

**An Overview of the Phase II Environmental Site Assessment
7000 Campeau Drive, Kanata, ON
Report [PE4321-2R] by Paterson Group for ClubLink May 20, 2020**

Link to Original Report

http://webcast.ottawa.ca/plan/All_Image%20Referencing_Subdivision_Image%20Reference_2020-07-16-%20Phase%202%20ESA-%20D07-16-19-0026.PDF

Background

- The KGPC raised the possibility of mercury contamination on the site of the Kanata Golf Club (KGC) lands in a November 2019 with the City of Ottawa Planning staff. A Phase II ESA completed by the Paterson Group and included in the original development application, identified a mercury reading of 2.3 mcg/gm in one sample , over 8.5 times the Ministry of the Environment, Conservation and Parks (MECP) Residential Limit of 0.27 mcg/gm
- The topic was included in the City of Ottawa’s Technical Comments and feedback to the proponents in December 2019. Additional Phase II study was completed by the Paterson Group in early May 2020 and was reported in this Phase II ESA titled PE4321-2R on May 20, 2020
- The above report was received and published by the City of Ottawa in July 2020 along with the entire ClubLink development application resubmission for the property
- The catastrophic risks to health and life by mismanaged mercury exposure are well documented. It should suffice to say that the World Health Organization (WHO) cites mercury among the top 10 chemicals causing major public health concerns in their overview on the risks and consequences of mercury contamination.¹

Literature Search

Historical Use of Mercury-Based Products (excerpt)

The mercury-impacts identified at Hillcrest Golf Course are from historical use of mercury-containing fungicides and other turf management agricultural products **commonly used on golf courses in the past**. These products were widely used across the United States and Canada, particularly in northern climates, to protect against seasonal, mold-related, turf problems.

¹ World Health Organization, <https://www.who.int/news-room/fact-sheets/detail/mercury-and-health>, March 31, 2017

Use of mercury-containing products on golf courses dates back to the 1950s and continued into the 1990s. These products were routinely applied to greens and/or other golf course areas, multiple times per year, using industry standard practices and applicable product label information. Since mercury in this form is relatively immobile, the result was elevated mercury concentrations in shallow soil, primarily the upper 12,” where the product was applied.

However, as a practical matter, the **MDA would expect mercury impacts to be properly cleaned-up should the property change use in the future.** When conducted, such cleanups are designed to ensure the remaining soil meets standards that are consistent with the future use of the property.²

Golf Course Contamination from Pesticide Use (excerpt)

Recently, the Minnesota Department of Agriculture (MDA) became aware of high levels of certain heavy metals in tee boxes and greens of golf courses undergoing conversion to residential use. The MDA believes these high levels of mercury and arsenic are the result of normal, legal use of certain herbicides and fungicides over many years....developers to conduct assessments and take appropriate measures if contamination exists.³

Distribution of Mercury Residues from the Use of Mercurial Fungicides on Golf Course Greens (excerpt)

Soil samples taken from two golf courses (North Halton and Mississauga, Ontario) with a long history of mercurial fungicide use for disease control showed mercury residues in excess of background levels to a maximum depth of 30 cm at one site and 60 cm at the other. Laterally, residues were found up to 30 m from the treated areas.

Not only does organic matter have a high capacity for retaining mercury (Maclean 1974), but there is evidence that some of the mercury that enters the soil is absorbed by the grass roots and moves up into the leaves by translocation (Gilmour and Miller 1913). In the present study, the difference in location of residue in the soil layers might be explained on the basis of soil texture, based on particle size. Results of laboratory analysis for particle size of the soil samples showed that the upper 10-cm increment of North Halton soil contained 13.5% clay compared with 4.5% for the Mississauga site. According to Aomine and Inoue (1961) soils retain chemical residues due to adsorption by both mineral and organic colloids but of these, the clay minerals are far the most important for mercury retention.

² Blog, Saint Paul Port Authority, May 30, 2019 <https://www.sppa.com/golf-course-contamination>

³ Minnesota Department of Agriculture, March 2015 <https://www.mda.state.mn.us/sites/default/files/inline-files/golfcoursecontamination.pdf>

The results given in Tables I and 2 show appreciable lateral movement of mercury from the site of application. How this movement occurs is not clear. Movement in drainage water is not a satisfactory explanation because, at both sites, residues uphill from the green were similar in magnitude to those downhill.

The evidence presented, both the experimental and from a review of literature, suggests that prolonged usage of mercurial fungicides on golf course greens can result in a pollution hazard. Although downward movement in the soil is not sufficient to pollute ground water lateral movement, however it occurs, is sufficient to potentially pollute water at distances up to 30 m from the treated area.⁴

Amounts of Mercury in Soil of Some Golf Course Sites (excerpt)

The amounts of Hg in the turf were high near the green but they decreased with distance, although here was as much as 7.50 ppm at 30.8 m from the green of fairway III. The surface soil (0-15 cm) at the edge of the green of fairway I contained a high concentration of Hg. The amounts decreased with distance from the green and dropped abruptly below the 15-cm depth. The data for fairway II showed a trend similar to that found in no. I, except that the zone of Hg retention by the soil extended slightly deeper. Fairway III contained by far the highest amounts of Hg and there was evidence of it leaching. The degree of leaching of Hg and its retention in the subsoil layers of the different fairways was in the order of sand < loam < clay loam and was in accord with the organic matter content of the samples.

The high amounts of Hg found in the surface soil layers were in agreement with the reported high retention of Hg by the surface layer of the Banff Springs Golf Course (Lebeau 1970). On the other hand, the occurrence of leaching of Hg to deeper soil layers as shown in the no. III course has been reported by others (Aomine et al. 1967). The retention or leaching of Hg in different soils may be expected to depend greatly on the forms of Hg and on amounts and nature of the organic matter and clay present. Although soil has a high adsorptive capacity for Hg (Jonasson 1970), our data illustrate that Hg applied to the surface may be leached to deeper layers and under some conditions may move laterally.⁵

An Overview

Absence of an Informed Testing Strategy

We were unable to find in this report a sampling strategy to organize a process for further assessment of this site for the presence of mercury. The citations from the St. Paul Authority

⁴ Fushtey, S. G. and Frank, R. , Canadian Journal of Soil Science 61: 525-527 (August 1981)

⁵ MacLean, A. J., Stone, B. and Cordukes, W. E. , Canadian Journal of Soil Science 53: 130-132 (February 1973)

and the Minnesota Department of Agriculture above confirm that the highest mercury deposits secondary to the historic use of fungicides on golf courses are found on tees and greens where turf quality is typically most valued and where, as a result, these toxic products were widely used to retard the damaging effects of snow mould.

In an effort, to understand where the testing in this Phase II ESA was done relative to these high risk areas, we created the following table in an effort to correlate the locations of mercury sampling to the test levels obtained. The data in the table was derived by taking the bore and auger hole data points in the Test Hole Location Plan PE 4321-3 (page 40) and matching them to the mercury concentrations recovered and noted on the Analytical Testing Plan PE 4321-4R (page 41) of the report.

KGC Hole	Tee	Survey Site ID	Reading mcg/gm	Greens	Survey Site ID	Reading mcg/gm
1	0			0	HA 1-20	
2	0			0	HA 3A-20	2.5
3	0			0	HA 1	
4	0			0	HA 5B-20	0.4
5	0			0	HA 6A-20	2.6
6	1	HA 7A-20	0.5	0		
7	0			0	HA 9A-20	2.7
8	0			0	HA 10B-20	
9	0			0	HA 12A-20	1.7
10	0			0		
11	0			0	HA 17A-20	0.8
12	0			0	HA 32A-20	2.6
13	0	HA 15-G1	2.3	0	HA 25-20	1.7
		HA 28-20	1		HA 14-G1	0.6
14	0			0		
15	0			0	HA 19-20	2
16	0			0	HA 18-20	0.5
17	0			0		
18	0			0	HA 13-20	0.9

The sample sites in the area of tee boxes and greens were scored in an attempt to correlate their location to the actual tee or green features on the map. Survey sites found to be located on a tee or a green scored 1 point ; sites beyond the feature scored 0.

- Only one tee site was sampled (Hole 6) although there are over 50 tee boxes on the course of various sizes and with varying elevations
- Fourteen sites near greens were tested but all testing locations avoided the green surfaces as noted above by the Paterson Group

As the Phase II Property is occupied by an operational golf course, borehole locations were limited to the roughs, off the edges of the fairways (page 8)

Despite the direction from available research, it is hard to understand the lack of serious effort at sampling the critically important tees and greens

- **Tee Boxes 1/50 represents 2 % of boxes tested (approximate)**
Greens 0/18 represents 0 % of greens tested

Red results in the Survey Site ID and Reading chart columns above indicate a result beyond the Ontario MECP Acceptable Ground Level Limit of Residential Mercury of 0.27 mcg/gm.

- The table clearly indicates **a serious level of mercury contamination across this site (of almost 10 times the MECP residential limit in several locations) despite what is an obvious failure to test the tees and greens where the mercury contamination would be the highest. Fully 15 of 55 tests (27.3%) yielded unacceptable levels of mercury.**
- Further, there were no samples taken at all proximal to tee or green on several holes (eg: Holes 10, 14 and 17). No explanations were noted.

The contamination is widespread - mercury values exceeding residential limits were found on 12 of the 14 golf course holes tested (86% exceed rate) and in all four parcels of land that comprise the KGC property. Each parcel requires the filing of a Record of Site Condition (RSC) according to Ontario standards for contaminated properties. The following indicates the current layout of the KGC holes relative to the land parcel and the number of exceed reads of mercury.

- Parcel 1: contains KGC Holes 1, 2, 6,7, 8, 9, 10, 11, 17, 18 **(6 exceed reads)**
- Parcel 2: contains KGC Holes 3, 4, 5 **(2 exceed reads)**
- Parcel 3: contains KGC Hole 13 **(4 exceed reads)**
- Parcel 4: contains KGC Holes 12, 14, 15, 16 **(3 exceed reads)**

The sampling pattern appears without design or an identifiable testing frequency (i.e.: number of samples per square metre) and as noted above, the test locations appear entirely arbitrary.

- **There were only 55 mercury samples noted on a 175 acre site which represents 1 test per 3 acres of land. The site is immediately adjacent to properties containing over 630 residences and with surrounding neighbourhoods housing of upwards of 7,000.**

Manipulation of Sampling Site Locations

In addition to the absence of a sampling strategy, the testing was further skewed by the involvement of the property owner at the outset.

To minimize damage to the golf course, near surface samples were collected using sampling equipment provided by ClubLink and where samples were required on the greens, they were taken from the fringe at the request of ClubLink. (page 8) (highlights added)

In an effort to keep the course playable, the owner ClubLink prevented its contractor from assessing the environmental condition of the site without bias. It is unclear to the reader why the Paterson Group did not supply its own equipment to conduct the surveys. The limiting of bore hole sites to “roughs and off fairway locations” was noted above and is not consistent with the areas where the mercury based fungicides would have been primarily used.

- **Furthermore, and based on the report of the Saint Paul Port Authority cited above, the eighteen greens which ClubLink prevented the Paterson Group from sampling, may well reflect the highest levels of mercury contamination on the site.**

Failure to Review Property History to Identify Other Contaminated Areas

There is no evidence that the longstanding use (over 50 years) of portions of the property as a golf course was considered when choosing contamination testing sites. The areas of the property that were most exposed to mercury, were those operating from 1968 to the 1980's as part of the original 9 hole KGC golf course. Today, these lands would approximate the current KGC Holes 1, 4, 5, 6, 7, 8.⁶

- The retired tee box and green locations from the period of 1968 to the mid-1980s, before the course was expanded to 18 holes were not identified by mapping on the Test Hole Location Plan PE 4321-E. It is imperative that these sites be mapped and included as part of any sampling plan given these sites would have received the greatest and longest exposure to the original source of mercury.

Further, there is no indication in the report that a review of engineering and construction documents related to the expansion of the golf course from 9 to 18 holes in the 1980s was completed. Such a review could identify sights of blasting, regrading and other soil displacement that potentially displaced mercury deposits at that time. We know there to be a number of people in the community who could potentially benefit such a review.

⁶ McLean, Joe https://flagstick.com/tee-shots/kanata-golf-country-club/?utm_campaign=shareaholic&utm_medium=email_this&utm_source=email, March 8, 2008

Sampling Impediments Identified by the Expert

There were additional impediments identified in the report by the Paterson Group which further compromised the sampling program

Physical impediments encountered during the Phase II ESA field program include the location of buried services and the fenced storage area adjacent to the Turf Building which limited the selection of borehole locations on the southeastern portion of the site. (page 8) (highlights added)

It is well documented that this golf course property was modified with an extensive underground drainage system to ensure the two naturalized ponds could adequately function as holding tanks for the stormwater management (SWM) requirements of this 175 acre site and the residential development surrounding it. The report could well be referring to these or other services buried given the entire property is embedded and immediately and fully surrounded by a developed urban residential subdivision.

- **Regardless, buried services should not obviate appropriate testing to identify a public health hazard such as mercury contamination.**

A Lack of Clarity on Groundwater Testing

The report confirms that mercury levels in the groundwater are acceptable for residential development. Does groundwater testing at depth alone assure water safety across the site? This report does not address the broad research that describes the potential for lateral mercury migration through soil nor other important factors such as the contribution of the soil type or mercury form (chemical nature) to its portability.

- **Migration of Mercury:** Fushtey et. al. ³ above concluded that mercury in one of two contaminated Ontario golf courses moved both downhill and uphill. Pollution by mercury at a surface depth of only 10cm moved laterally up to 30 metres away dependent on conditions.

The Paterson Group, in its Geotechnical Investigation report for the site noted multiple sites (five) where groundwater was measured not at depth but within less than one-half metre from the surface and where, it was noted that extensive pumping will be required during construction to manage the surface water.⁷

- BH 11-19 0.15m from surface (existing Hole 4 on Parcel 2)
- BH 15-19 0.12m from surface (existing Hole 12 on Parcel 4)
- BH 16-19 0.11m from surface (existing Hole 12 on Parcel 4)
- BH 17-19 0.10m from surface (existing Hole 14 on Parcel 4)

- BH 19-19 0.39m from surface (existing Hole 13 on Parcel 4)

However, the Phase II ESA report does not mention or address the potential for mercury migration through lateral soil migration, the impact to surface groundwater on that migration or the contribution of soil type or the chemical form of mercury to its portability.

- **Without a more robust testing plan to understand the potential for the documented lateral spread of mercury given the substantial amount of surface water on this site and, the above research citing the ability for bound mercury to move across a soil surface as opposed to washing deep, it seems that the safety of groundwater cannot be assumed by testing at depth alone.**
- **Soil Type:** Fushtey³ also concluded that different soil types have distinct binding capacities for mercury specifically. Clay minerals have the greatest propensity for mercury retention. The Paterson Group in its Geotechnical Investigation report for the site describes the soil

*Generally, the subsurface profile encountered at the test hole locations consists of a topsoil layer and/or fill overlying a very stiff to firm silty clay deposit at depths up to 20 m below existing ground surface.*⁷

There is therefore an expectation that the upper layers of the soil on the KGC property, due to high clay mineralization, may have the ability to substantially retain mercury and therefore, be a serious risk to public health should the soil be disturbed through property redevelopment associated with blasting, hoeing, grading etc.

- **Chemical Form of Mercury:** MacLean et. al.⁴ also notes that the chemical form in which mercury presents can be an additional factor in its mobility and its affinity for the organic ingredients found in soil. We could not find the details or discussion in the report as to what state the mercury found on the KGC lands was in. This is another unassessed but presupposing factor to the mobility of the mercury on this site.

Mercury should not be Disturbed

The lack of commentary and investigation in this Phase II study regarding the above complicating risk factors evident with this contamination is of great concern to our community. Of greater concern is the knowledge that the redevelopment of this site necessarily involves extensive blasting throughout to address bedrock at both surface and depth; excavation and hoeing secondary to the blasting for street and service formation on areas of the property

⁷ Paterson Group, Geotechnical Investigation [PG4135-2 Revision 4], May 26, 2020
http://webcast.ottawa.ca/plan/All_Image%20Referencing_Subdivision_Image%20Reference_2020-07-16-%20Geotechnical%20Study-%20D07-16-19-0026.PDF

where groundwater is marginally below the surface and will require pumping during construction⁷; fill grading at levels of up to 3 meters in different areas of the property as well as the creation of new stormwater drainage infrastructure.

As a result of the proposed plan of redevelopment, certain areas of the course have higher expectations of soil disturbance within extremely close proximity (10 metres or less) to existing homes. **No additional mercury testing was done in these areas despite the substantial soil disruption proposed**

- Hole 9 & 18: Existing southerly **SWM pond** to be filled and drainage system redirected (2/2 exceed reads already identified)
- Hole 3: Extensive blasting, hoeing, dredging, excavation for new **SWM pond 1** (only 1 normal read)
- Hole 6: Extensive blasting, hoeing, dredging, excavation for new **SWM pond 2** including redirecting existing drainage (only 1 proximal read)
- Hole 7 & 8: Existing northerly **SWM pond** and wetland area to be filled (1/2 exceed reads already identified)
- Hole 13: Extensive blasting, hoeing, excavation for new **SWM pond 3** (4/4 exceed reads already identified)
- Hole 14: Extensive blasting, excavation for new **SWM pond 4** (no proximal testing)

Any amount of the above construction activity has the potential to disturb and send the mercury airborne contaminating a larger area of the property and the surrounding community. A significant amount of this disturbance will occur in the manipulation of the existing drainage system, its two naturalized ponds and the creation of three new SWM lagoons.

The ability to identify all of the mercury locations on this 175 acres of bedrock and clay seems an impossibility. The amount of testing to quantify the mercury deposits and degree of leaching into the water supply may be a further impossibility.

Conclusions:

The report PE4321-2R by Paterson Group concludes

The mercury is considered to be present in pockets across the site, within the shallow soils, to a maximum depth of approximately 0.6m below grade.

It is recommended that a soil remediation program be carried out at the Phase II Property in conjunction with the redevelopment of the site. (page 29)

Despite the findings and report conclusion that mercury contamination is widespread on the Kanata Golf Club site to the degree that site wide soil remediation is required for residential development, this second Phase II analysis by The Paterson Group appears to be an inadequate

assessment of the degree of contamination of the property which has a direct link to the appropriateness and risk of remediation of this property.

- an incomplete inventory of probable sites of mercury contamination due to
 - an absence of focussed assessment on the history of the property including the portions of the property in continued use as a golf course since 1968 (Holes, 1 and 4-8 inclusive) and at highest risk to mercury contamination as well as the extensive renovation of the property to an 18 hole course in the 1980s which may have caused sublayer mercury displacement
 - incomplete assessments of key sites of contamination (tee boxes and greens)
 - inadequate numbers of sample sites throughout the entire Phase II property
 - inappropriate sample site locations based on identified impediments as well as key sample site restrictions put in place by the current site owner
- inadequate identification of the movement of mercury residues given that
 - the high clay component of the soil on this property which has been shown to increase the rate of mercury retention and subsequent lateral leaching on similarly contaminated sites
 - the high preponderance of surface groundwater that may increase residue migration and subsequent contamination of a large watershed
 - the uptake of mercury by organic matter, heavily present across the site
- an absence of appropriate contaminant testing across the site given the substantial ground disturbance associated with the proposed site redevelopment

While the Paterson Group notes that full site soil remediation is necessary for residential development, that is not to say that such remediation should be undertaken. Given this review of the shortcomings identified in this second Phase II ESA report, it seems inappropriate to quickly assume this property is safely remediable or should be remediated.

We believe this brownfield property is not appropriate for residential development and in the name of public safety its use should not be intensified beyond its present use, a golf course. The only reasonable alternative would be to rezone it as parkland and open space use with ongoing monitoring to manage the contamination. The public danger is in disturbing the settled mercury. This too is the conclusion of the Paterson Group.

The presence of impacted shallow soils is not considered to represent a concern to the continued use of the site as a golf course. (page 29)

The subsequent risk to public safety and health with remediation is huge given the size of the property to be remediated (175 acres), its location within a fully developed residential urban community (immediately surrounded by residential homes and families), the degree of soil disturbance contemplated by the development and the physical nature and location of the site (extensive surface groundwater and clay soils mixed with large amounts of bedrock feeding an extensive drainage system).

The Kanata Greenspace Protection Coalition opposes the suggestion in this report that this site should be remediated to accommodate any change in use. This 175 acre property should be marked "DO NOT DISTURB" and its ongoing use monitored in the name of public health and safety.
