the plot and hydrogeology information for the area are considered.

Plot B:

- Plot B was also located on the edge of the White Cedar Swamp community (like Plot A) and within the area where the landowner grazes his cattle.
- The same mitigating factors as in Plot A influence Plot B, and even greater change from 2012 to 2023 is shown Plot B than was noted in Plot A, based on Appendix 5 and 6. The level of cattle disturbance and damage to staked corners influencing the exact placement location of sampling quadrats, resulted in species presence change between 2012 and 2013. From 2013 on, more consistently the same species were recorded, but wide variations in percent cover over all the years continued as is attributed to cattle grazing.
- As trees and shrubs have matured over the 11 years of monitoring, some of the change can also be attributed to edge habitat of the cedar swamp community maturing towards the pit as edge, becoming more middle-aged habitat with increased shade from growing trees and shrubs.

- In addition to this, drought years from 2018 to 2023 with warm temperatures and limited precipitation also are considered significant influences on the changes noted between 2012 and 2023 (GSC 2024).
- As noted for Plot A, the annual Roszell Hydrogeology Report (GSC 2024) indicates no measurable water level changes have been observed in discharge areas west of Lake 1, based on data from DP2 and DP8.

Plot C:

- Comparison between 2012 data and that of 2023 indicates some change within the subplots with *Carex flava* showing reduced presence, but with change primarily occurring in 2016. Some plots showed this species fluctuating in extent of percent cover from year to year when present.
- Other species such as Dwarf Scouring Rush, also showed variation between years in percent cover, and an increase of up to 2 percent cover categories in 2023 compared with pre-extraction 2012 findings, in two different subplots.
- Coltsfoot, which is a non-native and undesired species, was noted to vary widely year to year, but 2012 data compared to 2023 data showed a decrease of up to 15% of percent cover (has been gone since 2021). This change in decreased percent cover, however, is positive as it shows this non-native species isn't outcompeting native species in this plot.
- Field Horsetail shows much variation on a yearly basis in the extent of percent cover, compared with other species, and shows it can change from solitary to up to 30% cover in just two years.
- Changes noted in Plot C between 2012 and 2023 were mostly limited to changes of <15% cover in subplots.
- No significant change in the vegetation community type present in 2012 compared to 2023, has been found.

Plot D:

- Comparison of 2012 and 2023 data for Plot D indicates for the species shown in Appendix 5 and 6 that the majority of them have had no change.
- Despite limited change in most species between 2023 and the pre-extraction years data, the in-between years data, shows Dwarf Scouring Rush, Field Horsetail, and Bulblet Fern to have percent cover values that fluctuate over time of typically one or two percent cover categories (both increasing and decreasing).
- There are no signs of significant change shown through review of the pre-extraction years data compared with the 2023 data for Plot D, or change in the vegetation community type present in 2012 compared to 2023.

Plot E:

- Comparison of the 2012 and 2023 data for Plot E shows that for species shown in Appendix 5 and 6, the percent cover for the wetland indicator species has increased including Cinnamon Fern, Moss sp., and Bulbelt Fern.
- The 2023 data indicates that in Plot E, Glossy Buckthorn and Common Buckthorn have in some subplots shown an increase in percent cover (1-5%) indicating this invasive shrub is slowly increasing in the plot.
- There are no indications from the species reviewed in Plot E, that there has been any wide scale significant changes within Plot E, or change in the vegetation community type present in 2012, compared to 2023.

Plot F:

- Plot F shows more change than Plot E when 2012 data is compared with 2023, and the species that show change in some of the subplot, however, were present in low percent cover in 2012.
- When all years are considered, the data shows many of the species from 2013 to 2023 fluctuated in the extent of their percent cover throughout the years, with some not present in some years and then returning the following year.
- Plot F data also shows it is consistently a plot within the White Cedar Swamp with generally limited groundcover, more bare soils than many of the other plots (dense cedars causing lots of shade). This accounts for many of the species in Plot F having typically percent covers of well below 16-30%, showing few species with high percent cover since the start of monitoring.
- Overall there are no indications from the species subset reviewed in Plot F, that there has been any wide scale significant changes within Plot F, or change in the vegetation community type present in 2012, compared to 2023.

Summary:

The species used in Appendix 3, 4, 5, and 6 (Dance Environmental Inc. 2023) were originally selected based on being a random selection of wetland indicator plants, and species ones that were relatively abundant within the subplots at the start of the study. Species such as Common Buckthorn were included as it is an invasive species that could potentially change the community as well.

An assessment of every plant species in every one of the subplots and comparison between all years, as noted in both of our previous year's responses, is considered unnecessary at this point, as no significant declines in wetland vegetation species have been noted. We do not see a significant change in circumstances that would warrant the request of the reviewer, and no rationale for this request was provided, identifying concern with the results of the findings.

It is still our professional opinion, as indicated in the previous two peer review responses, that the greatest potential for expressing significant impacts to the wetlands would be changes to the higher vegetation layer (the sub-canopy and canopy layers of vegetation). The subcanopy and canopy layers of the community are less prone to the annual variability than herbaceous species are.

Conclusions:

There have been some changes noted to occur within the vegetation Plots C to F, which were not impacted by the significant disturbances caused by cattle, like in Plot A and B. No measurable water level changes have been observed in the discharge area west of Lake 1 or elsewhere (GSC 2024), which supports the conclusion that changes in Plot A and B are not groundwater related, but rather cattle grazing impacts and natural change in edge habitat.

Based on our assessment of the data, the following factors are considered to explain the changes that have been noted:

- Community succession over time (11 years of monitoring), and the recent drought years of 2019 to 2023 (GSC 2024), provide primary natural occurring reasons for the changes noted in some sub-plots.

- Other natural occurrences which influence the limited amount of change noted within the vegetation plots monitored include new fallen wood debris, extent of rainfall, increasing air temperatures, changes in understory and canopy cover over time which increases the extent of shade, and deer/animal browsing; such changes are considered to be expected.
- There are no indications of >50% change in the percent cover of multiple species in the vegetation plots or at multiple vegetation plots, for the species assessed in Appendices 3, 4, 5, and 6 (Dance Environmental Inc. 2023) or indications of loss of the majority of wetland species.
- The overall vegetation community type in which all of the vegetation monitoring plots are located has not changed.
- As discussed previously in the peer review responses and the 2023 Annual Roszell Pit Monitoring Report, the health, condition, and species composition within Plots A to F have not changed for the trees and shrubs, which are more representative of the long-term conditions of the areas of the vegetation plots as they are not impacted by micro changes from years of limited precipitation, cattle browsing etc. discussed above.

A complete plant list should be appended that includes species present for each plot, or all field forms should be appended…

Any community level changes in overall wetness index may indicate a change in groundwater levels and should be included and discussed in detail and compared with relevant hydrogeological data.

As noted in 2022 and 2023 during our review, review and analysis of the average wetness index for each vegetation plot, including all species observed, compared year to year to determine changes to the vegetation composition and wetness index should be included graphically and discussed in the context of potential changes in groundwater level. This type of analysis has also been identified by the GRCA in their 2023 review. We recommend completing a floristic quality assessment by plot and by year to determine changes to the floristic quality index, average wetness value, and average coefficient of conservatism to help determine if changes as a result of hydrological changes, as opposed to agricultural changes.

Our response to these three related comments above, is as follows:
As replied to in previous peer review comments, the provision of the data forms on how they are filled out was provided to indicate how and what information was being collected for future reference (to ensure repeatability of the approach), and was done at the request of the original Township peer reviewer.

Based on our additional review and assessment of the 2023 data compared with pre-extraction year data, and our analysis of 2023 data compared to other post-extraction years data, it is still our opinion that there has not been any indications of significant change at the micro level of assessing herbaceous vegetation within the wetland community. The changes found are considered natural occurring changes, expected over 11 years of study, as nature is not static. Additionally at the community level scale the White Cedar Swamp wetland community has shown no negative change over time, and is showing natural maturing of edge habitat through increases tree and shrub growth.

Given the foregoing, we do not agree that it is necessary to provide significant amounts of raw data from 11 years of monitoring. The peer reviewer requests the inclusion of such historical data yet provides no rationale or trigger for the request of data to be compiled and assessed again. It is our opinion that the assessment of the subset of vegetation species is scientifically valid and therefore conditions on site has been adequately addressed and explained.

The Groundwater Science Corp. (2024) hydrogeology report indicates that since 2019 lower than historical seasonal water levels have been recorded at the site (reduced by 10-20cm). This coincides with the attached Figure A8 of the hydrogeology report (GSC 2024) which indicates drought conditions in Puslinch Township have occurred since 2018, resulting in reduced seasonal and annual groundwater recharge potential.

Therefore, natural influences faced by vegetation in conjunction with the identified decline in seasonal and annual groundwater recharge due to reduced precipitation since 2018 provide a clear explanation for any limited change in recent years compared to pre-extraction. These factors are not related to the extraction of aggregate within the Roszell Pit. Overall, even with the 5 years of reduced groundwater recharge and precipitation events, the changes noted in percent cover of subplots has been limited.

Dance Environmental Inc. has now been able to review the GRCA comment letter mentioned by the reviewer. The GRCA comment letter dated February 6, 2023 from Chris Lorenz was provided as the last comments to be provided by GRCA on Natural Heritage issues because Ontario Regulation 596/22 was passed.

The only comment provided by GRCA relating to vegetation was that “some variation in wetland plant cover (ie. rare sedge species was not recorded in 2022)..” The sedge to which GRCA is referring is *Carex Schweinitzii*, which is Regionally rare. There is no mention in the GRCA letter suggesting use of wetness indices etc. for every plot for every year. Yes, in 2022 in Plot B the northeast sub-plot showed no presence of *Carex Schweinitzii,* down from 1-5% category in 2021. The 2023 data showed the species present again at 1-5% (similar to 2019-2021 years). This species is primarily an open wet meadow species typically in areas with full sun, which Plots A and B were at the start of the surveys as they were in swamp edge habitat. Now, 11 years later cedars and shrubs are several feet taller, and branches have spread outwards creating more areas of permanent shade. Additionally, Plots A and B have been grazed by cattle to varying degrees over all of the survey years and this disturbance has shown to consistently change plot conditions and species presence due to grazing, trampling, and creating ruts. These changes are considered as typical transitional changes in maturing communities, as has been noted previously. The GRCA did not indicate a concern over some variation having been noted in some species percent cover, or that they considered what has been found to be significant negative impacts to the vegetation.

Amphibian Call survey locations should include direction of the survey on the figure or as part of Table 7.

We have addressed this comment in past years, where the peer reviewer has requested that the direction of amphibian call surveys be noted in the annual report. Once again to clarify,

the amphibian stations are always facing towards the direction of where surface water is present, the directions have remained the same for all years.

To rectify this in the 2024 report we will show direction arrows, showing the direction surveyors were facing on Figure 3.

The amphibian data presented in Section 4.4 (Table 14) does not indicate if amphibians were heard calling within or beyond 100m of the survey station. If frogs calling from beyond 100m of the survey station were excluded, this should be indicated in the data table.

We have responded to this same comment in past years
.
Our response to the peer review comment regarding failing to indicate whether amphibians were heard beyond 100m of the survey stations, is as follows:
Surveyors are to record any frogs heard during the survey on the field notes, and if they are heard at distances beyond the100m radius the general location and call code volume are noted, along with what species is heard, however, to standardize the results only amphibians heard within 100m in front of the surveyor are included in the results summarized, as is standard practice with the MMP methodology. Calls of any frogs outside 100m as per the Marsh Monitoring protocol are not typically counted as due to limitations of human hearing and distortion of calls by wind and obstacles such as trees, and vegetation which reduce the reliability of pinpointing locations and numbers of individuals at such a great distance away. Furthermore, in this specific case the wetlands where the amphibian call surveys are taking place are small in size, so anything heard outside of 100m from the survey station is typically not in the wetland being surveyed.

Within Section 5.0, complete and include a summary review, analysis, and integration of the results of the hydrogeological monitoring report, as it relates to trout spawning, wetland water levels, and changes in amphibian and salamander breeding.

We would like to remind the peer reviewer again that at the time when the Ecological and Aquatic Monitoring report for the Roszell Pit is due for annual submission (by December 31st) the Hydrogeology report for that same year has not been prepared. The Roszell Pit hydrological report is not due for submission until March. It is not possible at the time the annual ecology report is prepared to compare it with the 2023 hydrological data as it is not available to us at the time. Unless that date changes, this will continue to be the case. Despite the foregoing, we did address surface water temperature, precipitation and groundwater levels relative to 2023 fish and amphibian monitoring results based on an October 2023 Groundwater Science Corp. Report. See Pages 22 and 23 in the Dance Environmental Inc. (2023) 2023 Ecological and Aquatic Monitoring Report.

The full 2023 hydrogeology report is now available to us so we provide the following discussion based on the hydrogeology information:

- The Groundwater Science Corp. (2024) hydrogeology report identifies that seasonal and annual groundwater recharge potential has been significantly reduced for the last five years. This was indicated as a result of increasingly dry to very dry annual precipitation conditions since late 2018. Section 4.2 of the hydrogeology report

indicates this has resulted in lower than historical seasonal water levels recorded at the site since 2019, these reductions being in the 10-20cm range (GSC 2024)
- 2023 showed some partial recovery with spring and fall water levels closer to historical ranges but still below typical, with 2023 levels being greater than 2021 and 2022.

Vegetation:
- 2023 had increased spring and fall precipitation, but in 2023 there was not a return to long-term average values of water levels.
- The hydrogeology report Figure A8 attached shows a summary of precipitation for Puslinch on a seasonal and annual basis. From 2019 onward precipitation has been below normal, indicating drought years (GSC 2024).
- Both Spring and Fall vegetation data in Appendices 3, 4, 5 and 6 of the annual monitoring report (Dance environmental Inc. 2023) show the majority of species maintained their same percent cover in the subplots as the previous drier years or increased in percent cover. This suggests the increased precipitation in 2023 over the 2022 drought year was enough to rebound some species percent cover.
- It should be expected that over a several year period of below normal precipitation that there would be natural changes to percent cover of plants, and especially wetland plants, which require wetter conditions for their success. At the same time the maturing of trees and shrubs will result increased water uptake through roots and increase shade conditions, which are not preferred by all herbaceous plant species.

Fish:
- The Groundwater Science Corp. (2024) hydrogeology report indicated that “No measureable water level changes were observed in discharge areas west of Lake 1 (DP2 and DP8)”. See attached Figure 1 from the hydrogeology report which shows monitoring locations including DP2 and DP8.
- It is also noted in the hydrogeology report by GSC (2024) that “No groundwater or surface water temperature changes are observed within spawning areas of the Main Creek (including the primary spawning area between SW1 and SW2) or Tributary #7”.
- The warmer weather in early Winter 2023 was confirmed to have resulted only in some spawning occurring in December 2023 and the addendum report prepared for the Roszell Pit identified spawning continued into January 2024.
- Based on the assessment of the groundwater and surface water temperatures remaining within historical norms and the observed level of continued Brook Trout spawning in the Main Creek and Tributary #7, it is our opinion that there are no significant negative impacts occurring to Brook Trout spawning.
- SW8 is located on Tributary #8. At SW8 there was a seasonal maximum water temperature increase noted in 2020 (GSC 2024), which has remained consistent since, and no changes to downstream water temperatures have been noted. Surveys in Spring 2024 in Tributary #8 confirmed through observation that trout were present in the tributary. It is believed based on our observations that stream substrates, limited water depths and barriers to movement in the tributary result in no spawning in this tributary, as was confirmed by several years of monitoring this tributary. Tributary #8, despite the temperature change noted at SW8 still provides habitat for Brook Trout outside of the spawning season. Trout from Tributary #8 might leave the tributary and go to Tributary #7 or the Main Creek to spawn and then return to the lower reach of Tributary #8, during cool seasons.

Herptofauna:

- As discussed in the Annual Monitoring Report for 2023 (Dance Environmental Inc. 2023), Blue-Spotted Salamander breeding was found at the second highest level of all years in the Roszell wetland, south of the pit. For amphibians 2023 showed improvement similar to 2022 from the low count years of 2020 and 2021, but call codes for some species at certain stations were still not the same as pre-2020 count years.
- As discussed on page 25, and in Sections 4.5 and 5.0 the implementation of our adaptive management approach to include monitoring surface water levels in the Roszell Wetland (Dance Environmental Inc. 2023), indicated that surface water was disappearing before successful breeding of salamanders and frogs. In our report we indicated the previous several years had limited precipitation and therefore was the anticipated reason for the lack of water remaining within the wetland. This was supported based on the discussion on page 22 and 23 of the annual report which cited Groundwater Science Corp. (October 2023) letter report that cited seasonal precipitation patterns from 2001 to 2023.
- The GSC (2024) hydrogeology report Figure A8 (attached) shows the Puslinch area precipitation summary for seasonal and annual precipitation from January 2001 to January 2024. Figure A8 shows that from late January 2018 to January 2024 the annual and seasonal precipitation showed the greatest period of continual below normal conditions for precipitation (GSC 2024). This supports our observation and conclusion that several years of drought conditions have been occurring.
- The GSC (2024) hydrogeology report Figure B20 shows the hydrograph for PG7 (Roszell Wetland), and has been attached for reference. Figure B20 shows that after 2019 the water level elevations above the wetland floor have shown reduced extent of time that surface water is present (GSC 2024). Figure B20 confirms the visual observations of surface water not lasting long enough for salamander and frog eggs to successfully mature, as stated in the annual monitoring report (Dance Environmental Inc. 2023). Figure B20 also shows that the site specific conditions correlate to the trends for Puslinch shown in Figure A8 of the Hydrogeology Report (GSC 2024).
- Figures A8 and B20 both show a multi-year trend of limited precipitation (drought years) which are logically affecting the successful breeding of the frogs and salamanders at the Roszell Wetland to the south of the pit. As the annual report also indicated on page 44 that in 2005 (pre-extraction) the wetland had dried up and salamander egg masses were destroyed, as noted by Stovel and Associates Inc. (2005).
- It is our opinion based on evaluation of the above information that the change in reduced success of frog and salamander breeding is due to recent long-term drought conditions. Frogs have been confirmed breeding along the new pit lake edge, where permanent water is present.

The recommendations section should include adaptive mitigation measures to address results of the amphibian and salamander studies.

We will consider this recommendation when preparing the 2024 annual monitoring report.

We have already implemented the adaptive mitigation measure of completing weekly surveys during May and June of water level conditions at the Roszell wetland where frog and

salamander breeding takes place to improve understanding of the success or failure of breeding has occurred over the last few years.

We have discussed adaptive mitigation approaches previously, and this has included the presence of the peer-reviewer from Aboud & Associates Inc., Cheryl-Anne Ross. The peer reviewer was part of the discussions at the onsite meeting held in 2022 with Grand River Conservation Authority (GRCA) (Tony Zammit), Township hydrogeologist (Stan Denhoed), CBM staff and Dance Environmental Inc. staff. At that site meeting CBM staff and Dance Environmental Inc. staff offered potential options on how to try to address the impact of drought years on the wetland where salamanders and amphibians were breeding to the south of extraction area for the pit. GRCA identified they would not support any options that would change the existing conditions of the wetland. Options to dig deeper depressions in the wetland to hold water longer were not supported as options. Tony Zammit (GRCA), also indicated that it is natural for small shallow wetlands to naturally fill in and transition to different community types, and that it appears the wetland to the south of aggregate extraction is undergoing that natural transition, so they do not support changing any physical conditions in the wetland. The adaptive management recommendations that would address/solve the issue of the wetland drying up too quickly to allow for successful breeding cycles of salamanders and frogs, was not supported by the agency that would need to provide permits to allow for changing the wetland conditions.

In general, using more recent imagery for base mapping and figures is recommended.
This comment is unclear as we did update the air photo for Figure 3 of the annual report as had been request in the previous year's peer review comments. We used the latest air photo available to us at the time of the annual report, and used a 2023 air photo, and recreated the entire figure. The only other figure in the annual report is Figure 1, which is based on the Operational Plan. It provides accurate depiction of the licence, and locations of the creeks and tributaries.

Appendix 3 does not include all species observed per year as indicated in section 3.1 of the report.
Complete species lists observed in each plot for each year should be included as an appendix to the report, alternatively, inclusion of all field forms should be included in the appendix.

We cannot find the reference the peer reviewer is indicating is in Section 3.1 as it does not state that Appendix 3 includes all species in each subplot.

As has been discussed in detail above, the additional assessment of pre-extraction data compared to 2023 findings has been provided. The additional assessment does not suggest significant negative impacts to the tree and shrubs that define the vegetation community within which the vegetation plots are located, no signs of declining health in those species are noted either. Instead, it shows the cedar swamp is maturing, and continues to be dominated by Eastern White Cedar.

The consistent assessment of the same subset of species from the subplots as shown in Appendices 3, 4, 5, and 6 indicates natural fluctuations of the species assessed such as Field Horsetail. This species shows it can decline from 30% cover to 0% cover in different years and then still return to the same subplot.

No declines over 4 percent cover categories have been noted or eradication of entire species which comprised large, >50% cover in a subplot has ever been noted (the changes in Plot A and B have been explained at length regarding changes noted in those plots). As we have indicated previously, the micro-habitat assessment of vegetation plots face a wide range of natural variables that can easily and logically explain the year to year limited variations noted in all Plots.

There is no indication that the aggregate extraction at the Roszell Pit has resulted in significant change within the White Cedar swamp or has resulted in any obvious large scale transition or changes compared to pre-extraction years. It is, therefore, our opinion that the request for sorting through and compiling species lists for all 24 subplots from 11 years is unwarranted. No rationale is provided by the peer reviewer as to what is triggering the request. It is worth noting that no extraction has occurred in 2023 and 2024.

Appendices 3 and 4, and 5 and 6 should be amalgamated.
We will attempt to amalgamate Appendices 3 to 6 onto a larger sized page (11x17) in order to try to show years on one page and at a legible size font, for the 2024 annual monitoring report.

Peer Review Comments on Addendum to: 2023 Ecological and Aquatic Monitoring Report Roszell Pit, Puslinch, Licence #625189.

Table 2 does not include the air temperature, wind speed, or water temperature data for the 2024 trout red survey.
Please see table below to correct this.

Table 2. Brook Trout Spawning Survey Weather Conditions 2023 and 2024.

Year	Survey Date	Weather Conditions
2023/24	December 15, 2023	Air Temp. =3 ^{0}C; Wind = 5-20 km/hr; Percent Cloud = 90%; no precip.; Water Temperature: Main Creek = 5^{0}C; Trib. #7 = 7^{0}C.
	January 11, 2024	Air Temp. = -1^{0}C; Wind = 5-20km/hr; Percent Cloud = 90%; no precip.; Water Temperature: Trib. #7 = 7.3^{0}C.
	January 12, 2024	Air Temp. = -1^{0}C; Wind = 5-15km/hr; Percent Cloud = 100%; No precip.; Water Temperature: Main Creek = 2.7^{0}C.

In Section 4.0 inferences are made about a lack of changes to groundwater discharge, but no reference is made to any hydrological data or reports.
Groundwater Science Corp. is listed in the bibliography twice, but is not mentioned in text.

- The comment in the addendum regarding a lack of change to groundwater discharge is based on the conclusions of both the Groundwater Science Corp. (2023) letter report: “Roszell Pit Licence no. 625189 Thermal Impact Discussion”, and the Groundwater Science Corp. (2022) hydrogeology monitoring report, as was cited in the bibliography. At the time of preparation of the addendum those two documents were the only ones available to us with relevant hydrogeology information.

- As noted earlier, the Dance Environmental Inc. (2023) report did contain discussion of hydrogeological information on pages 22 and 23.
- Since the time of the addendum report the 2023 hydrogeology report has been provided to us. The findings as discussed in the GSC (2024) hydrogeology report continue to still support the findings regarding trout spawning.
    - Figure A8 (GSC 2024) shows that 2023 showed a slight move towards average precipitation, but still below normal amounts of precipitation.
    - Average to slightly above average trout spawning has continued to occur at the Main Creek and Tributary #7, despite disturbances at the culvert at Roszell Road, the recent dam structure built on the creek (by landowners) creating an increased area of siltation on the creek bottom, and still below normal amounts of precipitation.
    - No measurable water level changes have been observed in discharge areas west of Lake 1 (DP2 and DP8) based on the Groundwater Science Corp. (2024) report.
    - The only change that has been noted in the hydrogeology findings is that SW8 (an upwelling at the headwater of Tributary #8) has showed a seasonal temperature increase in late 2020 which has remained consistent at that level since that time, but SW7 (downstream end of Tributary #8 near Speed River) has not shown the same temperature change. No trout spawning has ever been found in Tributary #8.
- There are no indications of significant impact on the numbers of trout redds in 2023 compared with historical data or that any groundwater changes have negatively impacted Brook Trout spawning.

Conclusions:

Comments from the peer review on the formatting, wording choices, additions to figures used, revisions to air photos used etc. are recognized as potential improvements for the 2023 monitoring report and will where deemed appropriate, be considered and implemented.

As requested by the peer reviewer, additional analysis and discussion on the findings from 2023 have been provided, and rationale for why certain additional data have not been provided are given.

We anticipate that this response to the relevant questions and comments raised from the peer reviewer.

Bibliography:

Dance Environmental Inc. 2018. Overview of Biological and Aquatic Monitoring Results:2012-2017, Roszell Pit, Puslinch Township. ARA Licence No. 625189. Prepared for CBM Aggregates.

Golder Associates Ltd. 2021. Hydrological Evaluation of the Wetland Adjacent to the CBM Roszell Pit Site in the Township of Puslinch, Ontario.

Groundwater Science Corp. 2024 (March). Roszell Pit, Licence No. 625189 2021 Groundwater Monitoring Report. Prepared for CBM Aggregates.

Groundwater Science Corp. 2023a. Roszell Pit Lince no. 625189 Thermal Impact Discussion . May 2023.

Groundwater Science Corp. 2023b. Roszell Pit – Harden Environmental Review Comments, 2022 Monitoring Report. October 27, 2023.

Stovel and Associates Inc. 2005. Natural Environment Level 1 and 2 Report Proposed Roszell Pit…County of Wellington.

We trust that these clarifications will be of value to the Township.
Respectfully submitted,

K.W. Dance, M.Sc.
President
Dance Environmental Inc.

K.S. Dance, M.E.S.
Terrestrial Biologist and Partner
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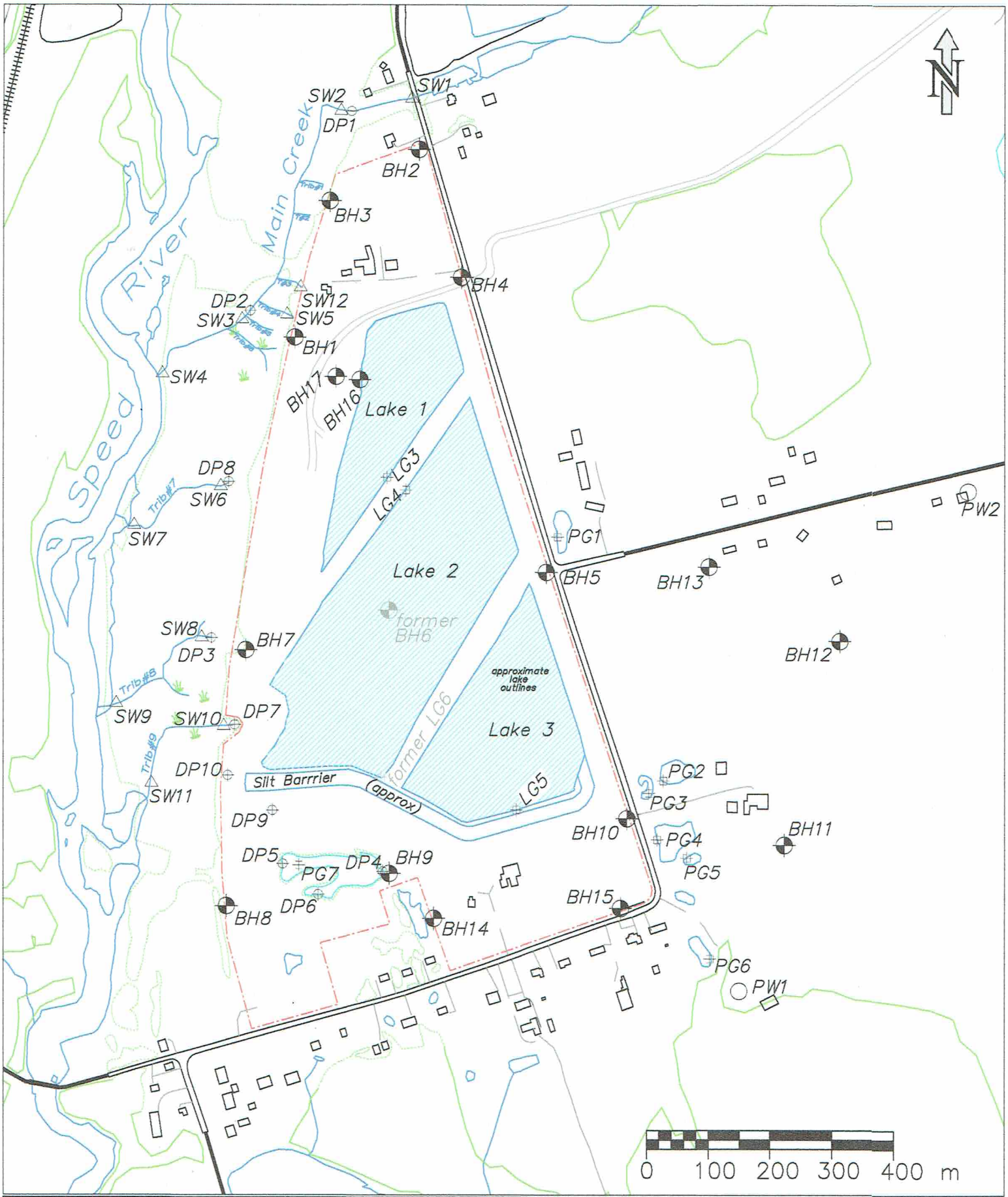
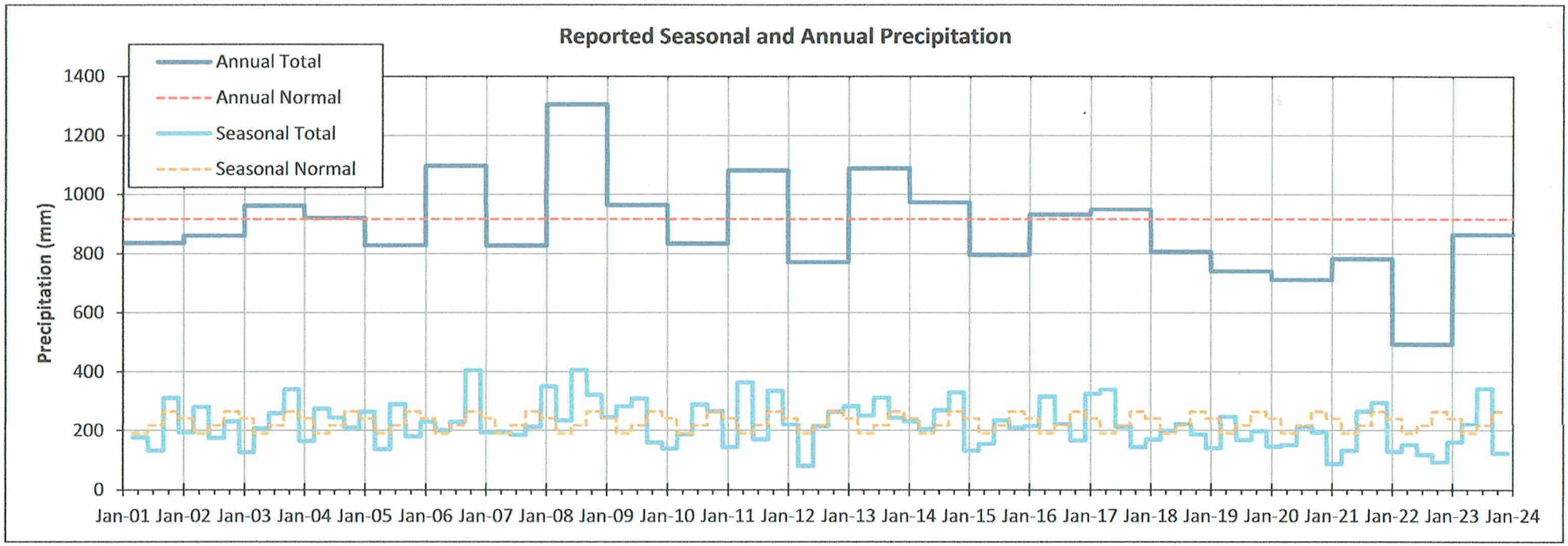


monitoring well (or well nest)
drive-point piezometer
surface water flow/temperature
pond/Lake gauge
private well

Groundwater Science Corp.

Figure 1: Site Details and Monitor Locations

March 2023 Scale: as shown modified from: 1:10,000 OBM	Groundwater Monitoring Program	CBM Aggregates Roszell Pit	Part Lots 1 & 2, Concessions 3 & 4 Township of Puslinch, County of Wellington



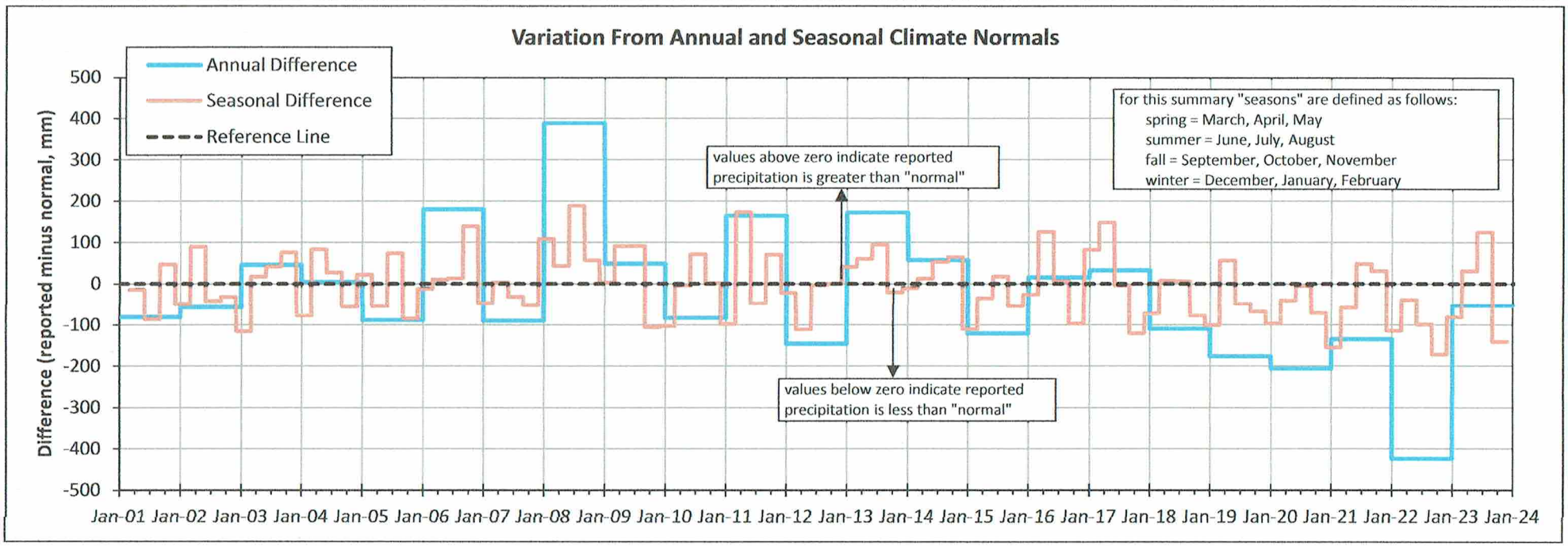
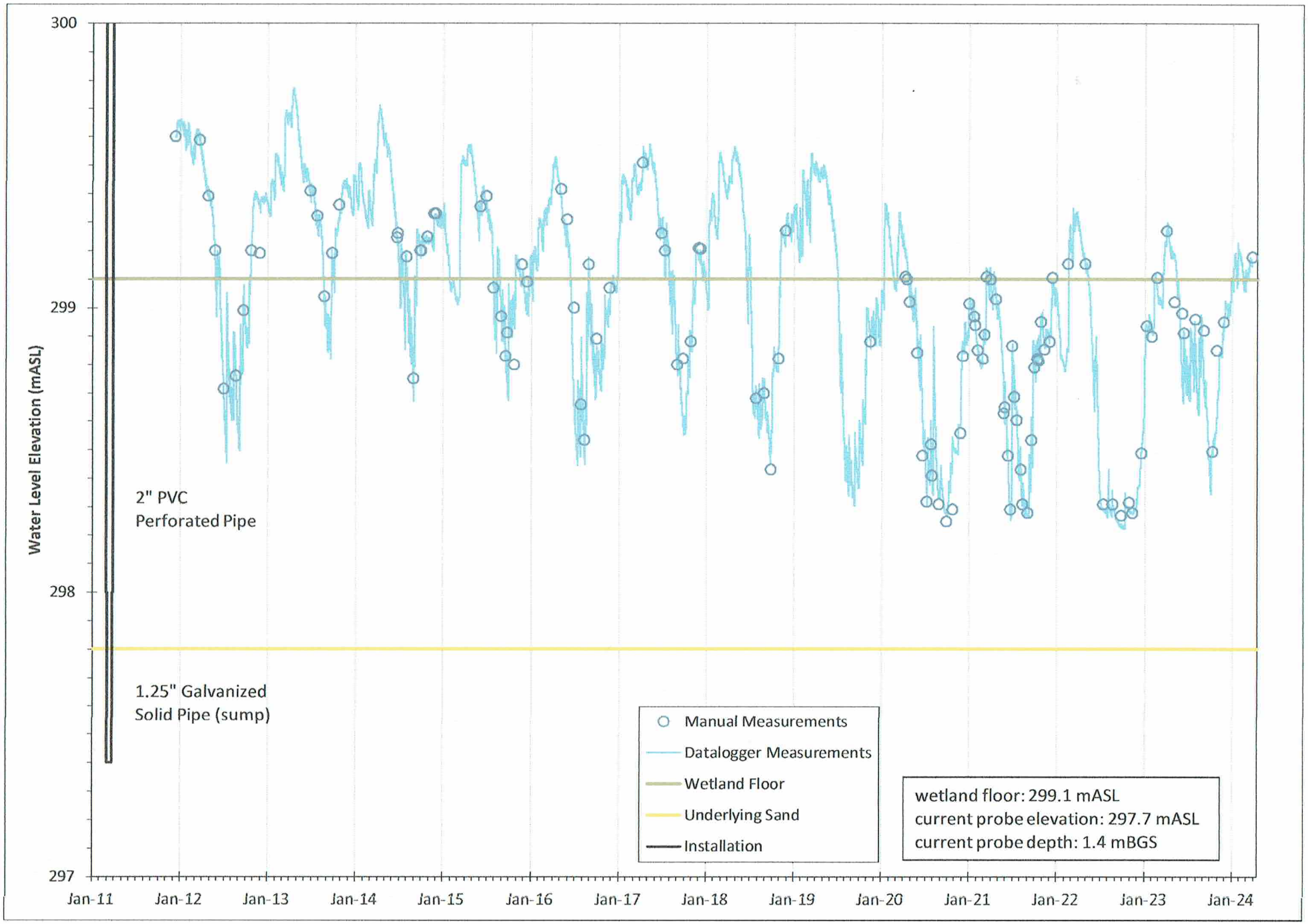


Figure A8: Puslinch Area Precipitation Summary



CBM Aggregates
Roszell Pit

Figure B20: PG7 (Roszell Wetland) Hydrograph

Groundwater Science Corp.
Monitoring Program

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RAVINE STEWARDSHIP PLANS
NATURALIZATION PLANS
INTERPRETIVE DESIGN
MONITORING
CONTRACT ADMINISTRATION

ENVIRONMENTAL STUDIES
SUBWATERSHED STUDIES
ENVIRONMENTAL IMPACT STATEMENTS
ECOLOGICAL LAND CLASSIFICATION
WETLAND EVALUATION
VEGETATION ASSESSMENT
BOTANICAL INVENTORIES
WILDLIFE SURVEYS
MONITORING

LANDSCAPE ARCHITECTURE
MASTER PLANNING
RESIDENTIAL COMMUNITIES
COMMERCIAL/INDUSTRIAL
HEALTHCARE AND EDUCATION
STREETSCAPES
PARKS AND OPEN SPACES
TRAIL SYSTEMS
GREEN ROOFS
CONTRACT ADMINISTRATION

EXPERT OPINION
LPAT TESTIMONY
LEGAL PROCEEDINGS
PEER REVIEW
RESEARCH
EDUCATION

April 29, 2024

Our Project #: AA21-049A-019
Sent by email: jbrotherston@puslinch.ca

Justine Brotherston
Deputy Clerk
Township of Puslinch
7404 Wellington Rd 34, Puslinch ON N0B 2J0

Re: Addendum to: 2023 Ecological and Aquatic Monitoring Report Roszell Pit, Puslinch, License No. 625189 (Prepared by: Dance Environmental Inc.)
Peer Review – Ecology

Dear Ms. Brotherstone:

Aboud & Associates Inc. (AA) has been retained by the Township of Puslinch to complete a Peer Review of the addendum to the 2023 Ecological and Aquatic Monitoring Report, as it pertains to the annual monitoring requirements of aggregate extraction within the Roszell road pit. The Roszell wetland is identified as part of the Speed River Provincially Significant Wetland complex. We have reviewed the following document as part of our assessment:

- Addendum to: 2023 Ecological and Aquatic Monitoring Report Roszell Pit, Puslinch Township. ARA Licence No. 625189. Dance Environmental Inc. April 8, 2024.
- 2023 Ecological and Aquatic Monitoring Report Roszell Pit, Puslinch Township. ARA Licence No. 625189. Dance Environmental Inc. December 22, 2023.
- 2023 Roszell Road Pit Ecological and Aquatic monitoring report peer review – Ecology (Aboud & Associates inc., February 26, 2024).

This addendum provides the results of the trout redd survey recommended in the 2023 Ecological and Aquatic Monitoring Report which took place in January 2024. It does not address any comments provided by AA in our peer review of February 2024.

Based on our review of the provided information, the following components should be reviewed and addressed in an updated addendum:

- Table 2 does not include the air temperature, wind speed, or water temperature data for the 2024 trout redd surveys.

- In section 4.0 inferences are made about a lack of changes to groundwater discharge, but no reference is made to any hydrogeological data or reports.

- Groundwater Science Corp. is listed in the bibliography twice, but is not mentioned in the text.

In conclusion, our review of the submitted report has determined that the proponents have outlined the results of the trout redd monitoring, and compared it with data from previous years. However, as with the December 2023 report, we recommend a comprehensive discussion of the results that reviews and summarizes supplementary studies (e.g., hydrogeological report) in supporting its conclusions.

Please contact the undersigned should you require additional information of the above.

Yours truly,

ABOUD & ASSOCIATES INC.

Heather Dixon, PhD
Aquatic Ecologist

Reviewed by:

[redacted]

Cheryl-Anne Ross, B. Sc.
MNRF Certified ELC & OWES
Ecology Lead & Wildlife Ecologist

S:\A+A Projects\2021\Approved\21-049A Puslinch Peer Review\AA File\21-049A-019A Roszell Ecological monitoring 2023\Report\AA21-049A-019 Roszell Pit 2023 addendum AA peer review.docx

DANCE ENVIRONMENTAL INC.

DE-382

April 8, 2024.

Addendum to:
2023
Ecological and Aquatic Monitoring Report
Roszell Pit, Puslinch Township.
ARA Licence No. 625189.

Prepared for:
CBM Aggregates
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Prepared by:
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1.0 INTRODUCTION

The following addendum report is provided to supplement the "2023 Ecological and Aquatic Monitoring Report, Roszell Pit", dated December 22, 2023.

The Ecological and Aquatic Monitoring report for 2023 at the Roszell Pit identified that an addendum report would be prepared to supplement the trout redd findings from 2023. The December 2023 Trout Redd surveys on the Main Creek and Tributary #7 resulted in lower than expected numbers of trout redds. The unseasonably warm temperatures and limited snow in December of 2023, were seen as potentially influencing the onset of trout spawning and the December survey may have only captured the start of Brook Trout spawning. It was recommended that a January survey be undertaken when cooler temperatures had settled in, potentially triggering the full extent of trout spawning for the season.

This addendum summarizes the December 2023 and January 2024 surveys for trout redds in the tributaries adjacent to the Roszell Pit.

2.0 Methods

Trout redd surveys were completed following the same methodology as previous years. The surveys for trout redds were completed on December 15, 2023 and additional surveys were completed on January 11, 2024 for Tributary #7, and January 12, 2024 for the Main Creek.

Tables 1 and 2 below summarize the survey dates and weather conditions from 2014 to 2024.

Table 1. Summary of Dates and Weather Conditions for Trout Redd Surveys on the Main Creek, and Tributaries #7, 8, and 9 from 2014 to 2017.

Year	Survey Date	Weather Conditions
2014	December 2	Air Temp. = -1^{0}C; Wind = 2-6 km/hr; Percent Cloud = 40-60%; No Precip.; Water Temperature: Main Creek & Trib #7 = 4^{0}C, Trib #8 = 5.5^{0}C & #9 = 5^{0}C
	December 19	Air Temp. = -2^{0}C; Wind = 3 km/hr; Percent Cloud = 30-50%; No Precip.; Water Temperature: Main Creek & Trib #7 = 4^{0}C, Trib #8 & 9 = 6^{0}C
2015	December 3	Air Temp. = 2^{0}C; Wind = 10-20 km/hr; Percent Cloud = 100%; No Precip.; Water Temperature: Main Creek & Trib #8 & 9 = 9^{0}C
	December 4	Air Temp. = 5^{0}C; Wind = 5-10 km/hr; Percent Cloud = 100%; No Precip.; Water Temperature: Main Creek = 7^{0}C, Trib #7 = 8^{0}C
	December 17	Air Temp. = 5^{0}C; Wind = 5-10 km/hr; Percent Cloud = 20-40%; No Precip.; Water Temperature: Main Creek, Trib # 8 & 9 = 8^{0}C, Trib #7 = 10^{0}C
2016	January 28	Air Temp. = -1^{0}C; Wind = 5-10 km/hr; Percent Cloud = 100%; light snowfall.; Water Temperature: Main Creek = 4^{0}C, Trib #7 = 6^{0}C

	December 7	Air Temp. = 1.5^{0}C; Wind = <10 km/hr; Percent Cloud = 40%; no precip..; Water Temperature: Main Creek = 5.5^{0}C
	December 9	Air Temp. = 2^{0}C; Wind = 6-8 km/hr; Percent Cloud = 40%; no precip.; Water Temperature: Main Creek = 5^{0}C, Trib #7 = 8^{0}C; Trib#8 & 9 = 7^{0}C
2017	November 26	Air Temp. = 0^{0}C; Wind = 5-10 km/hr; Percent Cloud = 90%; no precip.; Water Temperature: Main Creek = 5^{0}C,
	November 27	Air Temp. = 2^{0}C; Wind = 3-5 km/hr; Percent Cloud = 40%; no precip.; Water Temperature: Main Creek = 5^{0}C, Trib #7 = 8.8^{0}C,Trib.#8 & 9 = 8.1^{0}C
	December 14	Air Temp. = -12^{0}C; Wind = 0 km/hr; Percent Cloud = 20%; no precip.; Water Temperature: Main Creek =1.2^{0}C, Trib #7 = 8.8^{0}C,Trib.#8 =5.9^{0}C & Trib.#9 = 5.4^{0}C
	December 15	Air Temp. = -7^{0}C; Wind = 1-5 km/hr; Percent Cloud = 90%; light snow; Water Temperature: Main Creek =3.2^{0}C

Table 2. Summary of Dates and Weather Conditions for Trout Redd Surveys on the Main Creek, and Tributaries #7, from 2018 to 2024.

Year	Survey Date	Weather Conditions
2018	December 5	Air Temp. = -3^{0}C; Wind = 0 km/hr; Percent Cloud = <10%; no precip.; Water Temperature: Main Creek = 4.0^{0}C
	December 12	Air Temp. = -2^{0}C; Wind = 0 km/hr; Percent Cloud = 70%; no precip.; Water Temperature: Trib. #7 = 6.6^{0}C
2019	December 13	Air Temp. = 4-7^{0}C; Wind = 0-5 km/hr; Percent Cloud = 50%; no precip.; Water Temperature: Main Creek = 4.5^{0}C; Trib. #7 = 6.6^{0}C
	December 17	Air Temp. = -4^{0}C; Wind = 0-5 km/hr; Percent Cloud = 60%; no precip.; Water Temperature: Main Creek = 3.8^{0}C; Trib. #7 = 6.2^{0}C
2020	December 11	Air Temp. = 2-7^{0}C; Wind = 0-5 km/hr; Percent Cloud = 10%; no precip.; Water Temperature: Main Creek = 4.7^{0}C; Trib. #7 = 7.1^{0}C; Trib. #8 = 12.9^{0}C
	December 16	Air Temp. = -7^{0}C; Wind = 20-35 km/hr; Percent Cloud = 70-90%; no precip.; Water Temperature: Main Creek = 3^{0}C; Trib. #7 = 5.2^{0}C; Trib. #8 = 11.1^{0}C
2021	December 1	Air Temp. = 4^{0}C; Wind = 5-10 km/hr; Percent Cloud = 15%; no precip.; Water Temperature: Main Creek = 4^{0}C; Trib. #7 = 11^{0}C; Trib. #8 = 14^{0}C
	December 21	Air Temp. = 0^{0}C; Wind = 0-5 km/hr; Percent Cloud = <5%; no precip.; Water Temperature: Main Creek = 4.5^{0}C; Trib. #7 = 7.5^{0}C; Trib. #8 = 12^{0}C.
2022	December 14	Air Temp. = -4^{0}C; Wind = 5-15 km/hr; Percent Cloud = 90%; no precip.; Water Temperature: Main Creek = 3.4^{0}C; Trib. #7 = 5^{0}C.
	December 22	Air Temp. = -2^{0}C; Wind = 5-10 km/hr; Percent Cloud = 60%; no precip.; Water Temperature: Main Creek = 3.8^{0}C;

		Trib. #7 = 6.6^{0}C.
2023/24	December 15, 2023	Air Temp. =3 ^{0}C; Wind = 5-20 km/hr; Percent Cloud = 90%; no precip.; Water Temperature: Main Creek = 5^{0}C; Trib. #7 = 7^{0}C.
	January 11, 2024	Air Temp. = ^{0}C; Wind = km/hr; Percent Cloud = 0%; no precip.; Water Temperature: ; Trib. #7 = ^{0}C.
	January 12, 2024	Air Temp. = ^{0}C; Wind = km/hr; Percent Cloud = 0%; no precip.; Water Temperature: ; Main Creek = ^{0}C.

On January 11, 2024 Tributaries #8 and #9 were also surveyed for any trout redds and assessed for potential for barriers to fish movement which may influence their function for trout spawning.

3.0 Final Results:

Main Creek:

2023 was found to have an extended warm Autumn and Winter with limited precipitation. The total number of redds found in Main Creek during the 15 December 2023 and the January 12, 2024 survey shows numbers within the normal range of redd totals. The survey completed on January 12, 2024 resulted in 5 additional Brook Trout redds being confirmed to be present in the Main Creek. Therefore the 2023/24 spawing season had13-14 redds in the Main Creek. The 2023/24 results are just slightly higher than the average for all 12 years of 12-13 redds, showing despite the drought year, average spawning levels have occurred.

For comparison Table 3 and Table 4 have been included below which show trout redd numbers for every year of surveys completed.

Table 3. Summary of 2012 and 2013, Pre-extraction, Brook Trout Spawning Surveys, Roszell Pit.

	Tributary Name	Station Location	Number of Redds	Total Number of Redds
Dec. 2012	**Main Creek**	M-1	2 to 3	**8 to 9 redds**
		M-2	2	
		M-3	1	
		M-4	3	
	Tributary 7	7-1	2	**5 redds**
		7-2	2	
		7-3	1	
	Tributary 8 and 9		No redds	**0**
Dec. 2013	**Main Creek**	M-1 (13)	3	**19 redds**
		M-2 (13)	3	
		M-3 (13)	6	
		M-4 (13)	5	
		M-5 (13)	2	
	Tributary 7	7-1	1	**5 redds**
		7-2	4	
		7-3	0	
	Tributary 8 & 9	No redds	No redds	**0**

Table 4. Summary of 2014 to 2023, Extraction years, Brook Trout Spawning Surveys, Roszell Pit.

	Tributary Name	Station Location	Number of Redds	Total Number of Redds
Dec. 2014	**Main Creek**	M-1	2 to 3	**9-10 redds**
		M-1A (14)	1	
		M-2 (14)	2	
		M-3 (14)	4	
	Tributary 7	7-2(14)	2	**4 redds**
		7-2A (14)	2	
Dec. 2015	**Main Creek**	M-1(15)	1	**2-3 redds**
		M-2(15)	1 to 2	
	Tributary 7	No redds	No redds	**0**
Jan. 2016	**Main Creek**	M-1B(16)	1	**5-6 redds**
		M-1C(16)	3	
		M-5(16)	1 to 2	
	Tributary 7	7-2A(16)	1	**2 redds**
		7-2B(16)	1	
Dec. 2016	**Main Creek**	M-16A	1	**15-16 redds**
		M-16C	1	
		M-16D	3-4	
		M-16E	4	
		M-16F	1	
		M-16G	1	
		M-16H	1	
		M-16I	3	
	Tributary 7	7-1(16)	1	**6 redds**
		7-2(16)	2	
		7-3(16)	3	
Nov/ Dec. 2017	**Main Creek**	M-1(17)	1	**13 redds**
		M-2(17)	1	
		M-3(17)	1	
		M-4(17)	5	
		M-5(17)	1	
		M-6(17)	1	
		M-7(17)	1	
		M-8(17)	1	
		M-9(17)	1	
	Tributary 7	7-1(17)	1	**4-5 redds**
		7-2(17)	2	
		7-3(17)	1-2	

Table 4. Summary of 2015 to 2023, Extraction years, Brook Trout Spawning Surveys, Roszell Pit Cont'd.

	Tributary Name	Station Location	Number of Redds	Total Number of Redds
Dec. 2018	**Main Creek**	M-1(18)	3	**13 redds**
		M-2(18)	1	
		M-3(18)	1	
		M-4(18)	7	
		M-5(18)	1	
	Tributary 7	7-1(18)	1	**6-9 redds**
		7-2(18)	1-2	
		7-3(18)	2	
		7-4(18)	1-2	
		7-5(18)	1-2	
Dec. 2019	**Main Creek**	M-1(19)	2-3	**13-14 redds**
		M-1B(19)	1	
		M-2(19)	1	
		M-3(19)	2	
		M-4(19)	3	
		M-5(19)	2	
		M-6(19)	1	
		M-7(19)	1	
	Tributary 7	7-1(19)	1	**9 redds**
		7-1B(19)	2	
		7-1C(19)	1	
		7-2(19)	2	
		7-3(19)	2	
		7-4(19)	1	
Dec. 2020	**Main Creek**	M-1(20)	1	**8-10 redds**
		M-2(20)	1-2	
		M-2B(20)	1-2	
		M-3(20)	2	
		M-4(20)	3	
	Tributary 7	7-1(20)	1	**6-9 redds**
		7-1B(20)	1-2	
		7-2(20)	1-2	
		7-3(20)	1-2	
		7-4(20)	2	
Dec. 2021	**Main Creek**	M-2(21)	3	**11 redds**
		M-2B(21)	3	
		M-3(21)	3	
		M-4(21)	2	
				8 redds
	Tributary 7	7-2(21)	3	
		7-3(21)	4	
		7-4(21)	1	
Dec. 2022	**Main Creek**	M-1(22)	1	**16-20 redds**
		M-2(22)	1-2	
		M-2B(22)	1	

		M-3(22)	3-4	
		M-3A(22)	1	
		M-4(22)	1	
		M-5(22)	1-2	
		M-6(22)	2-3	
		M-7(22)	4	
		M-8(22)	1	
	Tributary 7	7-4(22)	2-3	**6-8 redds**
		7-2(22)	2	
		7-3(22)	1	
		7-4B(22)	1-2	
Dec. 2023 & Jan. 2024	**Main Creek**	M-3(23)	4	**13-14 redds**
		M-4(23)	1	
		M-4(23)* (Jan)	**2**	
		M-5(23)	1	
		M-6(23)	1	
		M-7(23)	1-2	
		M-2b(23)*	**1**	
		M-2a (23)*	**2**	
	Tributary 7	7-2(23)	3	**11 redds**
		7-3(23)	4	
		7-1(23)*	**3**	
		7-4(23)*	**1**	

M-_(23)* = Trout Redd location found on January 11th or 12th, 2024 survey dates.

The data from the 2023/24 spawning season for Brook Trout are within the range of the 2012 and 2013 pre-extraction year findings. The pre-extraction years showed a large variation with 9 redds in 2012 and 19 redds in 2013 in the Main Creek.

Trout redds in 2023 /24 were found in traditional locations in the creek, and no new redds were found in January 2024 in the upper watershed where the landowner's near Roszell Road created a dam , increasing sediment deposition in that area. Despite this, spawning has been confirmed to continue, with more redds being concentrated slightly farther downstream of the dam area. There does not appear to be any negative thermal impacts to the trout spawning in the Main Creek.

Tributary #7:

The December 15, 2023 survey of Tributary #7 found 7 trout redds present, which is 1 greater than the long-term average of six redds for all years. The January 11, 2024 survey to see if late spawning occurred, resulted in 4 additional redds being found in historically used areas of the creek, as shown in Table 4. A total of 11 redds were present in the 2023/24 spawning season.

During the two pre-extraction years, 5 redds were found in Tributary #7. So, there is no evidence of negative thermal impact on trout spawning in Tributary #7 in comparison to years prior to extraction.

Tributrary #8 and #9:
On January 11, 2024 both Tributary #8 and #9 were surveyed for trout redds to see whether any Brook Trout spawning was occurring in any of those tributaries.

Although Stovel (2005) captured 1 Brook Trout in Tributary #8, the ecological monitoring prior to extraction (2012 and 2013) and for 4 years once extraction began did not find trout redds in Tributary #8 or #9.

Tributary #8 starts as a groundwater upwelling at the base of a treed slope and flows through Eastern White Cedar swamp with its' mouth being located at the Speed River. There is shallow, dispersed flow in the upstream section of Tributary #8 and no firm sand/gravel substrate for spawning. This dispersed flow area is heavily shaded by trees.

At Tributary #8 where the small side channel enters the Tributary #8 from the southeast (flowing to the northwest), just downstream of where they meet there was a clear barrier to fish movement in the creek. For a approximately a 1.5m stretch of Tributary #8 there is a blockage of branches, wood debris, mud and cedar leaves throughout the entire water column. Downstream of that barrier were three other barriers to movement where Cedar roots/wood covered the entire tributary width and water column. In these areas water movement appears to be forced underground through the soil. On the 11 January 2024 survey no Brook Trout were observed and no trout redds were obsevered anywhere along Tributary #8.

Tributary #9 starts at as a groundwater upwelling in a perched water table at the top of the slope of the Roszell Wetland. The perched water table results in a shallow ponding area that flows West down the valley slope to the bottomlands of the White Cedar Swamp. At the bottom of the slope for the first 10-15m there were areas of 3-5m length where water flow went entirely underground and this area had shallow water depths of 1-3cm. Due to the underground water movement for long stretches, vertical slope, silt subtrates and shallow water depths the headwater area of Tributray #9 is seen to have many barriers to fish movement and spawning.

Also, Tributary #9 does not directly connect to the Speed River, but instead dissipates into open Reed Canary Meadow Marsh which was part of an old mill impoundment, with remnant berms still being present. Historically the Tributary may have had a connection to the Speed River when water was flowing through the mill race but that is no longer the case. The Tributary is, therefore, primarily a closed aquatic system unless significant flooding of the Speed River occurs and the meadow marsh becomes flooded. In the meadow marsh near the Speed River when there was a defined channel of the tributary present, it was 4-8 cm deep with dark silty substrate on the creek bottom. An area of Broad-leaved Cattails in the meadow marsh was found to disperse the defined channel of the Tributary for a stretch of 5-10m, and then at 5-7m before entering the swamp the channel became defined again with water depths of 3-10cm. From where the Tributary enters the cedar swamp upstream for approximately 12m, the creek is open and unimpeded, but with silty subrates not ideal for trout spawning. In the middle section of the tributary there were 3 to 4 areas on the creek that could act as barriers to fish movement due to cedar roots, leaf and wood debris blocking the entire water column. On the 11 January 2024 survey no Brook Trout were observed and no trout redds were obsevered anywhere along Tributary #9.

4.0 Conclusions:

As noted in the Annual Monitoring report by Dance Environmental Inc. (2023) the numbers and locations of Brook Trout redds have not changed significantly between the pre-extraction period and during the extraction period. If neither the numbers of redds, nor the locations where trout are spawning have changed, there have logically not been any significant thermal changes to groundwater discharge resulting in changes to the extent and location of trout spawing.

The most obvious change to locations of trout redds is on the Main Creek where the landowner near Roszell Road had built a dam with rock slowing water movement in a section of the creek, resulting in sediment deposition over areas which were once small cobble. Any shifts in redd locations in the Main Creek reach located immediately downstream of Roszell Road are explained by the loss of the plunge pool and new large rock substrate placed during the Roszell Road culvert replacement (Summer/Fall 2023), silt deposition on the creek bottom, and the continued barrier to fish movement that the rock dam created by a landowner has caused

Tributary #8 and #9 were surveyed again in January 2024 with the same outcome as the first 4 years of surveys, no trout redds were present, and no trout were observed in either of the tributaries. Several areas were confirmed to be present on both tributaries which appear to act as barriers to fish movement, compared to the larger deeper and more defined channels of the Main Creek and Tributary #7.

5.0 BIBLIOGRAPHY

Dance Environmental Inc. 2023. 2023 Ecological and Aquatic Monitoring Report Roszell Pit, Puslinch Township. ARA Licence No. 625189.

Groundwater Science Corp. 2023a. Roszell Pit Lince no. 625189 Thermal Impact Discussion . May 2023.

Groundwater Science Corp. 2023b. Roszell Pit – Harden Environmental Review Comments, 2022 Monitoring Report. October 27, 2023.

Stovel and Associates Inc. 2005. Natural Environment Level 1 & 2 Report. Proposed Roszell Pit Part of Lots 1 and 2, Concessions 3 and 4, Township of Puslinch, County of Wellington.

Report prepared by:

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Dance Environmental Inc.

ABOUD & ASSOCIATES INC.
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February 26, 2024

Our Project #: AA21-049A-019
Sent by email: jbrotherston@puslinch.ca

Justine Brotherston
Deputy Clerk
Township of Puslinch
7404 Wellington Rd 34, Puslinch ON N0B 2J0

Re: 2023 Ecological and Aquatic Monitoring Report Roszell Pit, Puslinch, License No. 625189 (Prepared by: Dance Environmental Inc.)
Peer Review – Ecology

Dear Ms. Brotherstone:

Aboud & Associates Inc. has been retained by the Township of Puslinch to complete a Peer Review of the 2023 Ecological and Aquatic Monitoring Report, as they pertain to the annual monitoring requirements of aggregate extraction within the Roszell road pit. The Roszell wetland is identified as part of the Speed River Provincially Significant Wetland complex. We have reviewed the following document as part of our assessment:

- 2023 Ecological and Aquatic Monitoring Report Roszell Pit, Puslinch Township. ARA Licence No. 625189. Dance Environmental Inc. December 22, 2023.
- 2022 Roszell Road Pit Ecological and Aquatic monitoring report peer review – Ecology (Aboud & Associates inc., February 1, 2023).

Per the methods described in the report, the requirements of the annual monitoring report include the following components:

- Vegetation monitoring, including quadrat sampling of herbaceous vegetation, photo monitoring, soil moisture sampling, and tree and shrub health information.

- Trout spawning surveys, including an evaluation of hydrogeological monitoring results and any evidence of resulting changes.

- Salamander egg mass surveys and amphibian call surveys.

Additional monitoring was implemented in 2022 and 2023 based on concerns noted during the 2021 monitoring season, this included weekly water level monitoring within the wetland from May until June and identifying the presence of any salamander egg masses or larvae during those visits.

The December 2023 report and associated appendices have identified the following regarding ecological and aquatic conditions of the associated natural heritage features in proximity to the Roszell pit:

- Vegetation surveys occurred within the same timing as previous surveys; changes in spring vegetation species cover from 17-50% were noted in the vegetation plots from 2023 values. While fall values showed a difference of 8-50% in the vegetation plots from 2022 values.

- Trout Redd Surveys occurred in the appropriate timing window and identified that trout spawning continues in both the main creek and tributary 7. No Trout Redds have ever been observed in tributaries 8 & 9, and are no longer surveyed per data included in the report. Low redd numbers in the Main Creek were attributed to a warm Autumn, and another survey was recommended for January 2024 to assess redd numbers further.

- Salamander egg mass surveys conducted yearly since 2013 confirmed salamander breeding in the subject site in 2023 within Wetland Areas A and B. However, water levels dropped prior to completion of larval development, although water was present for roughly a week longer than in 2022.

- Amphibian calling surveys completed in 2023 observed increased numbers of species at three of the sites, and the same number at the remaining two. Population levels were similar or higher than those found in 2022.

Based on our review of the provided information, Aboud & Associates find the monitoring report has an increased level of discussion and analysis to the previous years' reports, particularly in terms of the vegetation monitoring. The following components should be reviewed and addressed in an updated report:

- In general, discussion of all monitoring results should compare current vegetation monitoring to pre-extraction conditions, as well as the previous years' post-extraction monitoring effort.

- While the methods state that soil moisture levels will be sampled for each plot using a soil moisture meter, as was noted in our 2021 and 2022 reviews, the results of the moisture sampling are not included in the monitoring report for 2023. Please update these results or updates methods to reflect what is currently used to assess soil moisture.

- In Section 4.1 soil moisture is indicated as ‘damp’, ‘dry’ and ‘saturated’ in several instances. The soil moisture measurement method or sampling technique used to determine these results should be stated.

- In section 4.1, Soil moisture and standing water levels is not described for all plots. Please include these results.

- Section 4.1 does not include any discussion of changes in dominant taxa or a summary of the herbaceous cover present within vegetation subplots as compared to pre-extraction conditions. While efforts have been made to compare the vegetation monitoring data with early extraction years, the 2023 data was not compared with the baseline year data collected during pre-extraction conditions. For Spring vegetation monitoring the baseline year is 2013, while for Autum monitoring it is 2012. Instead, the 2023 data were compared to 2014/2015 data, after the pit had been established. In reviewing appendix 3, several dominant species listed are at <1% cover in a plot, if new species have filled those areas, they should be included in the dominant taxa list, if it is bare earth, this should be noted.

- A complete plant list should be appended that includes species present for each plot, or all field forms should be appended, an example field form from 2013 does not provide any additional information.

- Any community level changes in overall wetness index may indicate a change in groundwater levels and should be included and discussed in detail and compared with relevant hydrogeological data.

- As noted in 2022 and 2023 during our review, review and analysis of the average wetness index for each vegetation plot, including all species observed, compared year to year, to determine any changes to the vegetation composition and wetness index should be included graphically, and discussed in the context of potential changes in groundwater level. This type of analysis has also been identified by the GRCA in their 2023 review. We recommend completing a floristic quality assessment by plot and by year to determine changes to the

floristic quality index, average wetness value, and average Coefficient of Conservatism to help determine if changes are as a result of hydrological changes, as opposed to agricultural changes.

- Amphibian call survey locations should include the direction of the survey on the figure or as part of table 7.

- The amphibian data presented in Section 4.4 (table 14) does not indicate if amphibians were heard calling within or beyond 100 m of the survey station. If frogs calling from beyond 100 m of the survey station were excluded, this should be indicated in the data table.

- Within Section 5.0, complete and include a summary review, analysis, and integration of the results of the hydrogeological monitoring report, as it relates to trout spawning, wetland water levels and changes in amphibian and salamander breeding.

- The recommendations section should include adaptive mitigation measures to address results of the amphibian and salamander breeding studies.

- In general, using more recent imagery for base mapping and figures is recommended.

- Appendix 3 does not include all species observed per year or plot, as indicated in Section 3.1 of the report.

- Appendices 3 and 4, and 5 and 6 should be amalgamated.

- Complete species lists observed in each plot for each sampling year should be included as an appendix to the report, alternately, inclusion of all field forms should be included in the appendix.

In conclusion, our review of the submitted report has determined that while the proponents have outlined the results of the monitoring for 2023, they have not completed a thorough analysis of the data, or comparison to baseline conditions. Analyses should measure changes between pre- and post-extraction conditions as well as the year-over-year post-extraction changes. We also recommend a comprehensive discussion of the results that reviews and summarizes supplementary studies (e.g., hydrogeological report) in supporting its conclusions.

Please contact the undersigned should you require additional information of the above.

Yours truly,

ABOUD & ASSOCIATES INC.

[redacted]

Heather Dixon, PhD
Aquatic Ecologist

Reviewed by:

[redacted]

Cheryl-Anne Ross, B. Sc.
MNRF Certified ELC & OWES
Ecology Lead & Wildlife Ecologist

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Administration Centre: 400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6

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February 9, 2024
Via email

Justine Brotherston, Interim Municipal Clerk
Township of Puslinch
7404 Wellington Road 34
Puslinch, ON, N0B 2J0

Dear Ms. Brotherston,

Re: 2023 Ecological and Aquatic Monitoring Report
Roszell Pit, ARA Licence No. 625189
CBM Aggregates

Grand River Conservation Authority (GRCA) staff has reviewed the above-noted 2023 Monitoring Report for the Roszell aggregate pit in the Township of Puslinch and offer the following comments.

For municipal consideration
Please be advised that on January 1, 2023, a new Minister's regulation (Ontario Regulation 596/22: Prescribed Acts – Subsections 21.1.1 (1.1) and 21.1.2 (1.1) of the Conservation Authorities Act) came into effect. As a result, non-mandatory technical review services that the GRCA formerly provided under agreement with municipalities (e.g., technical reviews related to natural heritage and select aspects of stormwater management) will no longer be provided.

On this basis, we offer the following comments for municipal consideration:

1. Although there is some indication that hydrologic conditions improved in 2023, the consultant has not clearly indicated if and to what extent wetland vegetation communities on this site are being affected by periodic changes in local hydrology. The composition, structure, and function of wetlands is a very good indicator of hydrologic conditions, which have been affected by below average annual rainfall in recent years. Below water extraction could potentially result in a deeper and more prolonged drawdown in the local water table. A protracted drawdown during one or more growing seasons could cause a shift toward a drier plant community. The presence of obligate and/or facultative wetland species and the relative tolerance of individual plant species and the plant community as a whole will help determine if changes in water levels are having an adverse impact on the wetlands.

2. The use of coefficients of wetness (a species' relative affinity for wet or dry sites) and coefficients of conservatism (a species' relative tolerance to disturbance, including hydrologic changes) is recommended to help determine if plant communities are being impacted by fluctuating water levels, and if so to what extent.

Should you have any questions, please contact me at 519-621-2761 x 2327 or by email at vwismer@grandriver.ca.

Sincerely,

[redacted]

Tyler Slaght
Supervisor of Resource Planning
Grand River Conservation Authority

Copy: Dance Environmental (via email)

DANCE ENVIRONMENTAL INC.

2023
Ecological and Aquatic Monitoring Report
Roszell Pit,
Puslinch Township.
ARA Licence No. 625189.

Prepared for:
CBM Aggregates
55 Industrial Street
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M4G 3W9
Attn: Jennifer DeLeemans

Prepared by:
Dance Environmental Inc.
807566 Oxford Rd. 29
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N0J 1G0

December 22, 2023.
DE-382

1.0 BACKGROUND

Dance Environmental Inc. was retained on September 7, 2012 by CBM Aggregates to begin initial data collection on wetland vegetation, fish spawning, and sediment and erosion control monitoring in accordance with the site plans for the Roszell Pit, Puslinch Township.

The Roszell Pit was approved for aggregate extraction prior to 2012. The Roszell Pit is licenced for extraction into the water table.

The Summer of 2012 was characterized as a hot dry summer with lower than average precipitation, resulting in low water levels in streams and rivers throughout much of Ontario.

Aggregate extraction started to take place at the Roszell Pit in 2013, so the 2014 to 2023 monitoring provides data during aggregate extraction.

2.0 PURPOSE OF MONITORING

The monitoring started in the Autumn of 2012, and has continued yearly from 2013 to 2023. Monitoring has been conducted in order to meet ecological mitigation measures and ecological and aquatic monitoring requirements laid out in the site plan conditions for the Roszell Pit. The details of the ecological and aquatic mitigation measures for the Roszell Pit are outlined in the 2020 Ecological and Aquatic Monitoring Report, Roszell Pit prepared by Dance Environmental Inc. (Dance Environmental, 2020).

3.0 MONITORING METHODS

3.1 Vegetation Monitoring

Wetland Vegetation Quadrat Sampling

Objective: The objective of the vegetation quadrat sampling was to document the vegetation composition (species and relative abundance) and structure (vertical structure within the wetland) before extensive extraction had occurred, to record the baseline vegetation community conditions.

Baseline data were collected in 2012, to provide a basis for comparison as the extraction progresses both above and below the water table. In successive years (2013 to 2023) monitoring was conducted in Spring and Autumn.

Data Collection Methods:

The locations of the six 10x10 m quadrats which were established in 2012 are shown on Figure 1. The exact locations of the 10x10 m quadrats were randomly selected, but were generally placed near the upslope seepage areas of some of the tributaries within the Speed River Wetland Complex adjacent to the Roszell Pit, and were sited near existing piezometer locations. The location of quadrat placement was selected to specifically document vegetation and conditions around significant groundwater seepage features that the hydrogeology consultants had identified and monitored along the eastern margin of the wetland, to the west of the extraction area. Quadrats were

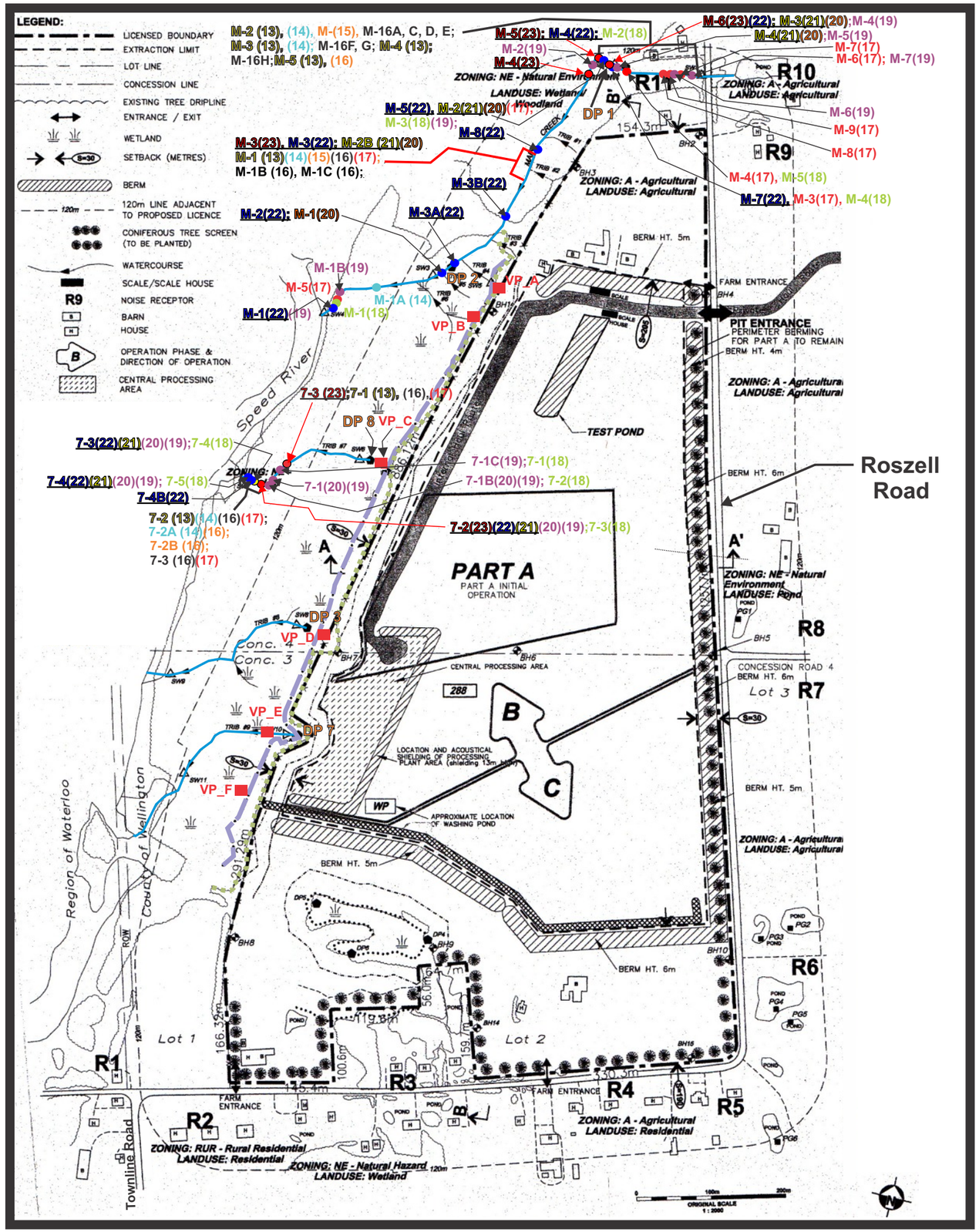

Figure 1. Location of Vegetation Plots and Creeks Surveyed and Locations of Trout Redds, 2013 to 2023, Roszell Pit.

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- VP_A = Vegetation Plot & Photomonitoring Locations
- = Watercourse in Which Spawning Surveys Were Conducted
- = Wetland Limit (Flagged by Stovel & Associates Inc. and GRCA, 2005)
- = Existing Tree Dripline
- M-1 (13) = Trout Redd Location, 2013
- 7-1 (14) = Trout Redd Location, 2014
- M-1(15) = Trout Redd Location, December2015 or January 2016
- M-1(16) = Trout Redd Location, December 2016
- M-1(17) = Trout Redd Location, 2017
- M-1(18) = Trout Redd Location, 2018
- M-1(19) = Trout Redd Location, 2019
- M-1(20) = Trout Redd Location, 2020
- M-1(21) = Trout Redd Location, 2021
- M-1(22) = Trout Redd Location, 2022
- M-1(23) = Trout Redd Location, 2023

Base Map Source: Operational Plan Page 2 of 6. Stovel and Associates Inc. 2010.

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placed in these locations since this is where any change in groundwater discharge might be first observed and subsequently where vegetation changes could be first observed.

The centre of each quadrat was marked by a steel T-bar with the top sprayed white. The outer margins of each quadrat were marked by wooden stakes which had the tops sprayed orange. The ground vegetation was to be monitored during early Autumn 2012 and in successive years was monitored in both Spring and Autumn to ensure accurate identification of species and to capture plants blooming at different times throughout the season (CVC 2010).

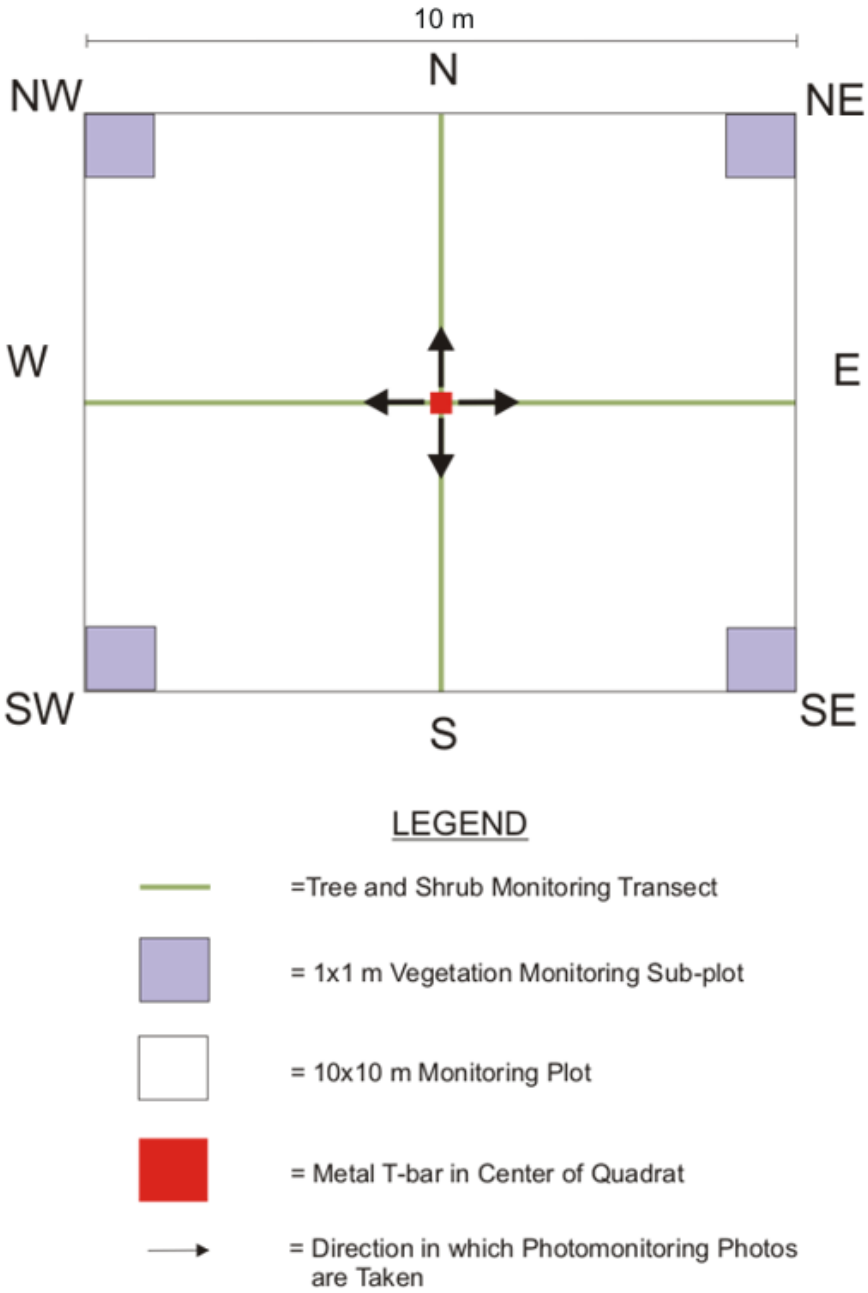
Collection of Herbaceous Vegetation Information:
Four 1x1 m quadrats were then set-up to record the herbaceous species and their relative abundance within each of the 10x10 m quadrats. The 1x1 m quadrats were set-up so that the one corner of the quadrat was on the ordinal direction stake, with the quadrat being entirely inside the 10x10 m quadrat, see Figure 2. The percent cover that each species within the 1x1 m quadrat occupied was recorded. The percent cover within each 1x1 m quadrat that roots, deadfall, or mosses occupied were also recorded. The water depth within each 1x1 quadrant was recorded. These steps were repeated for each of the 4 quadrats within each of the six 10x10 m quadrats. An example of a completed data sheet from 2012, with data from a vegetation plot at the Roszell Pit, is contained in Appendix 1.

Collection of Tree and Shrub Information within Vegetation Plots:
As changes to shrubs and trees happens more in the long-term, data were to be collected on trees and shrubs within the vegetation plots only during the Autumn inventory.

Information on the trees and shrubs within the vegetation plots was modified from the 2012 baseline data collection year, based on Greg Scheifele's comments on the 2012 vegetation monitoring. In order to capture trends/changes in the higher strata within the 10x10 m quadrat, two transect lines were surveyed within each 10x10 m quadrat. The transect lines were conducted to record information about trees and shrubs including density, species composition, and strata (sub-canopy or understory) in which they are present within each of the six 10x10 m quadrats.

Trees or shrubs which were <10cm DBH were identified as being within the understory category for height class. For consistency between all six 10x10 m quadrats, the one transect line that was sampled ran north-south and the other ran east-west across each 10x10 m quadrat. Along each of the tree and shrub transect lines data were collected for a 1 m wide area centered along the entire transect. Standing dead trees were also recorded, along with the strata in which they occurred. An example of a completed data sheet from 2013, with data from the tree and shrub transect, is contained in Appendix 2.

Figure 2. Vegetation Monitoring Plot Layout and Position and Direction of Photomonitoring.



A digital soil moisture meter (Vegetronics VG-METER-200 and VH-400 soil moisture sensor) was used to provide volumetric water content for soils in each of the six vegetation plots. The soil moisture probe was pressed into the soil until the entire probe was in the soil, and then a reading was taken. Soil moisture content was to be recorded as a percent and was recorded at the north, east, south and west corners of each vegetation monitoring plot along with a reading at the center t-bar, providing 5 soil moisture values from across the plot.

Starting in 2013, the health of each tree or shrub stem encountered along the east-west and north-south transect lines were to be recorded as dead, poor, or good.

It was also recommended by Greg Scheifele that tree health of all trees of >10cm dbh within the entire vegetation plot be recorded. For each tree >10cm dbh within the entire vegetation plot, the tree's health and whether it was a canopy or sub-canopy tree were recorded. We also recorded the same information for standing dead trees.

Photomonitoring:
As outlined in the site plans for the Roszell Pit, photomonitoring was to take place at fixed point locations so that photos can document potential changes to the vegetative conditions within the Speed River Wetland Complex adjacent to the Roszell pit.

Photomonitoring locations were to be located at the steel T-bar in the center of each of the 10x10 m vegetation quadrats. A total of six fixed point photo monitoring locations were set-up in 2012 with photos taken from the steel T-bar facing north, east, south and west, see Figure 2.

3.2 Spawning Surveys

The spawning surveys were to be conducted along Main Creek and Tributaries 7, 8, and 9 located within the Speed River Wetland Complex, to the west of the extraction area of the Roszell Pit. Surveyors wore polarized glasses and walked along each of the streams to be surveyed.

The location, number, size and species of redds were mapped and described on data sheets. Trout redds are the particular focus of the spawning surveys. Weather conditions including wind speed, percent cloud cover, precipitation, and air temperature were recorded during each survey visit and water temperatures were recorded for each of the streams or tributaries which were surveyed.

Observations of trout and their activities were recorded. Substrate conditions and water depth where spawning was observed were to be noted.

Spawning surveys were conducted on two dates to document the range of spawning dates and locations for Brook Trout.

The following approach was followed to determine whether the pit operation has affected fish habitat in a measurable way:

- Evaluate what the groundwater/hydrology consultant has determined about any significant changes in stream temperature, stream flow, ground water flux relative to meteorological conditions during the study period;
- Determine geographically where ground water/surface water changes have occurred relative to the aggregate pit margins and predicted impact zones;
- Where groundwater/ surface water data show significant changes the potential effects on fisheries data will be carefully inspected for any evidence of changes;

- In turn, any significant changes in trout redd number and location shifts would be compared with groundwater/surface water data trends.

3.3 Salamander Egg Mass Surveys

As part of the monitoring plan for the pit, annual surveys for salamander egg masses were to be undertaken. Spring 2013 was the first year that salamander egg mass surveys were conducted.

Salamander egg mass surveys were to focus on searching the wetland located in the southwestern end of the Roszell pit property. A survey was to be undertaken at the wetland in the Spring once the salamanders have laid their egg masses some time between April to May, as egg laying times are dependent upon weather conditions for each given year. At the beginning of the survey weather conditions including temperature, wind speed, water temperature, and water temperature were to be recorded.

To find and estimate numbers of egg masses of salamanders area searches throughout the wetland were to be conducted. Areas searches involved the searcher wearing chest waders, and walking throughout the wetland wearing polarized sun glasses, scanning into the water for egg masses. When egg masses were found they were to be identified to species along with number of eggs/egg masses, vegetation type that egg masses were attached to and any other details worth noting.

3.4 Amphibian Call Surveys

As outlined in the ecological and aquatic monitoring plan, amphibian call surveys were to be undertaken once extraction begins, so surveys began in 2013. Amphibian call surveys were undertaken in general accordance with the Marsh Monitoring Program Protocols. Surveys were to be undertaken at the wetland south of the southern most extraction limit for the pit, and at any adjacent properties (with ponds) where landowners provide permission to survey for frogs.

Surveys are to be conducted on three dates from April to June, at least 15 days apart. Night-time air temperature should be greater than 5°C (41°F) for the first survey, 10°C (50°F) for the second survey, and 17°C (63°F) for the third survey (MMP 2008). Surveys are to be conducted between one half hour after sunset and no later than midnight (MMP 2008).

Weather conditions were recorded for each of the surveys conducted, including wind speed, air and water temperature, cloud cover, and precipitation. Each survey station was monitored for 3 minutes. Surveys are to be conducted only when wind strength is between 0 and 3 on the Beaufort Scale (MMP 2008).

3.5 Water Level Monitoring within the Roszell Wetland, South of the Pit

For several reasons monitoring of the water levels in the Roszell wetland to the south of the Roszell Pit was undertaken on an approximately weekly basis from early May until the end of June. This monitoring started in 2022 as a result of the low water levels in

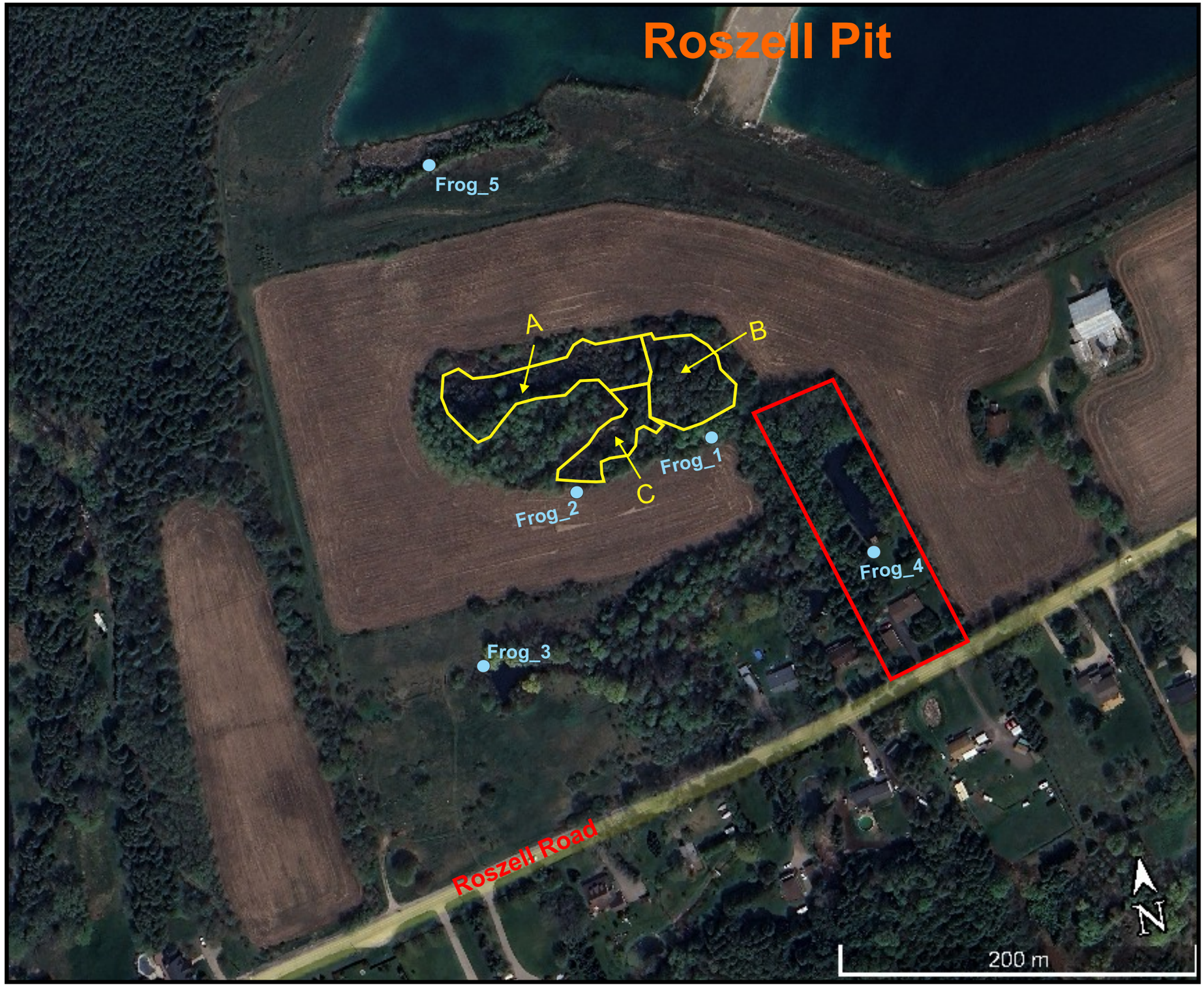


Figure 3. Areas Searched for Salamander Egg Masses, and Amphibian Call Survey Station Locations, Roszell Pit.

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A — Area Searched for Salamander Egg Masses, Areas “A to C” Categorized by Habitat Type

Frog_2 — Approximate Amphibian Call Survey Station Location

Approximate Property Boundary of the Jones Property

Base Map Source: Google Earth, 2023

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the wetland noted during 2021, which was attributed to drought conditions throughout Summer 2021. This monitoring was continued during 2023.

Water levels were recorded within the wetland in polygons A, B, and C as identified for the salamander egg mass surveys. During the months of May and June water levels were recorded (in cm) in the deepest locations in each polygon when water was present. The presence of any salamander egg masses or larvae in the water which was present was to be recorded. The dug pond farther south of the Roszell Wetland was also monitored during the same May to June period with water depth recorded at a stake in the southwest corner of the pond, which had been put in during previous years. When water levels at the stake were 0cm, the distance to the water's edge from the stake was then recorded (in cm).

4.0 MONITORING RESULTS

4.1 Vegetation Monitoring

A total of six permanent vegetation monitoring plots were set up near the eastern edge of the Speed River Wetland Complex, adjacent to the extraction area of the Roszell Pit. Vegetation monitoring quadrats were set up on September 28, 2012 (Plots A, B, and C) and October 1, 2012 (Plots D, E, and F).

The UTM co-ordinates (obtained with a hand-held GPS) for vegetation monitoring plots A to F, are shown in Table 1.

Table 1. UTM Co-ordinates for the Center of Vegetation Monitoring Plots and Photo Monitoring Locations

Plot Name	UTM Co-ordinates
Plot A	17T 0557139 4812349
Plot B	17T 0557132 4812259
Plot C	17T 0557057 4811973
Plot D	17T 0557042 4811849
Plot E	17T 0557005 4811745
Plot F	17T 0557017 4811664

As outlined in the ecological and aquatic monitoring site plans, vegetation monitoring was to be conducted in the spring and Autumn. The first Autumn vegetation information was conducted on September 28 and October 1, 2012, while the first set of Spring vegetation information was collected on May 30, 2013. The 2013 Autumn vegetation inventory was conducted on September 20th.

It was noted when setting up the vegetation plots that cattle from the farm to the north of the Roszell Pit had access to the Speed River Wetland Complex in the area of vegetation plots A and B. It was evident during the Spring 2022 monitoring that the cattle still had access to the areas of vegetation plots A and B, but there appeared to be no recent use in that area by cattle during the Autumn surveys.

The dominant taxa, their percent cover, and total number of species for each sub-plot for vegetation plots A to F during Spring 2014 to 2023 is summarized in Appendix 3. The Autumn vegetation survey results showing dominant taxa, their percent cover are provided in Appendix 4.

Tree and shrub data within the vegetation plots collected during the Autumn vegetation monitoring, at each of the six monitoring plots are summarized below.

2023 Survey Results:

The 2023 Spring vegetation plot survey was conducted on May 24 & 25, 2023 and the Autumn survey was conducted on September 28 & 29, 2023. The data from vegetation plots A to F are summarized below. A summary by species and sub-plot of the percent cover by certain species in Spring from 2014 to 2023 is provided in Appendix 3 & 4, and the data from the Autumn 2014 to 2023 surveys is summarized in Appendix 5 & 6.

Outside influences on Plot A and B have been noted since the initiation of the study, namely that the landowner allows his cattle to graze where the two plots are located. For several years discussion took place with the landowner and CBM staff to try to have him stop that practice, in that area. Those discussions were unsuccessful and Plots A and B have continued to experience varying levels of annual disturbance by cattle. This has resulted in deep depressions caused by cattle hooves in the soft, damp soils in that area, and which in turn creates colonizing areas where trampled vegetation becomes buried in the mud or if deep enough, the depressions collect standing water, and changes in colonizing species in these plots varies year by year.

Also, as a result of cattle using the area of Plots A and B the occasional stake in the plots has been found knocked over or broken by the time of the next survey, so slight changes may result at these sites attributed to slight variances in where the replacement stake is placed.

Spring Surveys:

In 2023 Plot A showed 50% of species assessed showing no change in percent cover compared with 2022, 25% of species showed an increase in percent cover, while 25% showed a decrease in percent cover. Moss sp. in Plot A was found to have increased by several percent cover categories in two of the sub-plots .

Plot B data shows 80% of species reviewed (see Appendix 3), having no change in percent cover in the sub-plots and 20% showed an increase by 1 category of percent cover compared to 2022. Two wetland species made up the increase in percent cover, showing continued presence of wetland species.

Spring data from Plot C when compared with 2022 data showed 50% of species assessed in Appendix 3 having the same % cover, while 25% showed an increase and 25% showed a decrease in percent cover. All increases in percent cover occurred in the Northwest subplot in wetland species, with an increase of a single percent cover category.

Comparison of 2023 data at Plot D to 2022 data showed 83% of species assessed comprising of the same percent cover as the previous year. An increase in percent cover at Plot D was noted in the Southeast subplot with increases of one percent cover category of two wetland species.

Assessement of Plot E data from 2023 compared to the previous year identified that 75% of species assessed in Appendix 3 showed no change in percent cover category. A decrease in percent cover was only noted in 25% of species assessed in Appendix 3, with declines by only one percent cover category, and where these species made up <5% cover. The declines noted in the Southeast and Northeast subplots are still within cover categories that have been found historically, since 2014.

At Plot F, 75% of species assessed from Appendix 3 showed no change in percent cover from 2022. An increase in percent cover was found in 17% of the species assessed in Appendix 3, and by one percent cover category from that of 2022 data. A decrease in percent cover was noted for only 1 species assessed in Appendix 3 from plot F was for Bulblet Fern in the Southeast subplot. This species was not recorded in 2023, similar to 2016, but was found to have returned to the plot between 2017 and 2022, with low percent cover.

Comparison of 2023 to 2014 & 2015:
Due to the high level of disturbance from cattle within plots A and B, comparision with pre-extaction and first year of extraction data it is difficult to clearly establish whether changes are due to extraction or agricultural disturbance.
At Plots C to F, the data from Appendix 3 shows change is variable depending on the species. Moss in some of the plots has shown decreases in percent cover after the first year of drought (2020), with 2021, 2022 and 2023 showing lower percent cover in some subplots compared with 2014 and 2015. Other species such as Field Horsetail is highly variable between subplots over the 10years of Spring surveys. In some locations it has a higher percent cover in 2023 than in 2014 and in other location 2014 had greater percent cover, suggesting its a more cyclical species, which may disappear entirely some years, but will occur in the plot again a year or two later.

Autumn Surveys:
At Plot A in Autumn, 62% of species examined in Appendix 5 showed no change in percent cover in 2023 from 2022, and wetland indicator species Field Horsetail and *Juncus articulatus* showed an increase in percent cover compared to Autumn 2022. Of the species assessed in Plot A, see Appendix 5, 23% showed a decrease in percent cover. Bublet Bladder Fern was found to have decreased by 2 percent cover categories.

In Autumn at Plot B, 75% of species in Appendix 5 showed no change in percent cover from Autumn 202, and 6% showed an increase including wetland indicator *Carex schweinitzii* showed an increase in percent cover compared to 2022. Declines in percent cover

from 2022 results, made up 19% but the sedge and fern were never in high abundance in the subplots over any of the survey years, with Tall Buttercup showing the most change in the southeast sub-plot.

In Plot C, 92% of species showed no change in percent cover compared to 2022, for species assessed in Appendix 5. Only Field Horsetail was noted to have decreased in percent cover from 2022, by one category.

Plot D had 64% of species assessed in Appendix 5 with no change in percent cover compared to Autumn 2022, and 36% of species showed an increase of percent cover with increases seen in wetland indicator species by one percent cover category from that of 2022.

Within Plot E, 62% of species listed in Appendix 5 showed no change in percent cover compared with 2022, while 38% showed an increase in percent cover from that of 2022. No declines in percent cover were noted from that of 2022. The species assessed in Plot E that showed increases in percent cover within the subplots were all noted to be wetland indicator species.

In Autumn, Plot F indicated 50% of species listed in Appendix 5 showed no change in percent cover compared to 2022, and 8% of species had an increase in percent cover. There were 42% of species assessed in Plot F that showed a decrease in percent cover, however, 4 of the 5 species comprised <1% cover in the sub-plots, and have always had limited to no presence in the sub-plots over all years. Plot F had the greatest amount of species showing a decrease in cover of all plots.

<u>Comparison of 2023 to 2014 & 2015:</u>
Vegetation Plots A and B show a big change in species and percent cover recorded between 2013 and 2014 (Appendix 6), so new species were used for Appendix 5 assesment in 2014, and those have been used since for assessment. Comparison between 2014 and 2023 at plots A and B show continued presence of wetland indicator species, and while some have shown variation over the years in their percent cover, many had the same percent cover as in 2014.
A species in Plot C which is no longer present in 2023 and has not been in the sub-plots for several years now, is *Carex flava*. Most other wetland indicators species have remained at a similar percent cover or have increased in percent cover.
Vegetation Plots D and E have shown the least amount of change of all plots when 2023 data are compared to 2014 with weltand indicator species remaining at comparable percent cover values or greater. In Plot E Moss sp. in the Southwest sub-plot has shown a decline by two categories of percent cover between 2014 and 2023, but other speicies assessed in the plot do not show the same decline. Moss cover is expected to respond directly to rainfall volumes and maximum sumer air temperatures. Recent hot, dry summers may have caused declines in moss cover.
Plot F Autumn data indicates numerous species have declined in percent cover from 2014 to 2023, however, those species have only ever been present at low percent cover in the plot. Similar to Plot E, Moss sp. in one sub-plot of Plot F had the greatest decline

from 2014 to 2023.

Tree and Shrub Data:
The tree and shrub transects are summarized in the following text for each vegetation plot with the numbers found in 2023 listed, and for reference the 2021 values are provided in brackets after the 2023 survey values.

Vegetation Plot A:
Vegetation Plot A was located in the upslope area where seepage begins which becomes Tributary #4, see Figure 1. Areas of rutted soils within vegetation Plot A were evident again in Spring 2023 throughout the area as a result of cattle foraging within the vegetation plot area, but no signs of recent use were present during the Autumn surveys. In Spring and Autumn 2023 surface water was present in all sub-plots ranging from 1-5mm, making it similar to slightly more than in 2022. Water was present at <1-4mm depth in Spring and Autumn 2022, also similar to 2020 and 2021 findings.

A generally limited abundance of trees and shrubs are present within vegetation Plot A, see Table 2. The east-west transect had three species: Glossy Buckthorn 11(10), Yellow Birch 1(1) and Eastern White Cedar 11(11), showing more Buckthorn and Cedar are now big enough to be counted.

The north-south transect had 1 Chokecherry in good health (same as 2020 to 2022), Eastern White Cedar 4(4) and Yellow Birch 1(1). All understory trees and shrubs were identified to be in good health, as in all previous years. There were no trees (>10 cm dbh) within the entire vegetation plot in 2023, same as in previous years.

Table 2. Tree and Shrub Transect Data Totals at Plot A, from 2012 to 2023.

	Year											
Plot A	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eastern White Cedar	15	0	0	0	6	8	8	8	8	15	15	14
Yellow Birch	1	0	0	0	2	2	1	1	1	2	2	2
Speckled Alder	0	1	1	0	0	0	0	0	0	0	0	0
Glossy Buckthorn	1	4	4	0	1	4	4	4	4	10	11	11
Chokecherry	0	1	1	1	1	1	1	1	1	1	1	1

*Values calculated by adding only good and fair condition trees/shrubs together from North-South and East-West transects.

Vegetation Plot B:
Vegetation Plot B was located approximately 33m to the southwest of Plot A, near the eastern wetland edge of the Speed River Wetland Complex. Vegetation Plot B was located in the upstream seepage area of Tributary #6, see Figure 1. In Spring 2023 evidence of cattle use within the plot was noted, but by Autumn there were no recent signs of use. In Spring 2021 a large tree was noted to have fallen across part of the NW subplot and it was still there in 2023.

There was no surface water present in Spring 2023 (same as 2022, 2021, 2020, and 2018) and soils were dry in two of the plots. No surface water was present in any of the sub-plots in Autumn 2023, similar to 2018, 2021, and 2022 (NW plot in Autumn 2020 had <1mm). Soils in Autumn 2023 at this plot at SE, SW noted to be damp while in the NW and NE plots soils were saturated (damper than noted in 2021 and 2020).

Tree and shrub transect data indicates Plot B contains slightly more trees and shrubs than Plot A (and it is similar in that they were all in the understory), but it is still a generally open habitat of predominantly herbaceous vegetation, Table 3. Species present within the east-west transect included Glossy Buckthorn 15(13), Eastern White Cedar 9(9), Yellow Birch 2(2), Red-Osier Dogwood 1(1); in the north-south transect Glossy Buckthorn 15(12), Yellow Birch 4(3), and Eastern White Cedar 5(6). Within the entire vegetation plot there were no trees that were >10 cm dbh, as was noted in previous years.

Table 3. Tree and Shrub Transect Data Totals at Plot B, from 2012 to 2023.

	Year											
Plot B	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eastern White Cedar	16	0	0	11	18	13	18	13	13	15	14	14
Yellow Birch	6	5	4	4	7	6	6	6	6	5	6	6
Glossy Buckthorn	18	17	31	23	23	21	24	26	25	25	28	30
Alternate-leaved Dogwood	1	0	0	0	1	0	0	0	0	0	0	0
Red-Osier Dogwood	0	0	0	0	0	0	1	0	0	1	1	1

*Values calculated by adding only good and fair condition trees/shrubs together from North-South and East-West transects.

Vegetation Plot C:
The Vegetation Plot C was located in fresh-moist cedar swamp. Vegetation Plot C was located in the upstream seepage area of Tributary #7 and near drive point piezometer DP8, see Figure 1. The vegetation plot is on a slope with scattered seeps which flow

downslope towards the cedar swamp. Surface water was present in only 1 sub-plot (Southeast) in Spring 2023 at 4-5mm similar to 2020, which is more than found in 2016, 2017, 2021 and 2022 which had 1-3mm. In the Southeast sub-plot 3-5mm flowing water was observed in the Autumn 2023, similar to 2021 with 3-4mm found (while 2018-2020 had less standing water thant 2-3mm).

Tree and shrub diversity within the transects continues to be limited, with only two species being present, Glossy Buckthorn and Eastern White Cedar, See Table 4. In the understory along the east-west transect Glossy Buckthorn 6(7) and Eastern White Cedar 2(2) were recorded to be present and in good health. Along the north-south transect line in 2023 Eastern White Cedar 8(8) and Glossy Buckthorn 1(0) were recorded. Eastern White Cedar was recorded with 20(23) in good health, fair health 3(3), and none in poor health. Glossy Buckthorn was recorded in the SE, in the sub-canopy in good health with 3(2) trees recorded.

Table 4. Tree and Shrub Transect Data Totals at Plot C, from 2012 to 2023.

	Year											
Plot C	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eastern White Cedar	18	0	0	5	9	10	10	11	11	10	10	14
Glossy Buckthorn	2	3	1	2	3	3	5	4	4	7	7	7

*Values calculated by adding only good and fair condition trees/shrubs together from North-South and East-West transects.

Vegetation Plot D:

The Vegetation Plot D was located in wet cedar swamp located in the upstream seepage area which enters Tributary #8 near the eastern edge of the wetland. Vegetation Plot D was located just east of drive point piezometer DP3. This vegetation plot is on a slope with scattered seeps with marl deposits. Standing water was present in the Northwest sub-plot in Spring 2023 at 1cm similar to 2021(1-2mm), while 2019, 2020, and 2022 had 2-4mm of water. Flowing water was not present in Autumn 2023 in the Northwest sub-plot but in 2022 and 2021 had 1-2mm and in 2018 & 2020 had 2-3mm). Standing water was present in the Southeast sub-plot in 2023 at 2-3mm (2022 had 1-6cm) in Spring, and 3-4mm in the Autumn (more than noted in 2022 and 2021). In Spring and Autumn 2016 & 2017 no surface water was present in any sub-plots. This continues to suggest wetter soils being present in Plot D after 2018.

Within Vegetation Plot D there was 1 Common Buckthorn in good condition along the north-south transect, same as in 2020 & 2021. This vegetation plot is located within cedar swamp, with Eastern White Cedar and Yellow Birch as the tree species of >10 cm dbh which were present within the entire plot. Eastern White Cedar was present with

20(20) in good health, and Yellow Birch with 2(2) also recorded in good health. No change was noted in 2023, see Table 5.

Table 5. Tree and Shrub Transect Data Totals at Plot D, from 2012 to 2023.

	Year											
Plot D	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eastern White Cedar	13	0	0	0	0	0	0	0	0	0	0	0
Yellow Birch	2	0	0	0	0	0	0	0	0	0	0	0
Common Buckthorn	0	0	0	0	0	0	0	0	1	1	1	1

*Values calculated by adding only good and fair condition trees/shrubs together from North-South and East-West transects.

Vegetation Plot E:

The Vegetation Plot E was located in fresh-moist cedar swamp. Vegetation Plot E was located in a seepage area approximately 30m downslope of the trail along the Speed River, in the bottomlands of the cedar swamp. The seepage area in which Vegetation Plot E was located is part of Tributary #9 and is located downslope of drive point piezometer DP7, see Figure 1. In 2023, standing water was present in the Spring at the Northwest sub-plot at 1-2mm (same as 2020 to 2022) and 1-2mm in Autumn 2023 similar to 2019, 2020 and 2022 findings, while 2021 had 3-4mm in the Autumn. In contrast, in 2018 and 2016 no surface water was recorded in the Spring or Autumn. The Southeast sub-plot had 2-3mm of standing water in Spring 2023 and 8-10mm in a depression in Autumn 2023.

Tree and shrub species along the north-south and east-west transects at >1m in height were very limited in this vegetation plot. Along the east-west transect Glossy Buckthorn 5(4) were present in good health, and 1(1) Glossy Buckthorn was recorded as dead (present since 2014). New in 2023 in the east-west transect was 1 Eastern White Cedar in good health. There were no shrubs recorded along the north-south transect in 2023 (same since 2014).

There were four species of trees and shrubs of >10cm dbh found within the entire vegetation plot, including: Eastern White Cedar, Yellow Birch, Speckled Alder, and Black Ash. Within the entire Vegetation Plot E there were 16(15) Eastern White Cedar found in good health, 8(8) Yellow Birch were found in good health, 1(1) Speckled Alder was in good health. There was also 1 dead Black Ash which has been present since 2018. No significant change was noted in 2023, see Table 6.

Table 6. Tree and Shrub Transect Data Totals at Plot E, from 2012 to 2023.

Plot E	Year 2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eastern White Cedar	9	0		0	0	0	0	0	0	0	1	3
Yellow Birch	1	0	0	0	0	0	0	0	0	0	0	0
Black Ash	1	0	1	0	0	0	0	0	0	0	0	0
Glossy Buckthorn	9	6	4	4	4	4	4	4	5	4	6	5

*Values calculated by adding only good and fair condition trees/shrubs together from North-South and East-West transects.

Vegetation Plot F:

The Vegetation Plot F was located in the bottomlands of a fresh-moist cedar swamp, dense with Eastern White Cedar. Vegetation Plot F was located in a seepage area downslope of the trail along the Speed River, to the west of the southeastern corner of the extraction area of the Roszell Pit. The closest drive point piezometer is DP7, to the northeast. Vegetation Plot F is not in a seepage area which contributes to a tributary through surface water flow, Tributary #9 is the closest tributary to this vegetation plot and is located to the west of it.

In Spring 2023, the Southeast sub-plot had flowing water at 2-3mm, similar to 2020-2022, 2016 and 2017. In 2019 and 2018 slightly deeper water was noted at 4-5mm. In Spring 2023, the Northwest sub-plot had 2-3mm of standing water similar to 2022, 2020 and 2019 (2021 had 1mm; 2018 & 2016 had 1-2mm).

The Southeast sub-plot in Autumn 2023 had 3-4mm of flowing water noted, while 2019 and 2018 had less water was noted at 1-2mm (2017, 2016, 2020-22 had 4-5mm). The Northwest sub-plot had 4mm of standing water in Autumn 2023 (1-2mm in 2022 and 2016), while 2021 had <1mm and 2018 to 2020 had no water, but saturated soils). The greatest water depths in the plot were noted in 2017 at 4-6mm deep, and indicates that the plot shows high variability over the years.

The tree and shrub transect data from Vegetation Plot F indicates a limited understory, with only Eastern White Cedar being present along the east-west or north-south transect. The north-south transect had 6(6) Eastern White Cedar in good condition, 5(1) in fair condition and 7(5) dead. The east-west transect had 2 Eastern white cedar in good condition, 2 in fair condition and 9 dead. Tree and shrub species within the entire vegetation plot of >10cm dbh include Eastern White Cedar, Tamarack, and White Birch. Eastern White Cedar was present in good health with 23(24), and White Birch in

good health with 1(1). The 2 standing dead Tamarack (snags of <8ft high) were still present in 2023.

Table 7. Tree and Shrub Transect Data Totals at Plot F, from 2012 to 2023.

Plot F	Year 2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eastern White Cedar	50	0	0	0	0	0	0	0	0	7	11	15
White Birch	1	0	0	0	0	0	0	0	0	0	0	0

*Values calculated by adding only good and fair condition trees/shrubs together from North-South and East-West transects.

Photo Monitoring Stations:

Photo monitoring stations were established in 2012, which provide baseline photos of the Speed River Wetland Complex located to the west of the Roszell pit. Photos were taken at each photo monitoring station facing north, east, south and west, from the center T-bar of the 10x10 m plots. A photo from each of the six vegetation plots in Spring 2023 is shown in Appendix 5. A photo from each of the six vegetation plots in Autumn 2023 is shown in Appendix 6.

4.3 Trout Spawning Surveys

Trout spawning surveys started in 2012 and have been undertaken every year since. A summary of survey dates and weather conditions during searches for trout redds from 2012 to 2023 are shown in Table 8.

The locations of the Main Creek and Tributary #7 and #8 are all shown on Figure 1. No trout redds were been found in Tributary #8 and #9 during the first 5 survey years, so effort was focused after that on the Main Creek and Tributary #7. The NETR Level 1 & 2 prepared by Stovel & Associates (2005) for the Roszell Pit licence application included electrofishing Tributary #8 and #9. Tributary #9 had no fish captured in it and Tributary #8 had only 1 Brook Trout captured (plus one observed) during the August 7, 2005 electrofishing surveys. The electrofishing of the Main Creek in August 2005 resulted in 4 Brook Trout being captured. Overall the historical electrofishing data suggest a rather small Brook Trout population was present prior to extraction at the Roszell Pit, based on the low capture numbers.

In 2015 spawning surveys were conducted on two separate dates for each of the creeks surveyed. This year had a warm Autumn. With fewer trout redds being found over the two separate surveys for each creek in December 2015, an additional survey was conducted in January 2016. The January 2016 survey was to identify whether any additional trout redds were present in the creeks being surveyed once the temperatures became cooler in case this had triggered Brook Trout spawning. The January 2016 survey confirmed that some additional Brook Trout spawning took place in January when weather conditions became more typical of the season.

Table 8. Summary of Dates and Weather Conditions for Trout Redd Surveys on the Main Creek, and Tributaries #7, 8, and 9 from 2014 to 2017.

Year	Survey Date	Weather Conditions
2014	December 2	Air Temp. = -1^{0}C; Wind = 2-6 km/hr; Percent Cloud = 40-60%; No Precip.; Water Temperature: Main Creek & Trib #7 = 4^{0}C, Trib #8 = 5.5^{0}C & #9 = 5^{0}C
	December 19	Air Temp. = -2^{0}C; Wind = 3 km/hr; Percent Cloud = 30-50%; No Precip.; Water Temperature: Main Creek & Trib #7 = 4^{0}C, Trib #8 & 9 = 6^{0}C
2015	December 3	Air Temp. = 2^{0}C; Wind = 10-20 km/hr; Percent Cloud = 100%; No Precip.; Water Temperature: Main Creek & Trib #8 & 9 = 9^{0}C
	December 4	Air Temp. = 5^{0}C; Wind = 5-10 km/hr; Percent Cloud = 100%; No Precip.; Water Temperature: Main Creek = 7^{0}C, Trib #7 = 8^{0}C
	December 17	Air Temp. = 5^{0}C; Wind = 5-10 km/hr; Percent Cloud = 20-40%; No Precip.; Water Temperature: Main Creek, Trib# 8 & 9 = 8^{0}C, Trib #7 = 10^{0}C
2016	January 28	Air Temp. = -1^{0}C; Wind = 5-10 km/hr; Percent Cloud = 100%; light snowfall.; Water Temperature: Main Creek = 4^{0}C, Trib #7 = 6^{0}C
	December 7	Air Temp. = 1.5^{0}C; Wind = <10 km/hr; Percent Cloud = 40%; no precip..; Water Temperature: Main Creek = 5.5^{0}C
	December 9	Air Temp. = 2^{0}C; Wind = 6-8 km/hr; Percent Cloud = 40%; no precip.; Water Temperature: Main Creek = 5^{0}C, Trib #7 = 8^{0}C; Trib#8 & 9 = 7^{0}C
2017	November 26	Air Temp. = 0^{0}C; Wind = 5-10 km/hr; Percent Cloud = 90%; no precip.; Water Temperature: Main Creek = 5^{0}C,
	November 27	Air Temp. = 2^{0}C; Wind = 3-5 km/hr; Percent Cloud = 40%; no precip.; Water Temperature: Main Creek = 5^{0}C, Trib #7 = 8.8^{0}C,Trib.#8 & 9 = 8.1^{0}C
	December 14	Air Temp. = -12^{0}C; Wind = 0 km/hr; Percent Cloud = 20%; no precip.; Water Temperature: Main Creek =1.2^{0}C, Trib #7 = 8.8^{0}C,Trib.#8 =5.9^{0}C & Trib.#9 = 5.4^{0}C
	December 15	Air Temp. = -7^{0}C; Wind = 1-5 km/hr; Percent Cloud = 90%; light snow; Water Temperature: Main Creek =3.2^{0}C

Brook Trout redds have been found annually from 2012 to 2023 in both Tributary #7 and the Main Creek channel. The approximate locations of Brook Trout redds are shown on Figure 1. In 2015, fewer than normal trout redds were found in the Main Creek and none were found in Tributary #7, but by January 2016, 7-9 redds were found in total in the Main Creek and 2 redds were present in Tributary #7. Previous years field data sheets have been archived for future reference.

Table 8 Cont'd. Summary of Dates and Weather Conditions for Trout Redd Surveys on the Main Creek, and Tributaries #7, from 2018 to 2023.

Year	Survey Date	Weather Conditions
2018	December 5	Air Temp. = -3^{0}C; Wind = 0 km/hr; Percent Cloud = <10%; no precip.; Water Temperature: Main Creek = 4.0^{0}C
	December 12	Air Temp. = -2^{0}C; Wind = 0 km/hr; Percent Cloud = 70%; no precip.; Water Temperature: Trib. #7 = 6.6^{0}C
2019	December 13	Air Temp. = 4-7^{0}C; Wind = 0-5 km/hr; Percent Cloud = 50%; no precip.; Water Temperature: Main Creek = 4.5^{0}C; Trib. #7 = 6.6^{0}C
	December 17	Air Temp. = -4^{0}C; Wind = 0-5 km/hr; Percent Cloud = 60%; no precip.; Water Temperature: Main Creek = 3.8^{0}C; Trib. #7 = 6.2^{0}C
2020	December 11	Air Temp. = 2-7^{0}C; Wind = 0-5 km/hr; Percent Cloud = 10%; no precip.; Water Temperature: Main Creek = 4.7^{0}C; Trib. #7 = 7.1^{0}C; Trib. #8 = 12.9^{0}C
	December 16	Air Temp. = -7^{0}C; Wind = 20-35 km/hr; Percent Cloud = 70-90%; no precip.; Water Temperature: Main Creek = 3^{0}C; Trib. #7 = 5.2^{0}C; Trib. #8 = 11.1^{0}C
2021	December 1	Air Temp. = 4^{0}C; Wind = 5-10 km/hr; Percent Cloud = 15%; no precip.; Water Temperature: Main Creek = 4^{0}C; Trib. #7 = 11^{0}C; Trib. #8 = 14^{0}C
	December 21	Air Temp. = 0^{0}C; Wind = 0-5 km/hr; Percent Cloud = <5%; no precip.; Water Temperature: Main Creek = 4.5^{0}C; Trib. #7 = 7.5^{0}C; Trib. #8 = 12^{0}C.
2022	December 14	Air Temp. = -4^{0}C; Wind = 5-15 km/hr; Percent Cloud = 90%; no precip.; Water Temperature: Main Creek = 3.4^{0}C; Trib. #7 = 5^{0}C.
	December 22	Air Temp. = -2^{0}C; Wind = 5-10 km/hr; Percent Cloud = 60%; no precip.; Water Temperature: Main Creek = 3.8^{0}C; Trib. #7 = 6.6^{0}C.
2023	December	Air Temp. 3= ^{0}C; Wind = 5-20 km/hr; Percent Cloud = 90%; no precip.; Water Temperature: Main Creek = 5^{0}C; Trib. #7 = 7^{0}C.
	January 2024	To be completed in early January 2024

The results of the 2012 and 2013 trout spawning surveys are summarized in Table 9 (considered pre-extraction survey years), and the most recent 5 years (2018 to 2022) of survey results are provided in Table 10. Table 9 and 10 both list the redd numbers by watercourse for each year. The 2013 trout spawning survey was the first data collected as aggregate extraction started at the Roszell Pit.

Table 9. Summary of 2012 and 2013, Pre-extraction, Brook Trout Spawning Surveys, Roszell Pit.

	Tributary Name	Station Location	Number of Redds	Total Number of Redds
2012	Main Creek	M-1	2 to 3	8 to 9 redds
		M-2	2	
		M-3	1	
		M-4	3	
	Tributary 7	7-1	2	5 redds
		7-2	2	
		7-3	1	
	Tributary 8 and 9		No redds	0
2013	Main Creek	M-1 (13)	3	19 redds
		M-2 (13)	3	
		M-3 (13)	6	
		M-4 (13)	5	
		M-5 (13)	2	
	Tributary 7	7-1	1	5 redds
		7-2	4	
		7-3	0	
	Tributary 8 & 9	No redds	No redds	0

Table 10. Summary of 2014 to 2023, Extraction years, Brook Trout Spawning Surveys, Roszell Pit.

	Tributary Name	Station Location	Number of Redds	Total Number of Redds
2014	Main Creek	M-1	2 to 3	9-10 redds
		M-1A (14)	1	
		M-2 (14)	2	
		M-3 (14)	4	
	Tributary 7	7-2(14)	2	4 redds
		7-2A (14)	2	
2015	Main Creek	M-1(15)	1	2-3 redds
		M-2(15)	1 to 2	
	Tributary 7	No redds	No redds	0
Jan. 2016	Main Creek	M-1B(16)	1	5-6 redds
		M-1C(16)	3	
		M-5(16)	1 to 2	
	Tributary 7	7-2A(16)	1	2 redds
		7-2B(16)	1	
Dec. 2016	Main Creek	M-16A	1	15-16 redds
		M-16C	1	
		M-16D	3-4	
		M-16E	4	
		M-16F	1	
		M-16G	1	
		M-16H	1	
		M-16I	3	

	Tributary 7	7-1(16)	1	**6 redds**
		7-2(16)	2	
		7-3(16)	3	
Nov/ Dec. 2017	**Main Creek**	M-1(17)	1	**13 redds**
		M-2(17)	1	
		M-3(17)	1	
		M-4(17)	5	
		M-5(17)	1	
		M-6(17)	1	
		M-7(17)	1	
		M-8(17)	1	
		M-9(17)	1	
	Tributary 7	7-1(17)	1	**4-5 redds**
		7-2(17)	2	
		7-3(17)	1-2	

Table 10. Summary of 2015 to 2023, Extraction years, Brook Trout Spawning Surveys, Roszell Pit Cont'd.

	Tributary Name	Station Location	Number of Redds	Total Number of Redds
Dec. 2018	**Main Creek**	M-1(18)	3	**13 redds**
		M-2(18)	1	
		M-3(18)	1	
		M-4(18)	7	
		M-5(18)	1	
	Tributary 7	7-1(18)	1	**6-9 redds**
		7-2(18)	1-2	
		7-3(18)	2	
		7-4(18)	1-2	
		7-5(18)	1-2	
Dec 2019	**Main Creek**	M-1(19)	2-3	**13-14 redds**
		M-1B(19)	1	
		M-2(19)	1	
		M-3(19)	2	
		M-4(19)	3	
		M-5(19)	2	
		M-6(19)	1	
		M-7(19)	1	
	Tributary 7	7-1(19)	1	**9 redds**
		7-1B(19)	2	
		7-1C(19)	1	
		7-2(19)	2	
		7-3(19)	2	
		7-4(19)	1	
Dec 2020	**Main Creek**	M-1(20)	1	**8-10 redds**
		M-2(20)	1-2	
		M-2B(20)	1-2	

		M-3(20)	2	
		M-4(20)	3	
	Tributary 7	7-1(20)	1	**6-9 redds**
		7-1B(20)	1-2	
		7-2(20)	1-2	
		7-3(20)	1-2	
		7-4(20)	2	
Dec 2021	**Main Creek**	M-2(21)	3	**11 redds**
		M-2B(21)	3	
		M-3(21)	3	
		M-4(21)	2	
				8 redds
	Tributary 7	7-2(21)	3	
		7-3(21)	4	
		7-4(21)	1	
Dec 2022	**Main Creek**	M-1(22)	1	**16-20**
		M-2(22)	1-2	
		M-2B(22)	1	
		M-3(22)	3-4	
		M-3A(22)	1	
		M-4(22)	1	
		M-5(22)	1-2	
		M-6(22)	2-3	
		M-7(22)	4	
		M-8(22)	1	
	Tributary 7	7-4(22)	2-3	**6-8**
		7-2(22)	2	
		7-3(22)	1	
		7-4B(22)	1-2	
Dec 2023 (Dec. 15)	**Main Creek**	M-3(23)	4	**8-9**
		M-4(23)	1	
		M-5(23)	1	
		M-6(23)	1	
		M-7(23)	1-2	
	Tributary 7	7-2(23)	3	**7**
		7-3(23)	4	

The Main Creek has consistently had the most redds present each year compared with Tributary #7. The numbers of redds present in the Main Creek in 2013 was double that of 2012. The years with the highest trout redd counts during extraction years to date were 2022 with 16-20 redds and 2016 with 15-16 redds found.

During the 2020 and 2021 drought years, the lower water levels in the creek and the homeowners on the north side of the Main Creek creating a rock dam across the entire creek were considered the main factors resulting in slightly lower trout spawning than historically noted. The dam structure (first noticed in 2020) was still in place in 2023

and the slow moving current in that area has resulted in a large area which had been bare cobble historically now being covered in a thick layer of silt. In 2023 road construction occurred along Roszell Road resulting in a new culvert being installed under the road. The plunge pool downstream of Roszell Road was considered to provide significant cover for Brook Trout. The roadside is now sloped with rock, resulting in the culvert emptying out over the rock, with no deep plunge pool present. These changes do represent potential impacts to Brook Trout habitat and movement within the Main Creek.

The 2023 trout spawning results at the Main Creek from December 15, 2023 resulted in a maximum of 9 redds being found which is below the average number of redds (12 redds) for the 12 years of surveys. The other recent drought years of 2020 and 2021 also had similar below average counts of redds. Of the 12 years of surveys 50% of years have had below average redd counts, including the pre-extration year of 2012.

The trout redd survey results from December 15, 2023 indicates a slightly greater number of redds in Tributary #7 with 7 redds, the average for Tributary #7 being 6 redds. The December 15, 2023 results are comparable to the previous 3 years results (from 2 December count dates) and are greater than 2012 to 2017 survery findings .

Based on warmer than average temperature in December 2023 and no snow cover by the time of the surveys, conditions appear similar to 2015 when lower than anticipated trout redds were noted in the the Main Creek and Tributary #7. A January 2024 survey will therefore be completed to see if additional trout redds are present once temperatures are closer to normal. An addendum report will be prepared and submitted once the January 2024 survey is completed, to provide additional information and assessment on trout redds in 2023/24.

Overall, the 2023 survey results show there is continued spawning in both creeks despite 2023 being a warm drought year, and numbers from one December survey visit are within ranges found historically for the Main Creek and Tributary #7.
In late October 2023 Groundwater Science Corp. (GSC) prepared a letter report and Appendices which addressed air temperature, surface water temperature, precipitation and water levels relative to the Roszell Pit.

Information from the GSC (2023) October 27, 2023 report is cited here relative to fisheries and amphibian monitoring at Roszell Pit.

GSC graphed seasonal precipitation patterns from January 1, 2001 to October 25, 2023. The annual comparisons “indicate that 2022 was by far the driest period over the 23 year period examined” (GSC 2023). GSC also concludes that the cumulative pattern of precipitation since 2018 can be considered to be exceedingly dry. Prior to 2018 there was no sustained multi-year trend, but around 2018 a year over year declining trend in precipitation began and it has been sustained until now. GSC further states that the precipitation pattern directly affects groundwater levels and must be considered fully when reviewing groundwater and related surface water levels.

As far as water levels are concerned, GSC (2023) states that water levels to date in 2023 are generally higher than observed in 2022 and no specific water level elevation thresholds have been exceeded in 2023.

GSC (2023) also indicates that water levels at the Roszell Wetland (PG7) in 2023 continue to differ from the adjacent groundwater level patterns which indicates that Spring season levels in the pond are significantly affected by runoff from the surrounding catchment. This observation is consistent with the 2023 Dance Environmental Roszell Wetland water depth observations. Some standing water was present in April, but due to low snowmelt volumes and low Spring season rains the pond dried out.

GSC further indicates that no surface water temperature effects are noted within the Main Creek (SW1 to SW4).

4.4 Salamander Egg Mass Survey

Salamander egg mass surveys were conducted in 2023, making it the 11th year of salamander egg mass surveys conducted within the southwestern wetland on the Rozell Pit property. The salamander egg mass survey dates and weather details for the salamander surveys for all of the years of monitoring are provided in Table 11.

Table 11. Salamander Egg Mass Survey Details 2013 to 2023.

Survey Date	Survey Details (Weather)
April 30, 2013	12:00 hrs to 15:25 hrs temperature: 19ºC; wind: 8 km/hr; water temperature: 15.4ºC; cloud <70%; no precipitation, and water pH: 8.0
May 9, 2014	11:20 hrs to 14:09 hrs temperature: 24ºC; wind: 6.6 km/hr; water temperature: 18.3ºC; cloud 40%; no precipitation, and water pH: 8.4
May 21, 2015	13:57 hrs to 15:21 hrs temperature: 18ºC; wind: 3.7 km/hr; water temperature: 16.1ºC; cloud 40%; no precipitation, and water pH: 7.8
June 3, 2015	13:55 hrs to 15:32 hrs temperature: 22ºC; wind: 5-10 km/hr; water temperature: 21ºC; cloud 60%; no precipitation, and water pH: 7.3
March 30, 2016	12:23 to 14:21 hrs temperature: 8ºC; wind: 10-15 km/hr; water temperature: 8.6ºC; cloud 40%; no precipitation, and water pH: 7.7
March 28, 2017	13:00 to 14:08 hrs temperature: 10ºC; wind: 5-15 km/hr; cloud 60%; no precipitation
April 11, 2017	14:19 to 14:40 hrs temperature: 20ºC; wind: <5 km/hr; water temperature: 18.1ºC; cloud 30-40%; heavy precipitation, and water pH: 7.1

April 12, 2017	11:40 to 14:00 hrs temperature: 10°C; wind: 5-10 km/hr; water temperature: 11°C; cloud 80-90%; no precipitation, and water pH: 7.5
April 24, 2018	11:20 to 13:09 hrs temperature: 9°C; wind: 0-5 km/hr; water temperature: 12°C; cloud 60%; no precipitation, and water pH: 7.3
April 22, 2019	11:00 to 13:40 hrs temperature: 15°C; wind: <5 km/hr; water temperature: 12°C; cloud 30%; no precipitation, and water pH: 8.4
April 7, 2020	11:30 to 12:45 hrs temperature: 11°C; wind: 5 km/hr; water temperature: 10.8°C; cloud 50%; no precipitation, and water pH: 8.1
April 20, 2021	10:55 to 11:40 temperature: 4°C; wind: 5-15 km/hr; cloud: 60%; cloud 50%; no precipitation; no standing water in wetland.
April 7, 2022	10:45 to 13:05 temperature: 11°C; wind: 3-5 km/hr; water temperature: 10.9°C; cloud 5%; no precipitation, and water pH: 6.4
April 11,2023	09:20 to 12:15 temperature: 13°C; wind: 5-15 km/hr; water temperature: 8.2°C; cloud 15%; no precipitation, and water pH: 7.8

To analyze survey results the wetland has been divided into three different areas based on the wetland's ecological characteristics, starting in 2013, see Figure 3. Wetland area "A" comprises of Reed Canary Grass and Red-osier Dogwood around the wetland edges and willow thicket through the majority of it. Area "B", shown on Figure 3, exhibits the characteristics of a Silver Maple swamp, very limited emergent vegetation, with leaves and sticks being predominant in the water column. Area "C" comprises the southern wetland lobe which extends in a southwesterly direction.

The total number of areas where salamander egg mass concentrations were located from 2013 to 2019 ranged from 6 to 13 areas within the entire wetland. In 2015 where no egg masses were counted, which was assumed to be due to an early spring resulting in egg masses hatching before the survey was conducted. The salamander egg masses in 2022 were concentrated in two areas and only within wetland area A.

The 2023 survey results showed egg masses in Areas A and B, with all egg masses concentrated in the western end of area A and the western edge of area B (at the transition area beween Silver Maples and the Willow Thicket).

Area "A" of the wetland (which represents the area of wetland with the deepest water) had the greatest numbers of egg masses in 2023. Table 12 shows that most salamander eggs based on the last 10 years of data (both pre and post extraction) are laid in Area A. This trend was confirmed to continue again in 2023.

Spring water levels within the wetland were noted to be lower than historically typical in April 2020 and 2021, where both years had no standing water in wetland areas “B” and “C”. In wetland area “A” even less area of surface water was present in 2021 compared to 2020.

The 2023 egg mass count was the second highest count ever, being greater than even the 2017 and 2018 count years, prior to drought condition years. The 2023 findings were just slightly greater than that of 2022, making it the second the highest count year after 2019.

Based on the results from April 11, 2023 salamander breeding was confirmed to have occurred and at a level above average for the wetland, despite the previous three years of drought conditions when very limited to no salamander breeding occurred.

Table 12. Summary of Total Number of Blue-Spotted Salamander Egg Mass Found in 2013 to 2023.

	Total Number of Egg Masses										
Wetland Area	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
A	46	147	0	571	1785	1439	2243	277	0	1931	1923
B	9	39	0	32	16	0	170	0	0	0	61
C	3	4	0	0	22	46	0	0	0	0	0
Total # Egg Masses	58	190	0	603	1823	1485	2413	277	0	1931	1984

The Roszell wetland was continued to be monitored in May and June 2023 to identify whether conditions would remain that would allow for a successful salamander reproduction cycle in 2023 and to monitor the water levels in the wetland. The same was done in 2022 where it was found that surface water in the wetland dried up due to a lack of precipitation in May and June. By the May 13, 2022 survey no standing water was present in areas “B” and “C” of the wetland and most of area “A”, where egg masses had been found, had no water. In 2023 on May 19th Area A at the piezometer had 7cm of water depth compared to 4cm in 2022. Overall surface water in 2023 was present for about a week longer than in 2022. This was still not enough time to ensure any of the salamander larvae would be mature enough to leave the wetland before there was no water left. The details of findings of the late spring water surveys are discussed in Section 4.5.

It should be noted that prior to extraction, the Roszell Wetland dried up before salamander eggs hatched –on June 1, 2005. The Roszell Wetland had largely dried up and no salamander egg masses remained (Stovel and Associates Inc. 2005).

4.4 Amphibian Call Surveys

Amphibian call surveys were conducted starting in 2013 at two wetlands, one to the south of the southern extraction limit of the pit (Roszell Wetland) and the other a small wetland to the southwest of the Roszell Wetland (dug pond). Adjacent landowners with a pond/wetland on their property were also contacted in Spring 2013 by CBM staff to see if any would allow for frog call surveys to be undertaken on their property. One landowner, Denise Jones, gave permission to conduct the amphibian surveys on her property (#6512 Roszell Road), see Figure 3 for location. Amphibian call surveys were conducted at all of the same locations from 2013 to 2019. On April 7, 2020 Denise Jones was contacted to obtain permission to undertake the amphibian surveys at her property as in previous years. Denise did not want the surveys done at her property in 2020. Station Frog_4 was therefore moved to the north area of the Jones pond, and frogs were listened for from the Roszell pit lands to the west of the Jones pond. Denise Jones provided permission again for the amphibian surveys on her property from 2021 to 2023, inclusive.

Amphibian call surveys were conducted on April 14, May 19, and June 29, 2023. Details of the weather conditions and survey dates for each year of amphibian call surveys, from 2013 to 2023, are shown in Table 13.

The results of the 2023 amphibian call surveys for each of the 5 point count stations where data were collected are summarized in Table 14. Monitoring at station Frog_5, shown on Figure 3, started in 2022 when frogs were heard calling along the southern lake edge.

Since 2013 a total of seven different species have been heard/observed during the amphibian call surveys. In 2023 seven species were heard. Six species were heard/observed in both 2020 and 2019, five species heard/observed in 2013, 2014, 2016, 2017 and four species heard/observed in 2015. In 2022 and 2021 a total of 5 species were heard/observed during the amphibian call surveys.

Table 13. Amphibian Call Survey Dates and Weather Conditions, Roszell Pit 2013 to 2023.

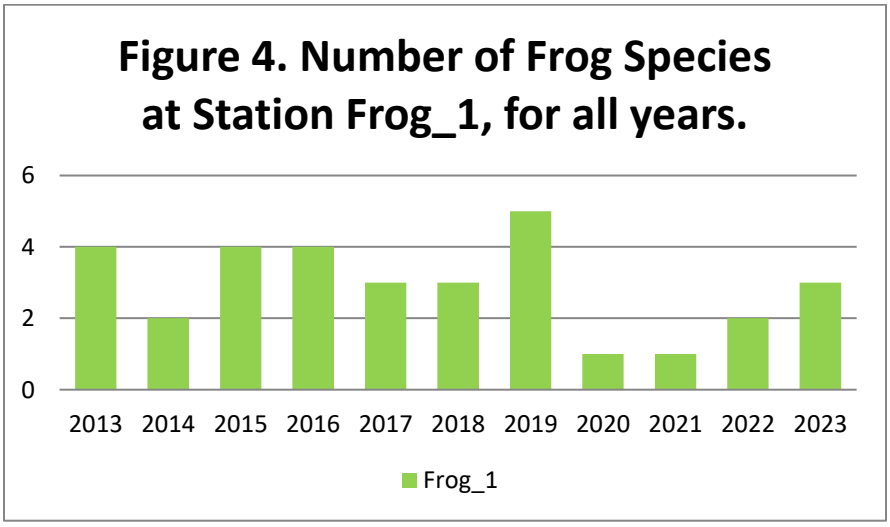
Survey #	Survey Date	Time (hrs)	Weather Conditions
2023			
1	**April 14**	**20:27 to 21:35**	**Air Temp. = 20^{0}C; Water Temp. = 14.2^{0}C to 19.9^{0}C; Wind = 0 (Beaufort); Percent Cloud = 20%; No Precip.; Water pH = 7 to 8.2**
2	**May 19**	**20:51 to 21:36**	**Air Temp. = 19^{0}C; Water Temp. = 16.2^{0}C to 18.1^{0}C; Wind = 0-1 (Beaufort); Percent Cloud = 90-100%; No Precip.; Water pH = 7.3 to 8.2**
3	**June 29**	**21:35 to 22:24**	**Air Temp. = 22^{0}C; Water Temp. = 20^{0}C to 22^{0}C; Wind = 0-1 (Beaufort); Percent Cloud = 40%; No Precip.; Water pH = 7.2 to 8.1**
2022			
1	**April 8**	**20:40 to 21:11**	**Air Temp. = 5^{0}C; Water Temp. = 7.7^{0}C to 9^{0}C; Wind = 0 - 1 (Beaufort); Percent Cloud = 70- 80%; Light Drizzle; Water pH = 7.3 to 8.2**
2	**May 5**	**20:39 to 21:43**	**Air Temp. = 11^{0}C; Water Temp. = 13.2^{0}C to 15.7^{0}C; Wind = 0 (Beaufort); Percent Cloud = 15% to 20%; No Precip.; Water pH = 8.3 to 8.6**

3	June 16	21:04 to 22:57	Air Temp. = 28^{0}C; Water Temp. = 23^{0}C to 25^{0}C; Wind = 1 (Beaufort); Percent Cloud = 80%; No Precip.; Water pH = 7.5 to 8.2
2021			
1	April 9	19:48 to 20:25	Air Temp. = 17^{0}C; Water Temp. = 17.1 ^{0}C; Wind = 1 (Beaufort); Percent Cloud = 15%; No Precip.; Water pH = 7.4
2	May 28	20:40 to 21:36	Air Temp. = 22^{0}C; Water Temp. = 21.3 ^{0}C; Wind = 1-2 (Beaufort); Percent Cloud = 80%; No Precip.; Water pH = 8.0 to 8.2
3	June 24	21:12 to 21:53	Air Temp. = 24^{0}C; Water Temp. = 21.3 to 23.7 ^{0}C; Wind = 0-1 (Beaufort); Percent Cloud = 60%; No Precip.; Water pH = 7.7 to 8.0
2020			
1	April 7	20:15 to 20:48	Air Temp. = 12^{0}C; Water Temp. = 11.3 ^{0}C; Wind = 0-1 (Beaufort); Percent Cloud = 80%; No Precip.; Water pH = 7.8
2	May 16	21:10 to 22:07	Air Temp. = 13^{0}C; Water Temp. = 17^{0}C; Wind = 0 (Beaufort); Percent Cloud = 15%; No Precip.; Water pH = 7.8
3	June 16	21:12 to 22:05	Air Temp. = 16^{0}C; Water Temp. = 22.2^{0}C; Wind = 0-1 (Beaufort); Percent Cloud = 30%; No Precip.; Water pH = 7.7
2019			
1	April 24	20:44 to 21:08	Air Temp. = 12^{0}C; Water Temp. = 11.7^{0}C to 12.3; Wind = 0 (Beaufort); Percent Cloud = <5%; No Precip.; Water pH = 6.9 to 7.3
2	May17	21:37 to 21:59	Air Temp. = 12^{0}C; Water Temp. = 15.4^{0}C to 15.8; Wind = 1 (Beaufort); Percent Cloud = 20%; No Precip.; Water pH = 6.9 to 7.4
3	June 6	21:16 to 21:55	Air Temp. = 20^{0}C; Water Temp. = 20.6^{0}C to 20.7; Wind = 1 (Beaufort); Percent Cloud = 20%; No Precip.; Water pH = 6.7 to 7.0
2018			
1	April 26	20:52 to 21:35	Air Temp. = 10.5^{0}C; Water Temp. = 11.5^{0}C to 13.1; Wind = 0 (Beaufort); Percent Cloud = <5%; No Precip.; Water pH = 6.7 to 7.2
2	May 9	21:02 to 21:42	Air Temp. = 19^{0}C; Water Temp. = 19.2^{0}C to 20.0; Wind = 2 (Beaufort); Percent Cloud = 50%; No Precip.; Water pH = 6.8 to 7.2
3	June 11	21:02 to 21:49	Air Temp. = 19^{0}C; Water Temp. = 19^{0}C to 19.9; Wind = 0 (Beaufort); Percent Cloud = 0%; No Precip.; Water pH = 7.3 to 7.4
2017			
1	April 13	20:32 to 20:52	Air Temp. = 10^{0}C; Water Temp. = 7.6^{0}C ; Wind = 0 (Beaufort); Percent Cloud = 20%; No Precip.; Water pH = 7.6 to 7.9
1	April 19	20:08 to 20:25	Air Temp. = 11.5^{0}C; Water Temp. = 12.7^{0}C ; Wind = 1 (Beaufort); Percent Cloud = 100%; No Precip.; Water pH = 8.4
2	May 23	21:02 to 21:32	Air Temp. = 17^{0}C; Water Temp. = 17.3^{0}C ; Wind = 0 (Beaufort); Percent Cloud = 80%; No Precip.; Water pH = 7.3 to 8.1
3	June 28	21:21 to 22:08	Air Temp. = 20^{0}C; Water Temp. = 21.1^{0}C ; Wind = 0 (Beaufort); Percent Cloud = 100%; No Precip.; Water pH = 7.5 to 8.5
2016			
1	Mach 30, 2016	20:00 to 20:33	Air Temp. = 13.7^{0}C; Water Temp. = 7.9^{0}C ; Wind = 1 (Beaufort); Percent Cloud = 100%; No Precip.; Water pH = 7.5 to 8.2
2	May 25	19:18	Air Temp. = 23.1^{0}C; Water Temp. = 21.8^{0}C ; Wind = 0 (Beaufort); Percent Cloud = 80%; No Precip.; Water pH = 8.4
2	May 26	21:16 to 21:38	Air Temp. = 22.1^{0}C; Water Temp. = 10.8^{0}C ; Wind =0(Beaufort); Percent Cloud = 50%; No Precip.; Water pH = 7.0 to 8.6
4	June 17	21:35 to 22:16	Air Temp. = 23^{0}C; Water Temp. = 24.2^{0}C ; Wind = 1 (Beaufort); Percent Cloud = 0%; No Precip.; Water pH = 7.7 to 8.3
2015			
1	April 15	20:35 to 21:20	Air Temp. = 11^{0}C; Water Temp. = 10.8^{0}C ; Wind = 1 (Beaufort); Percent Cloud = 80%; No Precip.; Water pH = 7.7 to 8.5

2	**May 6**	**20:42 to 21:31**	**Air Temp. = 20^{0}C; Water Temp. = 15.8^{0}C ; Wind = 0 (Beaufort); Percent Cloud = 80%; No Precip.; Water pH = 7.7 to 8.2**
3	**June 16**	**21:19 to 21:52**	**Air Temp. = 21.6^{0}C; Water Temp. = 18.2^{0}C ; Wind = 1 (Beaufort); Percent Cloud = 0%; No Precip.; Water pH = 6.8 to 8.1**
2014			
1	**April 11, 2014**	**20:05 to 21:05 hrs**	**Air Temp. = 9^{0}C; Water Temp. = 8.8^{0}C ; Wind = 2 (Beaufort); Percent Cloud = 100%; No Precip.; Water pH = 7.6 to 8.5;**
2	**May 21, 2014**	**21:20 to 22:41 hrs**	**Air Temp. = 9^{0}C; Water Temp. = 8.8^{0}C ; Wind = 2 (Beaufort); Percent Cloud = 100%; No Precip.; Water pH = 7.6 to 8.5;**
3	**June 26, 2014**	**21:36 to 22:03 hrs**	**Air Temp. = 9^{0}C; Water Temp. = 8.8^{0}C ; Wind = 2 (Beaufort); Percent Cloud = 100%; No Precip.; Water pH = 7.6 to 8.5**
2013			
1	**April 17, 2013**	**19:40 to 20:35 hrs**	**Air Temp. = 9^{0}C; Water Temp. = 8.8^{0}C ; Wind = 2 (Beaufort); Percent Cloud = 100%; No Precip.; Water pH = 7.6 to 8.5;**
2	**May 6, 2013**	**20:45 to 21:15 hrs**	**Air Temp. = 19^{0}C; Water Temp. = 18.2^{0}C; Wind = 0 km/hr; Percent Cloud = 10%; No Precip.; Water pH =7.6 to 8.5;**
3	**June 24, 2013**	**21:29 to 21:52 hrs**	**Air Temp. = 26.6^{0}C; Water Temp. = 25.7^{0}C; Wind = 0-1; Percent Cloud = 40%; No Precip.; Water pH =7.7 to 8.8**

Frog_1:
Station Frog_1 is located along the southeastern edge of area C. In 2023 the Wood Frog was recorded at call code 2,Spring Peeper at call code 3, and Northern Leopard Frog at call code 1 in April. During the May and June surveys no surface water was present in wetland area "C".

The 2020 and 2021 survey results at station Frog_1 were the lowest of all the years to date, based on number of species heard and lower call codes heard, see Figure 4. The 2022 results had the same number species recorded as 2014. With 3 species recorded in 2023, results were comparable to the 2017 and 2018 non-drought years. The average numbers of species recorded at this station based on 11 years of surveys is 3 species. The 2023 results show a recovery from the lows of 2020 and 2021 returning to the yearly average for numbers of species recorded for the station during the 2023 breeding season.



During 2020 and 2021 Grey Tree Frog at call code 1 was the only frog heard (during the June survey visit). In 2013, 2015 and 2016 four species were heard at this station. In 2019 Spring Peeper, Grey Tree Frog and American Toad had maximum call codes of 3, with Wood Frog having a call code of 2 in 2019.

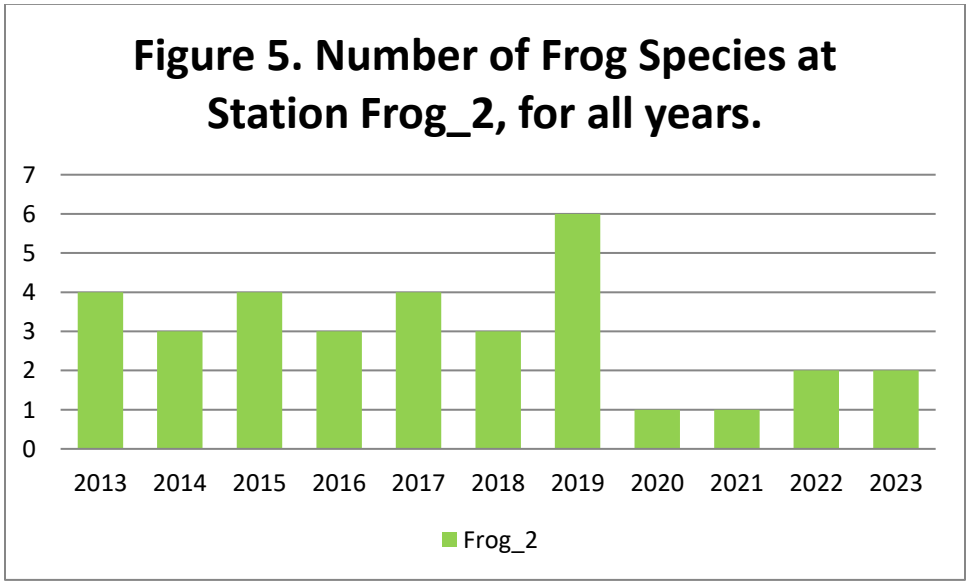
Frog_2:

Frog_2 is located along the southwestern edge of area C of the Roszell Wetland. In 2023 at the Frog_2 survey station, frogs were recorded only during the April survey, with nothing being heard in May or June when no surface water was present in Area C. In 2023, Spring Peeper was heard at call code 3 and Wood Frog at call code 2, indicating greater numbers of early breeding frogs than was noted in 2022.

In 2022 at Frog_2 two frog species were recorded, both on the May survey with Spring Peeper at call code 1 and American Toad at call code 2 during the May survey. No water was present in Area C of the wetland near this station during the June survey. The 2023 results indicated a stronger presence of Spring Peepers than in the previous year and a return of Wood Frogs but no American Toads.

As Figure 5 shows, 2020 and 2021 (start of the drought period) were the lowest years for numbers of species present breeding and low call codes, with only Grey Tree Frog at call code 1 being heard on the June survey visits those years.

Spring Peepers have been heard consistently every year since 2013 (including 2023) at call code 3 at this station, but in 2021 and 2020 none were present. The average number of species recorded at this station for the 11 years is 3. The 2023 findings are still 33% below average at this station for species heard, but are showing a positive trend towards the average.

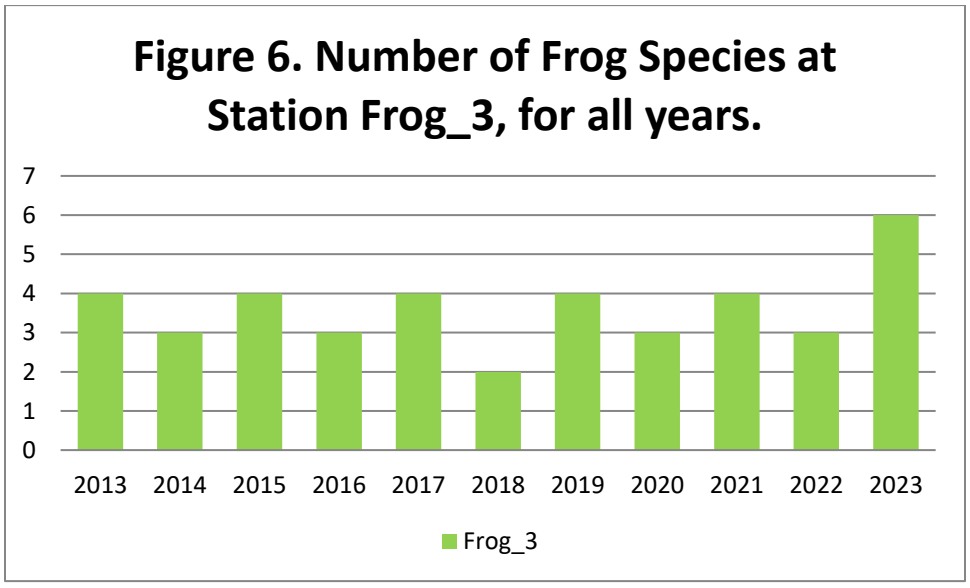


Frog_3:
The Frog_3 station is a dug pond located to the south of the Roszell Wetland where stations Frog_1 and Frog_2 are located. The water levels in the pond at Frog_3 in 2023 were noted to decline from May to June similar to that noted in 2022. This pond and associated wetland, however, maintained surface water at deeper depths and for longer than noted in Area C of the Roszell Wetland.

The average number of species recorded at this station based on the 11 years of surveys is 4. In 2023, there were 6 species recorded, making it the year with the greatest number of species, for all years surveyed. Table 14 shows all six of the species recorded at Frog_3 were.

Spring Peeper had the greatest call code 3 at this station from 2021 to 2023, and 2016 has been the only year with no Spring Peepers recorded. During all other years call codes for Spring Peeper have been 1 or 2, including the pre-extraction year (2013) at call code 2 and 2014 at 1. Over all of the survey years the only other species at Frog_3 that has had a call code of 3 was Green frog in 2015, which hasn't occurred again.

Compared with previous years 2023 had more species recorded and 4 of those species had call codes of 2, which is more than any other year so far, see Figure 6. This suggests greater numbers of individuals being heard/ being present at this station than historically.



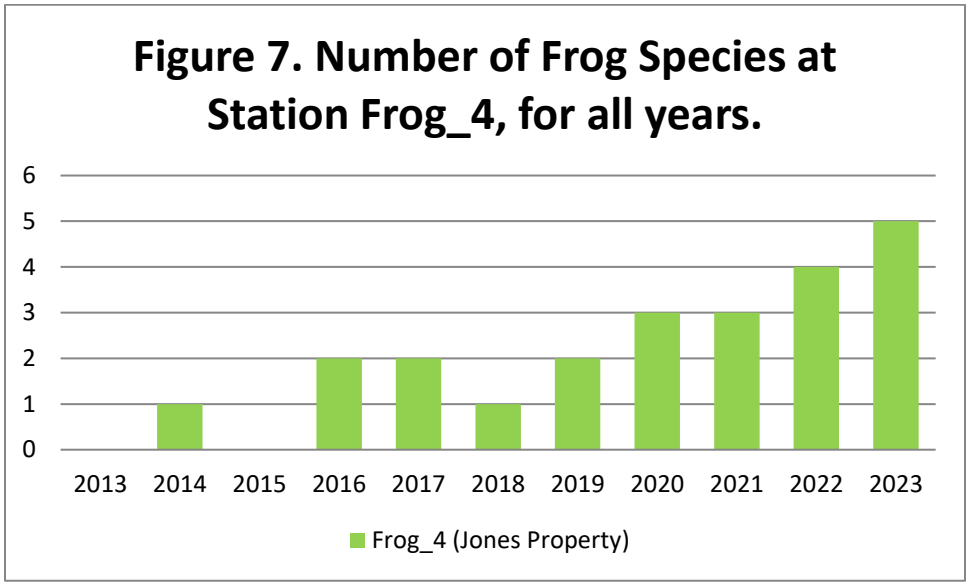
Frog_4:
The location of survey station Frog_4 (Jones Property), is shown on Figure 3, with the survey station from 2021 onward, being back at the south end of the Jones pond. In 2020 the survey station was changed from its historical location due to no permission being given to enter their property. The 2020 location of the survey station is shown on Figure 3.

The average number of species recorded at Frog_4 for all 11 years of surveys is 2, and in 2023 more than double the average was recorded, at 5 species, see Figure 7. The number of species recorded at Frog_4 has increased from 2018 where only 1 species was recorded to 2023 with 5 species.

During the recent drought years the number of species has not been noted to decline, but has remained the same or increased. The species recorded each year has shown variation over the years, and 7 of the 11 years had only call codes of 1 for all species. Call codes of 2 were heard in 2017 and 2023 for Green Frog, and Spring Peeper in 2020 had call code 2 and call code 3 in 2023.

The pre-extraction year of 2013 had no frog species recorded at this station, and the first two years when extraction started had 1 species recoded in 2014 and none in 2015.

The presence of more frogs species recorded may be due to frogs having moved locations for breeding since the wetland where Frog_1 and Frog_2 are located has had limited breeding habitat during recent drought years, especially for later season breeding amphibians. The Jones Pond is only 45-50m away from the Frog_1 and Frog_2 wetland.



Frog _5:
A new survey station, shown on Figure 1, was created during the June 2022 survey as frogs were heard calling from the closest lake of the Aggregate Pit (north of the Roszell Wetland). The Frog_5 station is located at the southern edge of the aggregate pit lake where Willow shrubs and Broad-leaved Cattail have established along the southwest corner of the lake edge.

In 2023 and 2022 a total of 3 species were recorded, with Spring Peeper and Grey Tree Frog recorded both years. In 2023 Green Frog was recorded, and in 2022 the third

species was American Toad. The species heard both years at this station had maximum call codes of 2 or greater, indicating numerous individuals being present. Spring Peepers were heard in both 2022 and 2023 at call code 3, indicating a strong presence of this species along the vegetated lake edge.
In 2022 Grey Tree Frog was heard at call code 3 and American Toad at call code 2. Grey Tree Frogs showed a slightly reduced chorus in 2023 with a call code of 2, same as Green Frog.

From 2020 onward at Frog_1 and Frog_2 lower call codes or no Grey Tree Frogs were noted, and the 2022 and 2023 data show clear use/presence of the the area at Frog_5. The data suggest that Grey Tree Frogs may have shifted into using the lake edge habitat for breeding since the recent drought years have provided little surface water during the May to June breeding season to the Roszell Wetland.

Table 14. Summary of 2023 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

		Survey Station Number				
Species	**Survey Visit #**	**Frog_1**	**Frog_2**	**Frog_3**	**Frog_4 (Jones Property #6512 Roszell Road)**	**Frog_5**
Spring Pepper	**1**	3	3	3	3	3
	2	-	-	1	-	1
	3	-	-	-	-	-
Wood Frog	**1**	2	2	2	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Green Frog	**1**	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	1	2	2
Grey Tree Frog	**1**	-	-	-	1	-
	2	-	-	1	-	-
	3	-	-	2	1	2
Northern Leopard Frog	**1**	1	-	2	1	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Chorus Frog	**1**	-	-	-	1	-
	2	-	-	-	-	-
	3	-	-	-	-	-
American Toad	**1**	-	-	-	-	-
	2	-	-	2	-	-
	3	-	-	-	-	-
Total # of Species		3	2	6	5	3

LEGEND
Call level codes (MMP):

1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3 = calls not distinguishable individually, overlapping

Table 15. Summary of 2022 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

		Survey Station Number				
Species	**Survey Visit #**	**Frog_1**	**Frog_2**	**Frog_3**	**Frog_4 (Jones Property #6512 Roszell Road)**	**Frog_5**
Spring Pepper	**1**	-	-	3	-	-
	2	1	1	3	1	3
	3	-	-	-	-	-
Wood Frog	**1**	1	-		-	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Green Frog	**1**	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	-	-	-
Grey Tree Frog	**1**	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	1	1	3
Northern Leopard Frog	**1**	-	-	-	-	-
	2	-	-	-	-	-
	3	-	-	2	1	-
American Toad	**1**	-	-	-	-	-
	2	-	2	-	2	2
	3	-	-	-	-	1
Total # of Species		2	2	3	4	3

LEGEND
Call level codes (MMP):

1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3 = calls not distinguishable individually, overlapping

Table 16. Summary of 2021 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

Species	Survey Visit #	Survey Station Number			
		Frog_1	Frog_2	Frog_3	Frog_4 (Jones Property #6512 Roszell Road)
Spring Pepper	1	-	-	3	-
	2	-	-	-	-
	3	-	-	-	-
Wood Frog	1	-	-	1	-
	2	-	-	-	-
	3	-	-	-	-
Green Frog	1	-	-	-	-
	2	-	-	1	1
	3	-	-	1	1
Grey Tree Frog	1	-	-	-	-
	2	-	-	1	1
	3	1	1	-	1
Northern Leopard Frog	1	-	-	-	-
	2	-	-	-	1
	3	-	-	-	-
American Toad	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
Total # of Species		1	1	4	3

LEGEND
Call level codes (MMP):

1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3 = calls not distinguishable individually, overlapping

Table 17. Summary of 2020 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

Species	Survey Visit #	Survey Station Number			
		Frog_1	Frog_2	Frog_3	Frog_4 (Jones Property #6512 Roszell Road)
Spring Pepper	**1**	-	-	2	Not surveyed
	2	-	-	2	2
	3	-	-	-	-
Wood Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
Green Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	-		-	1
Grey Tree Frog	**1**	-	-	-	Not surveyed
	2	-	-	-	-
	3	1	1		-
Northern Leopard Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	1	-
American Toad	**1**	-	-	-	Not surveyed
	2			2	1
	3	-	-	-	-
Total # of Species		1	1	3	3

LEGEND
Call level codes (MMP):

1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3 = calls not distinguishable individually, overlapping

Table 18. Summary of 2019 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

Species	Survey Visit #	Survey Station Number			
		Frog_1	Frog_2	Frog_3	Frog_4 (Jones Property #6512 Roszell Road)
Spring Pepper	**1**	3	3	1	-
	2	2	2	1	-
	3	-	-	-	-
Wood Frog	**1**	2	2	1	-
	2	-	-	-	-
	3	-	-	-	-
Green Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	1	-	1
Grey Tree Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	3	3	1	1
Northern Leopard Frog	**1**	1	1	1	-
	2	-	-	1	-
	3	-	-	-	-
American Toad	**1**	-	-	-	-
	2	3	3	-	-
	3	-	-	-	-
Total # of Species		5	6	4	2

LEGEND

Call level codes (MMP):

1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3 = calls not distinguishable individually, overlapping

Table 19. Summary of 2018 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

Species	Survey Visit #	Survey Station Number			
		Frog_1	Frog_2	Frog_3	Frog_4 (Jones Property #6512 Roszell Road)
Spring Pepper	**1**	3	3	1	-
	2	3	3	2	-
	3	-	-	-	-
Wood Frog	**1**	3	3	-	-
	2	-	-	-	-
	3	-	-	-	-
Green Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	1	1	1
Grey Tree Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
Northern Leopard Frog	**1**	1	-	-	-
	2	-	-	-	-
	3	-	-	-	-
Bullfrog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
Total # of Species		3	3	2	1

LEGEND

Call level codes (MMP):

1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3 = calls not distinguishable individually, overlapping

Table 20. Summary of 2017 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

Species	Survey Visit #	Survey Station Number			
		Frog_1	Frog_2	Frog_3	Frog_4 (Jones Property #6512 Roszell Road)
Spring Pepper	**1**	3	3	1	-
	2	-	-	-	-
	3	-	-	-	-
Wood Frog	**1**	-	2	-	-
	2	-	-	-	-
	3	-	-	-	-
Green Frog	**1**	-	-	-	-
	2		-	1	-
	3	1	1	1	2
Grey Tree Frog	**1**	-	-	-	-
	2	3	3	2	-
	3	-	-	-	-
Northern Leopard Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	1	-
Bullfrog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
Total # of Species		3	4	4	2

LEGEND

Call level codes (MMP):

1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3 = calls not distinguishable individually, overlapping

Table 21. Summary of 2016 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

Species	Survey Visit #	Survey Station Number			
		Frog_1	Frog_2	Frog_3	Frog_4 (Jones Property #6512 Roszell Road)
Spring Pepper	**1**	3	3	-	-
	2	1	1	-	-
	3	-	-	-	-
Wood Frog	**1**	3	3	1	-
	2	-	-	-	-
	3	-	-	-	-
Green Frog	**1**	-	-	-	-
	2	1	-	1	-
	3	-	-	1	1
Grey Tree Frog	**1**	-	-	-	-
	2	2	1	-	-
	3	1	1	1	-
Northern Leopard Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
Bullfrog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	-	1
Total # of Species		4	3	3	2

LEGEND

Call level codes (MMP):

1 = calls can be counted; not simultaneous

2 = some simultaneous call; but distinguishable

3= calls not distinguishable individually, overlapping

Table 22. Summary of 2015 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

Species	Survey Visit #	Survey Station Number			
		Frog_1	Frog_2	Frog_3	Frog_4 (Jones Property #6512 Roszell Road)
Spring Pepper	**1**	3	3	2	-
	2	3	3	2	-
	3	-	-	-	-
Wood Frog	**1**	3	3	1	-
	2	-	-	-	-
	3	-	-	-	-
Green Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	1	3	3	-
Grey Tree Frog	**1**	-	-	-	-
	2	-	-	2	-
	3	2	2	1	-
Northern Leopard Frog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
Bullfrog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
Total # of Species		4	4	4	0

LEGEND

Call level codes (MMP):

1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3= calls not distinguishable individually, overlapping

Table 23. Summary of 2014 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

Species	Survey Visit #	Survey Station Number			
		Frog_1	Frog_2	Frog_3	Frog_4 (Jones Property #6512 Roszell Road)
Spring Pepper	**1**	2	3	1	-
	2	1	1	1	-
	3	-	-	-	-
Wood Frog	**1**	-	1	-	-
	2	-	-	-	-
	3	-	-	-	-
Green Frog	**1**		-	-	-
	2	-	-	1	-
	3	-	-	1	-
Grey Tree Frog	**1**	-	-	-	-
	2	3	3	2	-
	3	-	1	-	-
Bullfrog	**1**	-	-	-	-
	2	-	-	-	-
	3	-	-	-	1
Total # of Species		2	3	3	1

LEGEND

Call level codes (MMP):

1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3= calls not distinguishable individually, overlapping

Table 24. Summary of 2013 Amphibian Call Surveys by Species, Call Level Code and Station Number, Roszell Pit, Puslinch.

Species	Survey Visit #	Survey Station Number			
		Frog_1	Frog_2	Frog_3	Frog_4 (Jones Property #6512 Roszell Road)
Spring Pepper	**1**	3	3	-	-
	2	3	3	2	-
	3	-	-	-	-
Wood Frog	**1**	3	3	-	-
	2	-	-	-	-
	3	-	-	-	-
Green Frog	**1**	1	-	-	-
	2	-	-	1	-
	3	1	2	1	-
Grey Tree Frog	**1**	-	-	-	-
	2	-	-	1	-
	3	2	1	-	-
Northern Leopard Frog	**1**	-	-	-	-
	2	-	-	1	-
	3	-	-	-	-
Total # of Species		4	4	4	0

LEGEND
Call level codes (MMP):
1 = calls can be counted; not simultaneous
2 = some simultaneous call; but distinguishable
3= calls not distinguishable individually, overlapping

4.5 Roszell Wetland Water Levels

The April 7, 2022 salamander egg mass survey initially identified that the water depths in the Roszell wetland were about half of what they had been during years prior to the drought years that started in 2020.

It was then requested by CBM starting in 2022 that the water levels within the Roszell Wetland be monitored for change over the critical May and June period when salamander and frog eggs require surface water in order to facilitate successful breeding.

The following summarizes May to June site visits to the Roszell Wetland, to the south of the exisitng pit, to confirm whether or not any surface water continued to be present within the wetland. The pond located to the south of the Roszell Wetland, where

amphibian monitoring station FRG_3 is located, was also checked during each survey visit in 2023.

Surface water levels were recorded where present in the Roszell Wetland and then mapped. The presence of surface water in the Roszell Wetland was recorded in relation to the habitat types of the wetland, as shown on Figure 3 as Areas A, B and C. For consistency, the locations of the DP7 piezometer in Area A of the wetland and at the steel pipe in the Southwest end of Area "C" were where water measurements were taken. In Area "B" (Silver Maple Swamp) any areas with standing water were checked and the greatest water depth in the area was recorded. At the pond to the South, water was measured at the north end of the pond at the wooden stake placed in the pond in Spring 2021. Table 25 shows the details of surface water depths in centimetres for each area of the Roszell Wetland and the pond to the south over the monitoring period in 2023 and Table 26show results from 2022.

Similar to 2022 the 2023 data showed the shallowest water depths were in area C of the wetland, followed by area B and area C contained lower topography for surface water to remain. In 2023 the water levels in area C declined between May 9 and 19th from 10cm maximum to 0cm. In 2022 there was no water in area C at the start of the surface water surveys on May 5th.
In area B the max surface water depths steadily declined from April 11, 2023 on, and between May 9 and 19th declined by 11cm. Area B reached no surface between May 19 and 25th in 2023 and between May 5 and 13th in 2022.

In Area A surface water was last present at the May 25th survey at 3.5cm and by June 1no surface water remained. In 2022 the May 9th survey had surface water at a depth of 4cm but reached 0cm by May 19th survey.

Table 25. Surface Water Levels at Roszell Wetland, 2023.

Location	Water Depth (cm)						
	April 11, 2023	May 3, 2023	May 9, 2023	May 19, 2023	May 25, 2023	June 1, 2023	June 7, 2023
Area A (at peizometer)	29cm	21cm	19cm	7cm	3.5cm	0	0
Area B	24cm	17cm	14cm	3cm	0	0	0
Area C	17cm	10cm	10cm	0cm	0	0	0
Pond to South at Stake	61cm	48cm	17.5cm	9.5cm	11cm	0 (20cm out form stake)	0 (68cm out form stake)

Table 26. Surface Water Levels at Roszell Wetland, 2022.

Location	Water Depth (cm)							
	May 5, 2022	May 13, 2022	May 19, 2022	May 29, 2022	June 6, 2022	June 9, 2022	June 16, 2022	June 25, 2022
Area A(at peizometer)	Ranged from 8-14cm	8.5cm	4cm (one depression at 7.5cm max. depth)	0	0	0	0	0
Area B	5cm	0	0	0	0	0	0	0
Area C	0	0	0	0	0	0	0	0
Pond to South at Stake	-	14cm	4cm	0(35 cm out from stake)	0(102 cm out from stake)	0(101 cm from stake)	0 (127 cm from stake)	0 (202 cm from stake)

5.0 Discussion

Area “A” of the Roszell Wetland had historically continued to consistently be where the greatest number of salamander egg masses were found each year until 2021. In 2021 no confirmed salamander breeding was found for the first year since monitoring began in 2013. In 2015 no egg masses were found during the surveys but this was attributed to an earlier than typical Spring breeding, resulting in the eggs already having developed into larvae before the survey occured. The 2022 surveys showed an improvement from 2021, with the second highest egg mass count of all years. In early May salamander larvae were confirmed in Area “A” but water levels were low and by May 29th had dried up completely, prior to larve becoming mature enough to leave the wetland as adults.

In 2023 the second highest number of salamander egg masses were found at 1,984 egg masses. This number is more than three times the counts between 2013 and 2016, inclusive. Unfortunately, by July 1, 2023 all of the standing water in the roszell wetland had dried up.

It should be noted that during a pre-extraction year, this wetland dried up and salamander egg masses were destroyed by June 1, 2005 (Stovel & Associates Inc. 2005).

FR_1 and FR_2 show continued improvement in numbers of breeding frog species present in the wetland in 2022 and 2023 compared to the 11 year lows of 2020 and 2021. The 2023 results showed a return of Spring Peppers calling at call code 3 for the first time since 2019 . The Jones Property in 2023 again showed an increasing use by different species of breeding amphibians, with the greatest number of species of all survey years. The call codes for frogs at the Jones Property, however, are low.

Spring Peepers were only recorded at call level code 3 in the original monitoring stations at FR_3. Wood Frog was also not heard at FR_1 and FR_2 in 2021 (historically it had been heard at call level code 2 or 3) but in 2022 was heard at FR_1 at call code 1. In 2022, the new monitoring station at FR_5 had frogs calling at the pit lake edge with 2 species calling at code 3. This showed a change in location from traditional breeding areas, which continued in 2023 when 3 frog species were calling including Spring Peeper at call code 3.

The Autumn vegetation plots showed some variation in percent cover of some species between 2013 and 2019 at vegetation Plots A and B, believed to be the result of grazing cattle where the vegetation plots are located. In 2021, 2022, and 2023 when there has appeared to be reduced cattle activity in the area of Plots A and B has resulted in species percent covers remaining mostly similar between years and less change occurring by several percent cover categories as was noted in years prior to 2019. Variations in the percent cover of certain species at the other vegetation plots sampled still typically show changes in only one percent cover category. In 2022, it was found at Plots C, D and E that Bulblet Fern and/or Dwarf Scouring Rush (indicator species) increased at some subplots which is positive during another drought year. Overall limited changes were noted in the percent cover of vegetation species (including the wetland indicator species) in 2023 and 2022, in both Spring and Autumn, when compared to 2021.

The 2023 tree and shrub data at the six vegetation plots suggests there has again been minimal change in species presence or health between 2022 and 2023, beyond natural yearly changes, with periodically a few shrubs or trees becoming large enough to count on the transects. There continues to be standing water noted in plots where standing water had been recorded in previous years and at depths similar to what has been recorded historically at the plots since 2013. A reduced amount of cattle activity was noted in Spring 2023 at vegetation plots A and B, and the Autumn surveys. Reduced cattle presence should help stabilize the vegetation at those plots in future years as disturbance is reduced.

The 2023 trout redd surveys indicate continued Brook Trout breeding in the tributaries to the Speed River adjacent to the Roszell Pit. The Main Creek which had trout redds found in 2012 has continued to have trout redds found every year and to have the most Brook Trout redds present in the study area. Tributary #7 in 2023 showed continued average levels of trout redds being present.

The 2023 December trout redd surveys indicate Brook Trout spawning is continuing to take place, despite several previous drought years. There does not appear to be any significant impact on Brook Trout spawning in the coldwater creeks adjacent to the Roszell Pit based on comparison of historical data with the 2022 and 2023survey findings.

The Autumn and early Winter of 2023 was warmer than usual. The slightly fewer trout redds found in the Main Creek may have resulted from the late onset of trout spawning

due to warm air temperatures. It is our opinion that a second redd inventory in early January 2024 is advisable advisable and it may reveal additional spawning. The results of the January 2024 redd inventory will be documented in an addendum report to the present report.

The addendum report will be provided to all of the agencies which receive the Annual Ecological Monitoring Report.

6.0 Recommendations

It is recommended that the FR_5 amphibian monitoring station continue to be monitored in future years in order to identify and assess the use of the south edge of the pit lake for frog breeding. It is also recommended that the pit lake edge around the FR_5 station be searched for frog eggs to confirm successful breeding is occurring. This is suggested to be undertaken between April and June during the other surveys being undertaken.

In 2024 it is recommended that again water levels within the Roszell Wetland be monitored on an approximately weekly basis during the months of May and June. Water levels should be recorded and mapped in the same way as they were in 2023.

It is recommended that a trout redd survey be conducted in January 2024 to document any late spawning activity. Result of this inventory shall be documented in an addendum report.

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APPENDIX 1.

Example of a Completed

Herbaceous Vegetation Data Form

(for a Sub-plot, 2012):

Roszell Pit

Dance Environmental Inc.

Herbaceous Monitoring Plots

SPECIES LIST

Site:	**Roszell Pit**		
Sampling Plot #:	F	**Subplot #:**	N W
UTM (centre of Plot):			
Date:	Oct. 1/12	**Time:**	**Start**
Surveyor(s):	KSD, KWD		**End**
Weather:		Water Depth:	0

Species	Solitary	<1%	1-5%	6-15%	16-30%	31-50%	51-75%	76-100%	Notes
Canada mayflower		✓							
Moss sp.				✓					
Glossy Buckthorn		✓							seedlings
Sedge sp.		✓							
Eastern White Cedar	✓								seedling
dead wood		✓							
liverwort sp.	✓								

APPENDIX 2.

Completed Tree and Shrub Inventory Data Form,

Example (Revised 2013 Data Form):

Roszell Pit

Dance Environmental Inc.
Tree Monitoring Inventory

Site:	**Roszell Pit** Plot E		
UTM (centre of Plot):			
Date:		**Time: Start**	11:05
Surveyor(s):	KSD	**End**	11:16
Weather:	Temp = 22°; wind = 0-2 km/hr; 100% cloud; light precip off and on		

Condition: To assess condition look for:
- Sores, Soot
- Disease, Fungus
- Rot, or damage to Trunk, Roots
- Dead main branches, small branches/twigs
- Lost/dead foliage

Transect Name: North -south

Shrubs

Species	Condition (good, fair, poor, dead)	Understorey: Tally
No Shrubs at 1m or taller		

Notes:

Transect Name: East-West

Shrubs

Species	Condition (good, fair, poor, dead)	Understorey: Tally
Glossy Buckthorn	Good	6 stems

Notes:

Trees:

tree health and numbers within entire 10x10 plot

all trees >10 dbh

Plot #: E

Layers: 1=canopy 2=sub-canopy

Species	Condition	location	Canopy Layer 1	Canopy Layer 2
E.W. Cedar	Good	NE	1	
		SE	1111	
		SW		
		NW	1111 1	
~1	Fair	NE		
		SE		
		SW	1 (uprooted and on ground) but alive still	
		NW		
Y. Birch	Good	NE	1111	
		SE		
		SW	1	
		NW	1	
Y. Birch	Fair	NE	1	
		SE		
		SW		
		NW	1	
Bl. Ash	Fair	NE		
		SE	1	
		SW		
		NW		
		NE		
		SE		
		SW		
		NW		
		NE		
		SE		
		SW		
		NW		
		NE		
		SE		
		SW		
		NW		
		NE		
		SE		
		SW		
		NW		
		NE		
		SE		
		SW		
		NW		

Notes: (Note all deadfall in the plots!)

APPENDIX 3.

Summary of 2014 to 2023 Spring Herbaceous

Vegetation in each Sub-plot

Appendix 3. Summary of 2014 to 2023 Spring Herbaceous Vegetation in each Sub-plot.

Plot	Sub-plot		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
		Dominant Taxa Species	Percent Cover for the Taxa									
A	NE	*Glyceria striata* Creeping Buttercup Bitter Dock	31-50% 1-5% 1-5%	6-15% 1-5% 1-5%	6-15% <1% solitary	16-30% 1-5% solitary	- 1-5% -	- 1-5% -	- 1-5% -	- <1% -	- <1% 1-5%	- 1-5% -
	NW	Moss sp. Bulblet Fern *Glyceria striata*	16-30% 1-5% 1-5%	16-30% 6-15% 1-5%	16-30% 6-15% 1-5%	31-50% 31-50% <1%	51-75% 6-15% -	51-75% 6-15% -	51-75% 6-15% -	51-75% 6-15% -	1-5% 16-30% 1-5%	51-75% 16-30% -
	SW	E. White Cedar-seedling Field Horsetail *Carex schweinitzii*	- 6-15% 1-5%	- 16-30% 1-5%	Solitary 16-30% -	- 31-50% -	- 16-30% -	- 16-30% -	- 6-15% -	- 6-15% -	- 6-15% -	- 1-5% -
	SE	Moss sp. *Agrostis stolonifera* Watercress	6-15% 6-15% -	16-30% - -	6-15% - 16-30%	16-30% - 6-15%	16-30% - 6-15%	16-30% - 1-5%	6-15% - 1-5%	1-5% - <1%	- - -	6-15% - -
B	NE	Field Horsetail *Carex Schweinitzii* *Carex flava*	1-5% 16-30% -	6-15% 16-30% -	16-30% 16-30% -	51-75% 6-15% -	31-50% - 1-5%	31-50% - 1-5%	6-15% - 1-5%	16-30% - 1-5%	1-5% - 1-5%	6-15% - 1-5%
	NW	E. White Cedar-seedling Moss sp. Bulblet Fern	6-15% 51-75% 6-15%	- 31-50% 6-15%	- 51-75% <1%	- 76-100% 1-5%	<1% 31-50% 1-5%	<1% 51-75% <1%	- 51-75% -	- 31-50% <1%	<1% 31-50% -	<1% 31-50% -
	SW	Kentucky Bluegrass	1-5%	-	<1%	-	-	-	-	-	-	-
	SE	*Ranunculus ripens* Creeping Charlie Kentucky Bluegrass	16-30% <1% 51-75%	76-100% 1-5% 31-50%	51-75% <1% 31-50%	31-50% Solitary 51-75%	51-75% - 1-5%	51-75% - 31-50%	31-50% - 31-50%	31-50% - 51-75%	16-30% - 51-75%	16-30% <1% 51-75%

Appendix 3. Summary of 2014 to 2023 Spring Herbaceous Vegetation in each Sub-plot Cont'd.

Plot	Sub-plot		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
		Dominant Taxa Species	Percent Cover for the Taxa									
C	NE	*Carex pedunculata* Bulblet Fern Field Horsetail	16-30% 1-5% 1-5%	6-15% 1-5% 1-5%	6-15% 1-5% 1-5%	16-30% 1-5% 1-5%	16-30% 1-5% 6-15%	16-30% - 1-5%	16-30% 1-5% 1-5%	31-50% <1% 1-5%	31-50% <1% 1-5%	- <1% 1-5%
	NW	*Carex pedunculata* Field horsetail Can. Mayflower	<1% <1% 1-5%	1-5% <1% 1-5%	1-5% - 1-5%	1-5% 1-5% 1-5%	6-15% <1% 1-5%	1-5% <1% 1-5%	1-5% <1% 1-5%	1-5% - 1-5%	1-5% - 6-15%	6-15% 1-5% 16-30%
	SW	Field Horsetail Three-leaved Solomon Seal Bulblet Fern	6-15% - 1-5%	16-30% 1-5% 1-5%	1-5% <1% <1%	1-5% 6-15% 1-5%	- 1-5% 6-15%	1-5% 1-5% 1-5%	1-5% 1-5% 1-5%	<1% 1-5% 1-5%	- 1-5% 1-5%	- - 1-5%
	SE	Field Horsetail Coltsfoot Bulblet Fern	1-5% 1-5% 6-15%	6-15% 6-15% 6-15%	16-30% 1-5% 6-15%	16-30% 1-5% 31-50%	6-15% 1-5% 31-50%	6-15% 1-5% 31-50%	6-15% 1-5% 31-50%	6-15% 1-5% 31-50%	1-5% - 16-30%	1-5% - 6-15%
D	NE	Bulblet Fern Dwarf Sc. Rush *Carex leptalea*	16-30% 16-30% -	16-30% 16-30% solitary	6-15% 16-30% <1%	31-50% 1-5% -	1-5% 6-15% <1%	6-15% 16-30% -	6-15% 16-30% -	16-30% 6-15% -	6-15% 6-15% -	6-15% 6-15% -
	NW	Bulblet Fern Field Horsetail Dwarf Sc. Rush	16-30% 1-5% 1-5%	31-50% 1-5% 1-5%	6-15% 1-5% 6-15%	6-15% - 16-30%	31-50% 6-15% 1-5%	16-30% 1-5% 6-15%	16-30% 1-5% 6-15%	31-50% 1-5% 6-15%	16-30% 1-5% 6-15%	16-30% 1-5% 6-15%
	SW	*Carex pedunculata* Bulblet Fern Dwarf Sc. Rush	6-15% 1-5% <1%	1-5% 1-5% <1%	1-5% 1-5% <1%	6-15% 1-5% -	6-15% 1-5% -	16-30% 6-15% 6-15%	16-30% 6-15% 6-15%	- 6-15% 1-5%	- 6-15% 6-15%	- 6-15% 6-15%
	SE	Bulblet Fern Field horsetail Moss sp.	16-30% Solitary <1%	31-50% Solitary -	31-50% - 1-5%	51-75% - 1-5%	31-50% - 1-5%	31-50% - 1-5%	16-30% <1% -	16-30% <1% -	16-30% - -	16-30% <1% 1-5%

Appendix 3. Summary of 2014 to 2023 Spring Herbaceous Vegetation in each Sub-plot Cont'd.

Plot	Sub-plot		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
		Dominant Taxa Species	Percent Cover for the Taxa									
E	NE	Cinnamon Fern Canada Mayflower Bulblet Fern	<1% 1-5% -	1-5% <1% <1%	1-5% <1% -	6-15% <1% solitary	6-15% <1% -	6-15% <1% <1%	6-15% <1% <1%	6-15% - <1%	6-15% <1% -	6-15% - -
	NW	Moss sp. *Agrostis stolinifera* Common Toothwort	76-100% - 16-30%	76-100% - 6-15%	76-100% - 6-15%	31-50% - 6-15%	51-75% - 6-15%	16-30% - 1-5%	76-100% - -	16-30% - 6-15%	16-30% - 6-15%	16-30% - 6-15%
	SW	Moss sp. Bulblet Fern Carex pedunculata Yellow Birch.	1-5% - 1-5% <1%	1-5% 1-5% 1-5% -	6-15% - <1% solitary	6-15% - 1-5% <1%	6-15% - <1% -	6-15% - 1-5% -	76-100% 6-15% 1-5% -	6-15% - 1-5% -	1-5% - 1-5% -	1-5% - 1-5% -
	SE	*Carex leptalea* Bulblet Fern Glossy Buckthorn	- <1% <1%	- <1% <1%	Solitary <1% <1%	- <1% <1%	- 1-5% <1%	- 1-5% <1%	- 1-5% <1%	- 1-5% <1%	- 1-5% 1-5%	- <1% <1%
F	NE	Moss sp. Canada Mayflower Marsh Fern	16-30% <1% -	16-30% - -	6-15% <1% -	6-15% <1% -	6-15% <1% -	16-30% <1% -	6-15% <1% -	6-15% - -	6-15% - -	6-15% - -
	NW	Moss sp. Canada Mayflower Common Buckthorn	31-50% <1% <1%	16-30% 1-5% <1%	31-50% 1-5% <1%	16-30% <1% solitary	- <1% -	16-30% <1% <1%	6-15% 1-5% -	6-15% - <1%	6-15% <1% <1%	1-5% <1% 1-5%
	SW	Moss sp. Dwarf Sc. Rush *Carex leptalea*	31-50% <1% -	31-50% <1% 1-5%	51-75% <1% <1%	16-30% - <1%	16-30% - <1%	16-30% 1-5% 1-5%	16-30% <1% <1%	6-15% <1% -	6-15% <1% -	6-15% <1% -
	SE	Moss sp. Canada Mayflower Bulblet Fern	- - <1%	1-5% - <1%	<1% - -	- - <1%	1-5% - <1%	1-5% - 1-5%	- - <1%	- - <1%	- - 1-5%	1-5% - -

APPENDIX 4.

Summary of 2013 to 2014 Spring Herbaceous

Vegetation in each Sub-plot

Appendix 4. Summary of 2013 Spring Herbaceous Vegetation in each Sub-plot.

		2013	
Plot	**Sub-plot**	**Dominant Taxa Species**	**Percent Cover**
A	NE	*Gliceria striata* Creeping Buttercup Bitter Dock	31-50% 6-15% -
	NW	Moss sp. Bulblet Fern *Glyceria striata*	31-50% 16-30% 16-30%
	SW	E. White Cedar Field Horsetail *Carex schweinitzii*	31-50% 16-30% 6-15%
	SE	Moss sp. *Agrostis stolonifera* Watercress	16-30% 16-30% 16-30%
B	NE	Field Horsetail *Carex Schweinitzii* *Carex flava*	31-50% 16-30% 6-15%
	NW	E. White Cedar Moss sp. Bulblet Fern	51-75% 31-50% 16-30%
	SW	Kentucky Bluegrass	51-75%
	SE	*Ranunculus ripens* Creeping Charlie Kentucky Bluegrass	6-15% 6-15% 16-30

Appendix 4. Summary of 2013 Spring Herbaceous Vegetation in each Sub-plot Cont'd.

		2013	
Plot	**Sub-plot**	**Dominant Taxa Species**	**Percent Cover**
C	NE	*Carex pedunculata* Bulblet Fern Field Horsetail	16-30% 6-15% 6-15%
	NW	*Carex pedunculata* Field horsetail Canada Mayflower	6-15% 6-15% 6-15%
	SW	Field Horsetail Three-leaved Solomon Seal Bulblet Fern	16-30% 6-15% 6-15%
	SE	Field Horsetail Coltsfoot Bulblet Fern	16-30% 6-15% 6-15%
D	NE	Bulblet Fern Dwarf Scouring Rush *Carex leptalea*	6-15% 6-15% 1-5%
	NW	Bulblet Fern Field Horsetail Dwarf Scouring Rush	31-50% 1-5% 1-5%
	SW	*Carex pedunculata* Bulblet Fern Dwarf Scouring Rush	1-5% 1-5% 1-5%
	SE	Bulblet Fern Field horsetail Moss sp.	31-50% <1% <1%

Appendix 4. Summary of 2013 Spring Herbaceous Vegetation in each Sub-plot Cont'd.

		2012	
Plot	**Sub-plot**	**Dominant Taxa Species**	**Percent Cover**
E	NE	Cinnamon Fern	6-15%
		Canada	1-5%
		Mayflower	<1%
		Bulblet Fern	
	NW	Moss sp.	51-75%
		Agrostis stolinifera	16-30%
		Common Toothwort	16-30%
	SW	Moss sp.	1-5%
		Bulblet Fern	1-5%
		Carex pedunculata	1-5%
		Yellow Birch.	1-5%
	SE	*Carex leptalea*	1-5%
		Bulblet Fern	<1%
		Glossy Buckthorn	<1%
F	NE	Moss sp.	6-15%
		Canda	1-5%
		Mayflower	<1%
		Marsh Fern	
	NW	Moss sp.	6-15%
		Canada	1-5%
		Mayflower	
		Common Buckthorn	<1%
	SW	Moss sp.	31-50%
		Dwarf Scouring rush	1-5%
		Carex leptalea	1-5%
	SE	Moss sp.	1-5%
		Canada	<1%
		Mayflower	
		Bulblet Fern	-

APPENDIX 5.

Summary of 2014 to 2023 Autumn Herbaceous

Vegetation in each Sub-plot

Appendix 5. Summary of 2014 to 2023 Autumn Herbaceous Vegetation in each Sub-plot.

Plot	Sub-plot	Dominant Taxa Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
			Percent Cover for the Taxa									
A	NE	Fowl Mana Grass	1-5%	16-30%	31-50%	16-30%	-	16-30%	6-15%	-	1-5%	-
		Juncus articulatus	6-15%	1-5%	-	6-15%	6-15%	-	6-15%	6-15%	6-15%	16-30%
		E. W. Cedar -seedling	<1%	1-5%	1-5%	1-5%	1-5%	16-30%	51-75%	-	-	-
	NW	Moss sp.	51-75%	31-50%	51-75%	51-75%	51-75%	51-75%	51-75%	51-75%	51-75%	51-75%
		Fowl Mana Grass	31-50%	1-5%	<1%	-	-	-	-	1-5%	<1%	-
		Bulblet Fern	6-15%	16-30%	6-15%	16-30%	1-5%	16-30%	-	<1%	6-15%	6-15%
	SW	Coltsfoot	6-15%	16-30%	31-50%	16-30%	31-50%	1-5%	6-15%	6-15%	16-30%	16-30%
		Carex schweinitzii	1-5%	-	-	-	-	-	-	-	-	-
		Bulblet Fern	1-5%	16-30%	16-30%	6-15%	1-5%	16-30%	16-30%	16-30%	16-30%	1-5%
		Field Horsetail	6-15%	31-50%	16-30%	31-50%	16-30%	1-5%	1-5%	-	-	1-5%
	SE	*Bidens connata*	-	Solitary	<1%	-	1-5%	-	-	-	-	-
		Watercress	<1%	6-15%	31-50%	6-15%	16-30%	-	1-5%	-	-	-
		Fowl Manna Grass	6-15%	1-5%	1-5%	6-15%	-	-	-	-	-	-
B	NE	*Carex schweinitzii*	16-30%	1-5%	6-15%	16-30%	-	1-5%	1-5%	1-5%	-	1-5%
		Purple Stemmed Aster	16-30%	16-30%	6-15%	6-15%	1-5%	<1%	1-5%	<1%	1-5%	-
		Field Horsetail	6-15%	16-30%	6-15%	16-30%	1-5%	6-15%	6-15%	16-30%	16-30%	6-15%
	NW	Moss sp.	51-75%	51-75|%	51-75%	76-100%	51-75%	51-75%	51-75%	51-75%	51-75%	51-75%
		E. W. Cedar -seedling	1-5%	1-5%	-	<1%	-	-	-	-	-	-
		Bulblet Fern	1-5%	6-15%	-	-	-	<1%	<1	<1%	-	-
	SW	*Agrostis stolonifera*	-	-	-	-	-	-	-	-	-	-
		Tall Buttercup	-	-	-	-	-	-	-	-	-	-
		Fowl Mana Grass	-	-	-	-	-	-	-	-	-	-
		Pilea fontana	6-15%	1-5%	<1%	1-5%	-	<1%	-	-	-	-
		Common Plantain	6-15%	6-15%	-	-	1-5%	-	-	-	-	-
		Spotted Jewelweed	1-5%	-	-	-	-	-	-	-	-	-
	SE	Tall Buttercup	31-50%	51-75%	31-50%	76-100%	76-100%	76-100%	16-30%	31-50%	16-30%	-
		Agrostis stolonifera	-	-	-	-	-	-	-	-	-	-
		Pilea fontana	Solitary	<1%	<1%	-	-	-	-51-75%	-	-	-
		Poa compressa	16-30%	6-15%	16-30%	1-5% 16-30%	1-5% 6-15%	<1% -	-	-	-	-

Appendix 5. Summary of 2014 to 2022 Autumn Herbaceous Vegetation in each Sub-plot Cont'd.

Plot	Sub-plot	Dominant Taxa Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
			Percent Cover for the Taxa									
C	NE	*Carex flava* Bulblet Fern Field Horsetail	31-50% 6-15% 1-5%	16-30% 1-5% 6-15%	- 1-5% 6-15%	- 1-5% 16-30%	- 1-5% 31-50%	- 1-5% 1-5%	- 6-15% -	- 1-5% <1%	- 1-5% -	- 1-5% -
	NW	*Carex flava* Dwarf Scouring Rush C. Buckthorn	6-15% 1-5% 1-5%	6-15% 1-5% <1%	- 6-15% <1%	- 1-5% -	- 6-15% -	- 1-5% <1%	- 1-5% <1%	- 1-5% <1%	- 6-15% <1%	- 6-15% <1%
	SW	Field Horsetail Moss sp. Bulblet Fern *Carex flava*	6-15% 1-5% 1-5% 6-15%	16-30% 1-5% 1-5% <1%	6-15% 1-5% 1-5% <1%	16-30% 6-15% 1-5% -	<1% 6-15% 6-15% -	1-5% 16-30% 6-15% -	- 6-15% 6-15% -	- 6-15% 1-5% -	- 6-15% 1-5% -	- 6-15% 6-15% -
	SE	Field Horsetail Coltsfoot Bulblet Fern	Solitary 6-15% 6-15%	1-5% 6-15% 6-15%	1-5% 1-5% 6-15%	16-30% 1-5% 16-30%	6-15% 6-15% 31-50%	6-15% 16-30% 16-30%	1-5% 16-30% 16-30%	1-5% - 6-15%	1-5% - 16-30%	<1% - 16-30%
D	NE	Dwarf Scouring Rush Bulblet Fern	16-30% 6-15%	31-50% 16-30%	51-75% 6-15%	51-75% 6-15%	31-50% 6-15%	6-15% 6-15%	16-30% 6-15%	31-50% 6-15%	31-50% 6-15%	31-50% 16-30%
	NW	Bulblet Fern Field Horsetail Dwarf Scouring Rush	31-50% 1-5% 6-15%	16-30% 6-15% 6-15%	31-50% 6-15% 16-30%	31-50% 6-15% 1-5%	51-75% 6-15% <1%	51-75% 1-5% 6-15%	51-75% 1-5% 6-15%	51-75% <1% 6-15%	31-50% <1% 6-15%	31-50% 1-5% 16-30%
	SW	*Carex pedunculata* Bulblet Fern Dwarf Sc. Rush	6-15% 6-15% 1-5%	6-15% 1-5% 1-5%	16-30% 6-15% <1%	6-15% 1-5% 1-5%	6-15% 16-30% 1-5%	6-15% 6-15% 1-5%	16-30% 6-15% 1-5%	16-30% 6-15% 1-5%	16-30% 6-15% 6-15%	16-30% 6-15% 6-15%
	SE	Bulblet Fern Glossy Buckthorn Moss sp.	31-50% Solitary 1-5%	16-30% - 1-5%	31-50% - 1-5%	31-50% - -	31-50% - <1%	31-50% - -	16-30% - <1%	16-30% - 16-30%	16-30% - 16-30%	16-30% <1% 16-30%

Appendix 5. Summary of 2014 to 2023 Autumn Herbaceous Vegetation in each Sub-plot Cont'd.

Plot	Sub-plot	Dominant Taxa Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
			Percent Cover for the Taxa									
E	NE	Cinnamon Fern Moss sp. Bulblet Fern	6-15% 1-5% -	6-15% 1-5% -	6-15% 1-5% -	6-15% 1-5% -	6-15% 1-5% 1-5%	6-15% 1-5% <1%	6-15% 1-5% -	6-15% 1-5% <1%	6-15% 1-5% -	6-15% 6-15% <1%
	NW	Moss sp. *Agrostis stolinifera* Dwarf Raspberry	76-100% 6-15% 1-5%	76-100% - 1-5%	76-100% 1-5% solitary	76-100% 1-5% 1-5%	76-100% 6-15% <1%	16-30% - 1-5%	16-30% - 1-5%	31-50% 6-15% 1-5%	31-50% 6-15% 1-5%	31-50% 16-30% 1-5%
	SW	Moss sp. Bulblet Fern *Carex pedunculata* Glossy Buckthorn	1-5% <1% 1-5% 1-5%	6-15% Solitary - 1-5%	1-5% - 1-5% 1-5%	16-30% - 1-5% 1-5%	6-15% - 1-5% 1-5%	1-5% - 1-5% 1-5%	1-5% - 1-5% 1-5%	1-5% - 1-5% 1-5%	1-5% - 1-5% 1-5%	1-5% <1% 6-15% 1-5%
	SE	Moss sp. Bulblet Fern Glossy Buckthorn	16-30% <1% <1%	16-30% <1% <1%	16-30% <1% <1%	16-30% - <1%	16-30% 1-5% 1-5%	6-15% <1% 1-5%	6-15% - 1-5%	6-15% <1% -	16-30% 1-5% 1-5%	16-30% 1-5% 1-5%
F	NE	Moss sp. Marsh Fern Glossy Buckthorn	6-15% - <1%	6-15% - <1%	16-30% - solitary	6-15% 1-5% -	16-30% 1-5% <1%	6-15% - -	6-15% - -	6-15% - -	6-15% - <1%	6-15% - -
	NW	Moss sp. Glossy Buckthorn Canada Mayflower	31-50% 1-5% <1%	16-30% 1-5% 1-5%	16-30% <1% <1%	16-30% - <1%	6-15% <1% <1%	16-30% 1-5% <1%	16-30% 1-5% <1%	16-30% <1% <1%	6-15% <1% <1%	6-15% 1-5% <1%
	SW	Moss sp. Dwarf Sc. Rush Glossy Buckthorn Showy Ladyslipper	31-50% <1% <1% 1-5%	31-50% 1-5% <1% 1-5%	31-50% 1-5% 1-5% 1-5%	16-30% <1% <1% Solitary	6-15% 1-5% - -	1-5% 1-5% 1-5% -	6-15% 1-5% 1-5% -	6-15% <1% <1% -	16-30% <1% <1% -	6-15% <1% - -
	SE	Glossy Buckthorn Bulblet Fern	1-5% <1%	Solitary <1%	- <1%	- -	1-5% <1%	<1% -	<1% <1%	<1% <1%	<1% <1%	- -

APPENDIX 6.

Summary of 2012 and 2013 Autumn Herbaceous

Vegetation in each Sub-plot

Appendix 6. Summary of 2012 and 2013 Autumn Herbaceous Vegetation in each Sub-plot.

Plot	Sub-plot		2012		2013
		Dominant Taxa Species	**Percent Cover for the Taxa**	**Dominant Taxa Species**	**Percent Cover for the Taxa**
A	NE	*Carex hystericina* Common Mint *Poa compressa*	51-75% 31-50% 6-15%	Fowl Mana Grass *Juncus articulatus* E.W.Cedar-seedling	16-30% 6-15% 6-15%
	NW	Moss sp. Bulblet Fern *Agrostis sp.*	51-75% 6-15% 6-15%	Moss sp. Fowl Mana Grass Bulblet Fern	31-50% 16-30% 6-15%
	SW	Coltsfoot *Carex sp*. Bulblet Fern Field Horsetail	31-15% 6-15% 6-15% 6-15%	Coltsfoot *Carex schweinitzii* Bulblet Fern Field Horsetail	6-15% 6-15% 6-15% 6-15%
	SE	*Carex sp.* Watercress Kentucky Bluegrass	31-50% 31-50% 16-30%	*Bidens connata* Watercress Fowl Manna Grass	6-15% 6-15% 6-15%
B	NE	Carex *hystericina* Moss sp.	31-50% 1-5%	*Carex schweinitzii* Purple Stemmed Aster Field Horsetail	16-30% 16-30% 16-30%
	NW	Yellow Birch – saplings Moss Spp. Glossy Buckthorn – seedlings	51-75% 51-75% 31-50%	Moss sp. E.W. Cedar – seedling Bulblet Fern	51-75% 16-30% 1-5%
	SW	*Poa compressa* Tall Buttercup	31-50% 6-15%	*Agrostis stolonifera* Tall Buttercup Fowl Mana Grass *Pilea Fontana* Common Plantain Spotted Jewelweed	31-50% 6-15% 1-5% <1% 1-5% -
	SE	Tall Buttercup *Poa compressa* *Carex hystericina*	76-100% 6-15% 6-15%	Tall Buttercup *Agrostis stolonifera* *Pilea fontana* Poa compressa	16-30% 6-15% 1-5% -

Appendix 6. Summary of 2012 and 2013 Autumn Herbaceous Vegetation in each Sub-plot Cont'd.

Plot	Sub-plot	2012		2013	
		Dominant Taxa Species	**Percent Cover for the Taxa**	**Dominant Taxa Species**	**Percent Cover for the Taxa**
C	NE	*Carex sp.* Bulblet Fern	51-75% 6-15%	*Carex flava* Bulblet Fern Field Horsetail	16-30% 6-15% 6-15%
	NW	*Carex sp.* Dwarf Scouring Rush Field Horsetail	6-15% 1-5% 1-5%	*Carex flava* Dwarf Scouring Rush Common Buckthorn	6-15% 1-5% 1-5%
	SW	Field Horsetail Moss Sp. Bulblet Fern Rough-leaved Goldenrod	6-15% 1-5% 6-15% 1-5%	Field Horsetail Moss sp. Bulblet Fern *Carex flava*	31-50% 6-15% 1-5% 1-5%
	SE	Field Horsetail Coltsfoot Bulblet Fern	31-50% 6-15% 1-5%	Field Horsetail Coltsfoot Bulblet Fern	16-30% 6-15% 1-5%
D	NE	Dwarf Scouring Rush Bulblet Fern	51-75% 16-31%	Dwarf Scouring Rush Bulblet Fern	31-50% 6-15%
	NW	Bulblet Fern Shade Horsetail Dwarf Scouring Rush	31-50% 1-5% 1-5%	Bulblet Fern Field Horsetail Dwarf Scouring Rush	31-50% 6-15% 1-5%
	SW	*Carex sp.* Bulblet Fern	16-30% 1-5%	*Carex pedunculata* Bulblet Fern Dwarf Scouring Rush	6-15% 1-5% 1-5%
	SE	Bulblet Fern	16-30%	Bulblet Fern Glossy Buckthorn Moss sp.	31-50% Solitary

Appendix 6. Summary of 2012 and 2013 Autumn Herbaceous Vegetation in each Sub-plot Cont'd.

			2012		2013
Plot	Sub-plot	Dominant Taxa Species	Percent Cover for the Taxa	Dominant Taxa Species	Percent Cover for the Taxa
E	NE	Cinnamon Fern Moss sp. Marsh Fern	<1% <1% <1%	Cinnamon Fern Moss sp. Bulblet Fern	6-15% 1-5% Solitary
	NW	Grass sp. Moss sp. Field Horsetail	76-100% 51-75% 6-15%	Moss sp. *Agrostis stolinifera* Dwarf Raspberry	76-100% 16-30% 1-5%
	SW	Moss sp. Marsh Fern *Carex sp.* Glossy Buckthorn	1-5% <1% <1% <1%	Moss sp. Bulblet Fern *Carex pedunculata* Glossy Buckthorn	1-5% 1-5% 1-5% 1-5%
	SE	Moss Sp. (6-15%) Bulblet Fern Buckthorn Sp.	6-15% <1% <1%	Moss sp. Bulblet Fern Glossy Buckthorn	16-30% 1-5% <1%
F	NE	Moss sp. (1-5%) Bulblet Fern (<1%)	1-5% <1%	Moss sp. Marsh Fern Glossy Buckthorn	6-15% 1-5% <1%
	NW	Moss Sp. (6-15%) Can. Mayflower *Carex sp.*	6-15% <1% <1%	Moss sp. C. Buckthorn Canada Mayflower	16-30% 1-5% <1%
	SW	Dwarf Scouring Rush Moss Sp.	31-50% 31-50%	Moss sp. Dwarf Sc. Rush Glossy Buckthorn Showy Ladyslipper	31-50% 1-5% 1-5% -
	SE	Moss Sp. Glossy Buckthorn	<1% <1%	Glossy Buckthorn Bulblet Fern	1-5% <1%

APPENDIX 7.

Photos of Spring Vegetation Monitoring
Plots A-F,
2023

Spring 2023

Photo 1. Vegetation Plot A, facing North from Steel T-bar.

Photo 2. Vegetation Plot B, facing East from Steel T-bar.

Photo 3. Vegetation Plot C, facing South from Steel T-bar.

Photo 4. Vegetation Plot D, facing East from Steel T-bar.

Photo 5. Vegetation Plot E, facing East from Steel T-bar.

Photo 6. Vegetation Plot F, facing South from Steel T-bar.

APPENDIX 8.

Photos of Autumn Vegetation Monitoring
Plots A-F,
2023

Fall 2023

Photo 1. Vegetation Plot A, facing North from Steel T-bar.

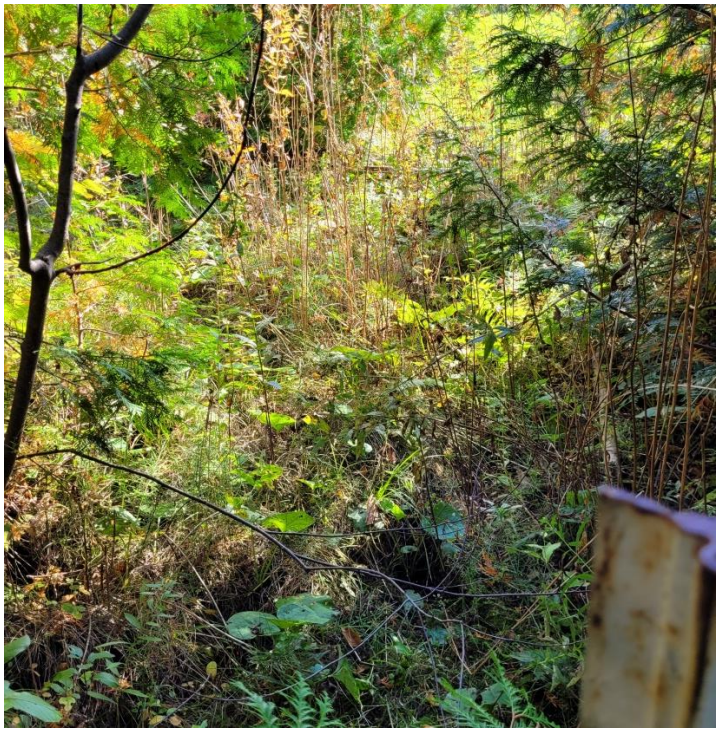

Photo 2. Vegetation Plot B, facing East from Steel T-bar.

Photo 3. Vegetation Plot C, facing East from Steel T-bar.

Photo 4. Vegetation Plot D, facing East from Steel T-bar.

Photo 5. Vegetation Plot E, facing East from Steel T-bar.

Photo 6. Vegetation Plot F, facing East from Steel T-bar.

APPENDIX 9.

C.V.s
of
Report Authors.

K.W. Dance, M.Sc.

K.S. Dance, M.E.S.

DANCE ENVIRONMENTAL INC.

KEN DANCE
CONSULTING BIOLOGIST

EDUCATION

- M.Sc., Biology, 1977; University of Waterloo
- B.Sc., Honours Biology, 1975; University of Waterloo

COURSES

- Butternut Health Assessment Workshop & Update – OMNR, 2010 & 2013
- Preparation of E.I.S. Reports – OMNR, 1995
- Bioassessments & Biological Criteria for Warmwater Streams – AFS 1993
- Ontario Wetland Evaluation System, 3rd Edition – OMNR, 1993
- Creating and Using Wetlands – University of Wisconsin, 1992
- Fluvial Geomorphology – University of Guelph and AFS, 1992

PROFESSIONAL EXPERIENCE

1991 to date. Consulting Biologist and President, Dance Environmental Inc.
The firm has completed over 440 assignments.

Mr. Dance has been consulting for 42 years and has gained extensive experience on the following types of studies: ecological inventory, biological monitoring, environmental planning, Species at Risk Overall Benefit Plans, watershed management, no net loss of fish habitat, tree saving plans, vegetation management, wetland Environmental Impact Studies, non-game wildlife and environmental assessments.

He also has experience in biological resource inventory, impact prediction, management option development and comparison, attendance at public information centres and as an expert witness before boards and tribunals.

1988-1991 Senior Biologist, Ecologistics Limited. As Senior Biologist, Ken was responsible for review of all biological projects. He consulted to private and public sector clients on management of fish, vegetation, and wildlife resources.

1985-1988 Associate and Manager of Biological Services, Gartner Lee Limited. Mr. Dance consulted to industrial and government clients.

1982-1985 Senior Biologist and Project Manager, Gartner Lee Limited.

1977-1982 Biologist and Project Manager, Ecologistics Limited.

1975-1976 Research Technician, University of Waterloo. Mr. Dance acted as a research technician on a PLUARG contract study of two streams.

KEN DANCE
CONSULTING BIOLOGIST

PROJECT EXAMPLES

E.I.S. Reports

Undertook inventory, site assessments and reporting for over one thousand sites relating to residential, industrial, aggregate and waste management proposals.

Highways and Roads

Examples of Environmental Assessment and highway construction projects, which Mr. Dance has worked on follow.

- Parkhill Road and Bridge, Cambridge – inspection of in-water construction to minimize erosion and sedimentation and construction of fish pool habitat.
- Gordon Street Bridge, Guelph – inspection of in-water construction and placement of fish habitat rock, 2000-2002.
- Highway 60 at Huntsville – inspection of in-water work during replacement of 4 culverts, including trout habitat; inspection of tree and shrub plantings.
- Highway 35 Minden – inspection of stream habitat restoration construction and inspection of tree and shrub plantings.
- Wellington County Roads – fisheries assessments for 3 culvert replacements.

Wastewater Management

- Etobicoke and Mimico Creek Watersheds: Toronto Wet Weather Flow Management Master Plan – ecological consultant addressing fish, wildlife, forests, wetlands and Lake Ontario near shore habitat.
- Thunder Bay Water Pollution Prevention Study – biological consultant addressing fish, wildlife, forests, wetlands and Lake Superior near shore habitat.
- Cincinnati and Cleveland, Ohio – CSO Review Studies: biological consultant addressing existing impacts on aquatic ecosystems and advice regarding solution options.
- Wastewater Treatment Plant Class E.A.s: biological consultant for Ayr, Flesherton, Ingersoll, Keswick, Lambeth, Tavistock and Wellesley plant upgrades/expansions.

Water Supply

Fisheries/biological assessments regarding water taking and/or facility siting for projects in Elmira, Georgetown, Acton, Cambridge, Caledon and Brampton.

Publications

Published chapters in three books. Over forty papers on fish, wildlife, wetland and vegetation management, as well as water quality and fisheries. Articles in publications such as Ontario Birds, Ontario Field Biologist, Newsletter of the Field Botanists of Ontario, Recreation Canada, Landscape Architectural Review and the Water Research Journal of Canada.

07/19

DANCE ENVIRONMENTAL INC.

KEVIN DANCE, M.E.S.
TERRESTRIAL BIOLOGIST
AND PARTNER

EDUCATION

- M.E.S., Masters of Environment and Resource Studies, 2011; University of Waterloo.
  Thesis Title: "Raptor Mortality and Behavior at Wind Turbines Along the North Shore of Lake Erie During Autumn Migration 2006-2007"
- B.E.S., Honours Bachelor of Environment and Resource Studies with Parks Option, 2006; University of Waterloo.

CERTIFICATIONS & PROFESSIONAL ASSOCIATIONS

Workshops/Certifications:

- Wildlife Acoustics: Kaleidoscope In-depth Seminar for Bat Research. Royal Ontario Museum, Toronto, Ontario. March 29, 2019. Instructor: Ian Agranat (creator of Kaleidoscope Pro).
- Wildlife Acoustics: Kaleidoscope In-depth Seminar for Non Bat Research. Royal Ontario Museum, Toronto, Ontario. March 28, 2019. Ian Agranat (creator of Kaleidoscope Pro).
- Ontario Bat Working Group, Spring 2017, Toronto Zoo.
- Bat Survey Solutions LLC. Bat Acoustic Fieldwork and Data Management Workshop. Instructors: Janet D. Tyburec and Joseph M. Szewezak (creator of SonoBat and Professor at Humbolt State University, California). February 2016, Punta Gorda, Florida.
- Wildlife Acoustics: Bat Acoustics Training with Dr. Lori Lausen, February 2015, Miami, Florida
- Butternut Health Assessment Workshop, BHA #486, July 16, 2014, re-certified in 2019.
- Dragonfly and Damselfly Identification Workshop, 2013, Guelph Arboretum.
- OMNR, Ontario Wetland Evaluation System, Northern Manual and Southern Manual. North Bay, 2012
- OMNR Ecological Land Classification for Southern Ontario, Lindsay, 2010
- Diploma of Environmental Assessment, University of Waterloo, 2006
- Member, Ontario Field Ornithologists (OFO)
- Member, Waterloo Region Nature
- Member, Canadian Herpetological Society
- Member, The Orianne Society –Reptile and Amphibian Conservation
- Member, North American Society for Bat Research (NASBR)
- Member, Bat Conservation International (BCI)
- Member, Northeast Naturalist
- Member, Canadian Field Naturalist

AREAS OF PROFESSIONAL EXPERIENCE

Kevin Dance has over 10 years of consulting experience on a wide range of projects throughout Ontario. Kevin specializes in inventories, evaluations, research, and impact studies of natural resources. He is experienced in identifying important natural features and evaluating the significance and sensitivity of these features. Kevin regularly works with multidisciplinary study teams focusing on the management of terrestrial and wetland ecosystems.

Terrestrial Vegetation and Wildlife Studies

Kevin has worked on various studies investigating a variety of wildlife habitats, determining wildlife populations including numbers and seasonal trends and monitoring of long-term impacts of

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developments on species. Kevin has conducted a wide range of monitoring surveys and inventories to identify the presence of wildlife on study sites as well as species specific guided surveys for Species at Risk and Species of Conservation Concern including:
Bobolink, Barn Swallow, Bank Swallow, Eastern Meadowlark, American Badger, Milksnake, Blanding's Turtle, Wood Turtle, Jefferson Salamander, Common Nighthawk, Whip-poor-will, Henslow's Sparrow, Short-eared Owl, Least Bittern, and all Endangered *Myotis* bat species.

He has completed numerous detailed vegetation community mapping inventories and conducted vegetation monitoring at permanent sample plots, as well as transects and random sample quadrats to assess short-term and long-term impacts of developments on vegetation. Kevin is trained and experienced in applying the Ecological Land Classification System in projects in Southern Ontario to delineate, describe and map vegetation communities.

Kevin's specific terrestrial expertise includes:

- wildlife and vegetation habitat mapping, evaluations, and research.
- surveys of plants, birds, mammals: including bats, reptiles, amphibians, dragonflies and butterflies.
- identification of rare and sensitive species and habitats.
- bat acoustic monitoring and data analysis for Ontario bat species
- development of monitoring methodologies for Species at Risk
- preparing Overall Benefit Plans and Management Plans for Species at Risk
- obtaining permitting from MNR to conduct Jefferson Salamander trapping surveys, and snake coverboard surveys
- over 15 years of bird identification experience
- identification and analysis of potential wildlife corridors.
- short-term and long-term monitoring techniques for flora and fauna

Wetland Studies

Kevin is certified to conduct Ontario Wetland Evaluations and has worked in habitats throughout Ontario using the Ontario Wetland Evaluation System for Wetlands in Southern and Northern Ontario. Kevin has also participated in numerous studies focusing on the impact of development on wetland ecology and function.

Kevin's specific wetland expertise includes:

- inventories and mapping of wetland flora and fauna.
- wetland evaluations using the Ontario Wetland Evaluation System (OWES).
- wetland boundary delineation, and regularly working with relevant Conservation Authority staff to obtain approval of boundaries
- wetland Environmental Impact Studies (EISs).

Aquatic Studies

Kevin has assisted with numerous long-term fish monitoring programs using electrofishing to sample reaches of streams to assess and monitor development impacts to cold water streams. Kevin has experience collecting fish during electrofishing sampling, fish identification, marking and measuring. He also has experience identifying aquatic and wetland vegetation as well as collection of aquatic habitat data including stream depth, temperature, stream bed composition, flow speed and invertebrate sampling. Kevin has assisted with electrofishing surveys and aquatic habitat assessments within Wellington County and the Region of Waterloo.

Renewable Energy Projects:

Kevin has extensive experience conducting and organizing both pre-construction and post-construction studies at wind farms in Ontario, Manitoba and Alberta. Kevin has been developed monitoring methodologies for mortality searches, scavenger removal trials and searcher efficiency studies. Kevin has been involved in post-construction studies at four large scale wind farms and has conducted pre-construction studies at over a fifteen wind farms throughout Ontario, Manitoba

and Alberta.

Kevin's specific renewable energy expertise includes:

- development of mortality search methodologies and conducting mortality searches, organizing and conducting scavenger removal studies and searcher efficiency trials
- identification of bird and bat fatalities
- developing study methods for pre-construction wind farm studies, including: migration surveys (dawn and dusk), daytime soaring surveys, waterfowl surveys, shorebird surveys, winter raptor and diurnal owl surveys, walking transect surveys, and driving transect surveys.

EMPLOYMENT HISTORY

Terrestrial Biologist and Project Manager
Dance Environmental Inc., Drumbo, Ontario. 2011 to present

Terrestrial and Wetland Biologist
Natural Resource Solutions Inc., Waterloo, Ontario. 2008 to 2011

Environmental Scientist
Stantec Ltd., Guelph, Ontario. 2006 to 2007

Avian Field Technician –Breeding ecology and impacts of urban development on Wood Thrush in the Region of Waterloo. Bird banding crew leader, nest searcher, nest monitoring.
Canadian Wildlife Service and University of Waterloo, Waterloo, Ontario 2003 to 2005

Terrestrial Biologist
Dance Environmental Inc., Drumbo, Ontario 2001 to 2003

PUBLICATIONS, PRESENTATIONS, AWARDS

Dance, K.S. 2019. Finding Bats Based on Their Calls (Pittock Reservoir, Woodstock). Outing for the Woodstock Field Naturalist Club. Outing leader.

Dance, K.S. 2017. Bats in Urban Natural Areas: A case Study of Kitchener Natural Areas. Oral Presentation. Nature in the City Speaker Series, Kitchener Public Library. November 15, 2017.

Dance, K.W., K.S. Dance, & M.B. Dance. 2012. Giant Ragweed (*Ambrosia trifida*) as a Food Source for Autumn Migrants and Winter Birds in the Grand River Basin. Ontario Birds 30(3):148-164.

Dance, K.S. 2012. Manipulation of Caterpillars for Consumption by Eastern Bluebirds. Ontario Birds 30(2):102-108.

Dance, K.W., K.S. Dance. 2012. Wetlands: What are they Good For? Oral Presentation. Princeton Historical Society. Princeton, Ontario. September 24, 2012.

Dance, K.S. 2011. "Raptors and Wind Farms". Oral Presentation. Ruthven Park 2nd Annual For The Birds Festival. September 17, 2011.

Dance, K. S. 2010. On the Wind: A Discussion of Raptors and the Wind Industry. Oral Presentation. Owen Sound Field Naturalist Club (OSFN). September 9, 2010.

Dance, K. S., Dance, K. W. 2010. "Raptors on the Wind". Oral Presentation. Kitchener-Waterloo Field Naturalist Club (KWFN). March 22, 2010.

Dance, K. S., Dance, K. W. 2010. Review of Raptor and Turbine Interaction Literature: the Case of the Erie Shores Wind Farm. Oral Presentation. RARE Charitable Research Reserve, Cambridge, ON. January 23,

2010.

Dance, K. S., R. James, L. Friesen, S. Murphy. 2009. “Raptor Behavior and Mortality (Erie Shores Wind Farm)”. Poster Presentation. Canadian Wind Energy Association Annual Conference & Exhibition. September 20-23, 2009.

Dance, K. S., R. James, L. Friesen, S. Murphy. 2009. “Migrant Raptor Behavior and Mortality (at the Erie Shores Wind Farm)”. Poster Presentation, 3rd place winner. A.D. Latornell Conservation Symposium. Nottawasaga, Ontario.

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