MEMORANDUM

TO: Coalition for a Better St. Catharines
c/o Dennis Van Meer dennis.vanmeer@uswa1005.ca
St. Catharines ON

FROM: D.G. Fitzgerald, Ph.D.* (ELM Inc.) and L.S. McCarty, Ph.D. (LSM SR&C)

DATE: August 25, 2020

TOPIC: **Review of land near 282 Ontario Street, St. Catharines ON**

The findings reported in this Memorandum were based on observations on plants, soil, water, and other environmental features on July 25, 2020 along with a brief review of public literature. As such, the use of this report is subject to the Statement of Limitations (SOL) presented at the end of this Memorandum. The reader's attention is specifically drawn to the SOL as it is considered essential that they be followed for the proper use and interpretation of the recommendations.

1. Introduction

Representatives from Coalition for a Better St. Catharines (CBSC) involving D. Edell, J. Richardson, D. Sawyer, E. Smith, and D. Van Meer met with Dean Fitzgerald, Ph.D., Senior Ecologist from ELM Inc. (ELM) and Lynn McCarty, Ph.D., Senior Ecotoxicologist from LSM SR&C, on July 25, 2020. During this meeting, the group inspected land near 282 Ontario Street, St. Catharines, ON, in proximity to Twelve Mile Creek (TMC); this area represents the Site of interest (Figure 1).

In response to the inspection, we have prepared a brief review of the land use history of the Site. This provides a basis to identify possible source(s) of contamination that may explain vegetation and soil patterns evident in proximity to drainage channels that end at TMC (Figure 2). Consideration of historical land use acts as the basis for an initial explanation for 1) types of vegetation, 2) health of the vegetation, and 3) distribution of vegetation in proximity to the Site. This is useful as the type, health, and distribution of vegetation often reflects contaminants within an area of interest, as well as may indicate possible risk to wildlife and human health in the area.

This memorandum is focused on reviewing information on past land use near the Site to assess possible source(s) of contamination, and to identify evidence of possible off-Site transport of contaminants. With this assessment of evidence, it becomes feasible to quantify possible exposures and potential risks to environmental receptors, such as fish and humans, in the TMC watershed. Additionally, we provide an overview of the generic "brownfield redevelopment" process in Ontario and indicate where this Site appears to be in this iterative process. Generally, iterations in "brownfield redevelopment" are required to address progressive rehabilitation, as contamination is initially quantified and then managed.

*-Dr. Fitzgerald can be reached via Dean@elminc.ca

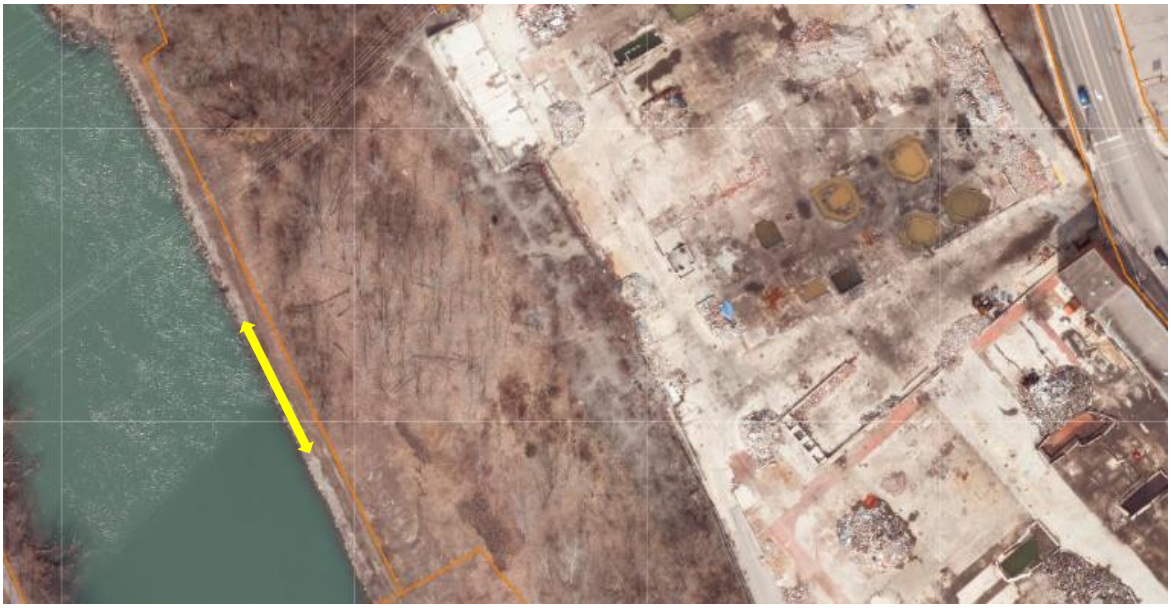

Figure 1: View of the lands near 282 Ontario Street in proximity to TMC. Property lines are marked with the orange lines. These lines show a public bike path exists along TMC (marked with the yellow arrow). Image sourced from public database (https://www.niagararegion.ca/exploring/navigator.aspx).

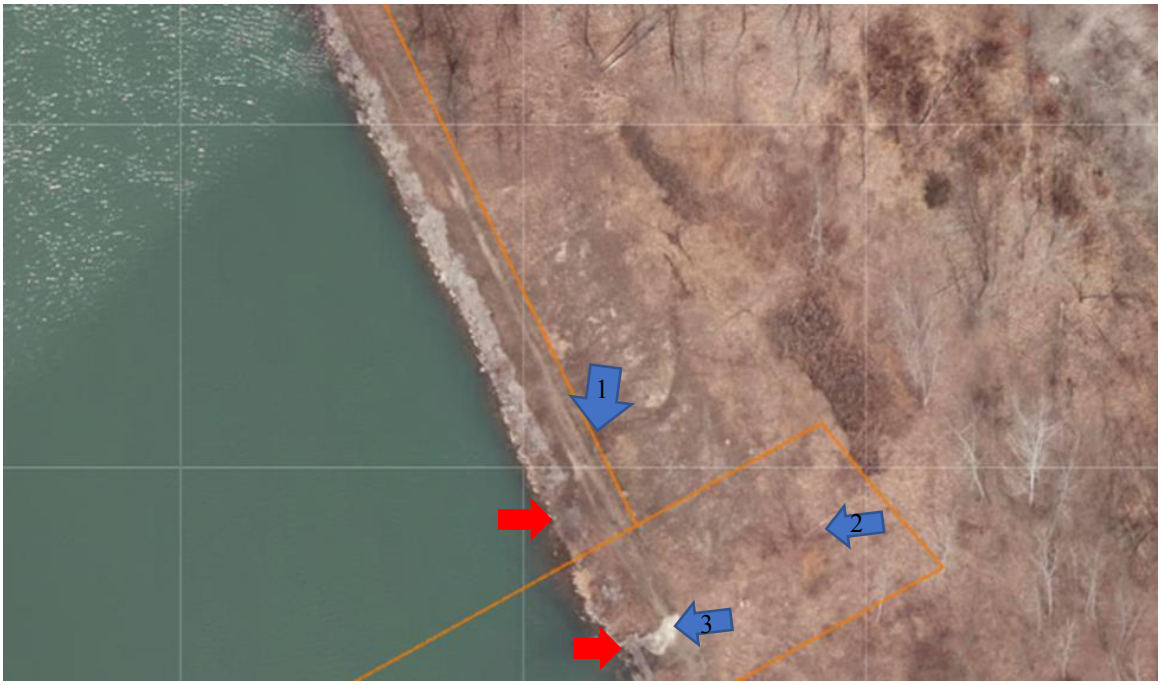

Figure 2: Another view of 282 Ontario Street in proximity to TMC. Property lines are marked with the orange lines. Three arrows (blue) show two drainage channels inspected on July 25, 2020. These drainage channels flow downslope and intersect the bike path, and then end at TMC (marked with red arrows). Image sourced from public database (https://www.niagararegion.ca/exploring/navigator.aspx).

2. A Brief History of the Site

A brief literature review, as well as communications with CSBC, facilitated preparation of a summary of local land use activities for the 1800s to 2020 (Table 1). This activity shows that the Site has been constantly disturbed during this period; a provisional list of contaminants is noted. Although likely incomplete, this summary should be adequate for scoping purposes. Table 2 notes contaminants and possible exposure pathways via dust, soil erosion, and water for off- and on-Site sources.

Although it is beyond the scope of this memorandum, we feel this disturbance history is sufficient justification for completion of a thorough evaluation of existing air, surface water, groundwater, and soil monitoring data for the local area and, particularly, the Site. This would improve confidence in the list of expected contaminants of concern in Table 1. In this context, a number of abandoned groundwater sampling wells were observed along the edge of TMC on July 25 suggesting minimally that groundwater monitoring data has been collected in this area in the past. This past groundwater monitoring data would provide ancillary evidence of contaminant(s) near TMC.

Table 1: Land use for Site with sources of disturbance and possible contaminants from 1800 to 2020

Date	Disturbance (Sources)	Implication	Possible Contaminants
1800s – 1820s	Forest burning and harvest for farms, housing, roads	Major disturbance along entire TMC watershed.	Ash, dust, hydrocarbons, metals, sediment, sewage
1820s – 1829	Construction / Earthworks for Old Welland Canal (OWC)	Excavation and engineering of TMC; wetlands also lost.	Ash, dust, hydrocarbons, metals, sediment, sewage
1829 – 1900s	Operation of OWC	Disturbance from boats and traffic along TMC; runoff from shoreline to TMC.	Ash, dust, hydrocarbons, metals, sediment, sewage
1829 – 1900s	Operation of Commercial, Manufacturing, and Houses	Flat land draining to TMC developed for residential, commercial, and industrial uses. Surface and groundwater runoff from area to TMC. Conduit for storm-water and groundwater to TMC.	Ash, dust, hydrocarbons, metals, sewage
1940s – 1950s	Manufacture of electric transformers		Hydrocarbons, metals, PCBs
1950s – 2020	Electricity transformer Station		Hydrocarbons, metals, PCBs
1918 – 2010	Manufacture of motor vehicles; change of ownership in 1929		Ash, dust, hydrocarbons, metals, sewage
2014 – 2017	Active demolition of motor vehicle manufacturing facility	Airborne dust, precipitation-induced surface runoff, & groundwater all transporting substances off-site to TMC.	Ash, dust, hydrocarbons, metals, water drainage
2017 – 2020	Demolition incomplete. Site insecure with transport of dust and water off-Site	Continuing off-site transport of dust from rubble and debris. Continuing off-site transport of chemical substances in surface runoff & groundwater to TMC.	Ash, dust, hydrocarbons, metals, water drainage

Table 2: Likely Exposure Pathways for Contaminants Originating From the Site Via Dust Erosion, and Water (groundwater and surface water)

1 Dust: long distance transport of ash, asbestos, silica from off-Site areas to the Site;
2 Dust: ash, asbestos, silica from operations and demolition to air and adjacent residences;
3 Erosion: dust and soil to surface water;
4 Water: petroleum-based products (e.g., operations, spills) and inorganic compounds (e.g., metals) leaching from contaminated soil to groundwater and then to surface water;
5 Water: petroleum-based products (e.g., operations, spills) and inorganic compounds (e.g., metals) leaching from contaminated soil directly to surface water;
6 Water: materials like road salt leaching to groundwater and surface water; and
7 Dust, Erosion, Water: transport of PCBs from area where electrical transformers were manufactured now occupied by electricity transformer station to adjacent lands.

3. Field Observations

During the inspection, the drainage channels identified within the aerial photographs (Figures 1 and 2) were found and photographed while standing on or near the public bike pathway. These drainage channels exist on the sloped shoreline and extend to the bike pathway, ultimately draining to TMC. These channels are each about 1 m wide (Plates 1 and 2). Generally live vegetation exists along the edge of the channels and are limited to tolerant weeds with sparse density and bare soil in the channels. As well, trees that grow near the channels show dead branches along the channel, suggesting the roots near the channel are stressed and possibly dead even though the soil is intact (Plate 3).

This pattern suggests transport of chemicals from the drainage channel to the roots of the nearby trees along the drainage path to TMC. We observed the presence of white particulate residues in the channel, with sparse vegetation in the channel, and dead branches on woody stems near the channel. These observations collectively suggest runoff to TMC contains contaminants that are causing the noted white particulate residues, low plant diversity, limited distribution of plants, bare soil, and adverse effects (dead branches) in local vegetation. Since this pattern indicates an association with drainage, a more detailed follow up study would be appropriate to ascertain the contaminant(s) that are the likely causative factor(s) for the observed soil and vegetation effect patterns. The presence of disturbed/ distressed vegetation along drainage to TMC also indicates these contaminants are likely entering TMC, with unknown consequences on wildlife and human health. Chemical analysis of the particulates in the dry channels could identify the type(s) of chemicals in drainage during wet periods.

The above evidence of the presence of unknown contaminant(s) on the site suggests that some contaminants may also be migrating from the Site to adjacent residential areas via surface water, ground water, or wind-blown dust, as migration of contaminants does not occur only in one direction or by a single pathway. As such unknown contaminant(s) may represent hazards and risks to adjacent residential neighbourhoods further off-site investigation by these exposure pathways is warranted.

Plate 1: View of drainage channel looking upslope, marked with metal stake, that is about 1 m wide and about 0.5 m deep. Plants are sparse in the channel but grow along the edge, and thereby obscure the presence of bare soil in the channel. This channel corresponds to the location marked by blue arrow 1 in Figure 2.

Plate 2: View of drainage channel in Plate 1 looking downslope to public bike path and drainage to TMC (red arrow). This channel shows bare soil with sparse plants in the general area, marked by blue arrow 1 on Figure 2.

Plate 3: View of Willow (*Salix* spp.) growing next to drainage channel, upslope of view in Plate 1. Note how most branches over the drainage channel are dead (orange arrow) whereas the branches on the opposite side of the trunk are green and seem healthy (green arrows). This pattern implies roots near drainage channel are dead.

4. An Outline of "Brownfield Redevelopment"

The regulatory framework for rehabilitating an existing contaminated land and water falls under what is often generically termed "brownfield redevelopment" in Ontario. Without reference to any specific regulatory framework, it follows a general process using a two-stage approach. Depending on the complexity of the land and water, the selected approach may have more than two stages.

Stage 1

- close the land and secure the facility, to prevent public access to possible health and safety hazards;
- remove equipment and valuable salvageable material;
- demolish the buildings and remove all debris to appropriate disposal facilities;
- when large areas are covered with concrete or asphalt, like the Site, such water-impermeable cover must be removed to control drainage. As well, existing ponds, whether natural or man-made must be drained to prevent migration of contaminated liquids to proximate lands and water; and
- as the soil under the concrete/asphalt is exposed, and considered a contaminated "brownfield", the land and drainage must be secured against migration of soil and dust via air and water.

When Stage 1 remediation is completed, the land may be held indefinitely, with modest monitoring requirements to ensure no unacceptable migration of contaminants occurs. A key concern for Stage 1 is to ensure off-Site migration is controlled to reduce risk to adjacent lands. It is prudent to secure all sources of contaminants from any "brownfield redevelopment" as soon as feasible. Once the specific Stage 2 process is established and agreed to by all relevant parties, work can begin. Often the findings from Stage 1 are used to facilitate consultation with stakeholders, including adjacent landowners, local governments, and provincial ministries.

Stage 2

- a detailed (by area and depth) soil contamination survey is necessary to determine the identity, quantity, and extent of contaminants that, based on review, are or are likely to be found;
- a detailed (by area and depth) groundwater survey is necessary to provide additional resolution on the spatial distribution of contaminants;
- based on the soil contamination survey, in conjunction with the applicable contaminated soil regulatory guidance and land use classification, areas classified with a scheme such as highly contaminated (must be removed to a contaminated soil disposal site), moderately contaminated (may require specialized construction approaches and/or designs depending on where they occur in the proposed development), and similar to background (no special approach required);
- based on the groundwater contamination survey, in conjunction with Provincial guidance, identify options for management and possible treatment of groundwater prior to discharge to TMC;

● redevelopment and or remediation can begin with specific requirements and monitoring, as justified by the soil contamination survey, as specified by applicable regulatory and local requirements;
● use monitoring observations to prepare a cost estimate to complete clean up for alternate scenarios;
● use monitoring to assess short- and long-term risk to human health from exposure scenarios;
● subsequent to completion of the development, post-project air, water, and/or soil monitoring may be required, to ensure that specific regulatory cleanup objectives are achieved.

In summary, the generic "Brownfield Redevelopment" process outlined above is followed to ensure the location remains secure and does not become an additional source of contaminants migrating to adjacent lands, either during demolition/cleanup or during/after subsequent redevelopment under changed land use specifications.

5. Path Forward

This review identifies the long history of disturbance for the Site and evidence of substantial past environmental monitoring. The identification of how the Site was disturbed also reveals the wide range of possible sources of contamination. Inspection of some disturbed areas identified the likely presence of contaminants migrating to TMC. This migration of contaminants to TMC leads to the corollary that other contaminants may be moving from other areas to residential lands. At this time, the most important current consideration is that the Site demolition activities are incomplete. Since the Site is not demolished, large areas of debris exist in an uncontrolled state, available to migrate off-Site.

Using the simple two-stage "Brownfield Redevelopment" scheme outlined above as a basis, it is clear the first goal that must be achieved in the near-term is completion of Stage 1; demolition, cleanup, and securing the site to limit off-Site contaminant transfer. The latter may simply be establishing a vegetative cover to prevent off-Site dust transfer and reduce off-Site soil transfer from precipitation runoff. At this point, while negotiations on establishing a generally acceptable Stage 2 plan are underway, some site-specific information should be collected, to assess risk to human health and TMC.

In this regard, field studies to identify and quantify the contaminants that may exist along the shoreline of TMC associated with the vegetation stress associated with drainage channels is warranted. In conjunction with a review of existing chemical monitoring data for the Site and off-Site areas, such work would improve identification and quantification of loadings of contaminants both in the past and during the period between completion of Stage 1 and the commencement of Stage 2. For example:

1 Quantify contaminants in dust migrating to TMC and to adjacent land uses;
2 Quantify contaminants migrating to TMC via surface water;
3 Quantify contaminants migrating to TMC via groundwater;
4 Quantify contaminants migrating to TMC via storm water sewers;
5 Quantify contaminants migrating to adjacent land uses along TMC;
6 Quantify contaminants evident in soil associated with former OWC shoreline along TMC;

7 Secure / stop transport of contaminants in water and dust arising from incomplete demolition from migrating to TMC, as needed;
8 Secure / stop transport of contaminants in water and dust to adjacent land uses, as needed.

After the contaminants are better identified, spatially mapped, and ranked according to relative risk to wildlife and humans, this information will aid in formulating guidance for overall management of the Site irrespective of the timing or nature of the ultimate redevelopment plan. Such multi-media analysis is required to estimate costs for handling, transport, and disposal of contaminants in soil. This requirement may also include estimation of costs to treat drainage water. The reader's attention is specifically drawn to the *Statement of Limitations*, as it is considered essential to be followed for the proper use and interpretation of the recommendations.

STATEMENT OF LIMITATIONS

All interpretations provided in this Memorandum regarding land at and in proximity to 282 Ontario Street, St. Catharines, ON reflect direct observations during the inspection. These observations were interpreted using past experience from other similar settings in Ontario. After the land and vegetation was observed, it provided the basis to provide aforementioned interpretations based on best professional judgement. This Memorandum also relies on the findings reported within articles in public newspapers and aerial photographs available from a public database. The Memorandum was prepared for the sole benefit of Coalition for a Better St. Catharines.

The interpretations included within this Memorandum reflect guidance provided in the past to the authors by government agencies for similar sites in Ontario. This past guidance was provided by Ontario Ministry of Natural Resources and Forestry, Ontario Ministry of Environment, Conservation, and Parks, Environment Canada and Climate Change, and Department of Fisheries and Oceans as well as the Region of Niagara. These interpretations were presented for the purposes of assessing possible contamination of soil, water, and vegetation as well as processing a zoning / development application that may possibly occur in the future. This report may not be relied upon by any other person or entity without written authorization of Coalition for a Better St. Catharines and ELM Inc.

Any conclusions or recommendations presented in this report were developed in accordance with currently accepted assessment standards and practices at ELM Inc. and LSM SR&C. This presentation also reflects the professional judgment by the authors based upon a brief literature review, other work on similar sites on Ontario in the past as well as the focal inspection on July 25, 2020.

While efforts have been made to substantiate information provided by third parties, ELM Inc. and LSM SR&C makes no representation or warranty as to its completeness or accuracy. As a result, this report does not guarantee that 282 Ontario Street, St. Catharines is free of hazardous or potentially hazardous material or conditions, or that latent or undiscovered conditions will not become evident in the future. Since land use activities are beyond control and can change at any time after the completion of this Memorandum, the observations, findings, and opinions can be considered valid as of the date hereof.

The scope of this Memorandum is limited to the matters expressly covered. The scope of services performed in the execution of this investigation may not be appropriate to satisfy needs of others, and any use or reuse of this document or the findings, conclusions, or recommendations represented herein is at the sole risk of said users.