**APPENDIX J**

**RESPONSE TO MOE COMMENTS ON THE RISK ASSESSMENT**

**March 4, 2011 (including supplemental comments provided on April 6, 2011)**

**August 6, 2010**

## APPENDIX J: RESPONSE TO MOE COMMENTS ON THE RISK ASSESSMENT

**SCHEDULE A**
**To Director's Notice**
**Comments by the Ministry of the Environment**
**On Risk Assessment**
**for**
**Former Mulock Farm Property, Newmarket**
**RA1054-09**
**IDS Ref No. 8812-7RBMXF**

March 4, 2011

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The following are Ministry comments on the following Risk Assessment (RA):

- **"A Risk Assessment of the Former Mulock Farm Property, Newmarket, Ontario", by Intrinsik Environmental Science Inc, dated September 2010**

# Comments On Risk Assessment

## General Comments

This is the second review of a risk assessment for a site located east of Bathurst Street on the north and south sides of Mulock Drive in the Town of Newmarket. The risk assessment is for the forested areas around Summerhill Woods and William Thomas Mulock Park. There are no buildings on-site. The overall site was used as an apple orchard until the late 1950s with lead arsenate being used as an insecticide. Recent on-site sampling indicates lead and arsenic present in the soils. There is an on-site stream making the site "sensitive" in accordance with Ontario Regulation 153/04.

## Specific Review Comments

1) The QP's response is adequate.

2) The QP's response is adequate.

3) The QP's response is adequate.

**Site Characterization**

4) The discussion of surface water sample SWNWSW provided in the response should be included in Section 3.3.2.4 of the RA. Currently, Section 3.3.2.4 states that the maximum arsenic and lead concentrations are 3.36 and 0.7 µg/L, respectively, which are not consistent with the results shown on Figure 3-1 which shows concentrations of 25 µg/L and 78 µg/L, respectively, arsenic and lead concentrations detected in sample SWNWSW.

The concentrations of arsenic (25 ug/L) and lead (78 ug/L) at sample location SWN WSW, as shown on Figure 3-1, are correct. This sample was collected at the property boundary from surface water flowing onto the RA property, during a seasonal flow event in a seasonal drainage ditch. At the time, road construction work was being conducted upstream along Bathurst Street, resulting in heavy sediment roads being carried during storm events onto the RA property. The results do not reflect typical surface water quality on the RA property (see all other surface water data). The RA report has been modified.

5) The selection of COCs in the sediment provided in Section 3.3.2.3 of the RA is very confusing. In addition the last sentence in the Section which relates to the COCs in sediment that were retained is incomplete. Based on the Table, it is assumed that arsenic, lead, DDD and DDE are COCs in sediment. This section needs to be revised and the list of sediment COCs identified.

The RA report has been modified as requested.

6) The maximum concentrations of contaminants in groundwater shown on Figure 3-1 do not correspond with the maxima presented on Table 3-1 as shown below:

| Parameter | Maximum presented on Table 3-1 (µg/L) | Maximum on Figure 3-1 (µg/L) |
|---|---|---|
| Arsenic | 4 | 2.5 (MW Fd) |
| Lead | 1.21 | 85.2 (MW Fd) |
| Boron | 98 | 0.98 (MW B) |

The concentration of 85.2 µg/L for lead is significantly greater than the concentration of 1.21 µg/L used in the RA. The arsenic and boron concentrations shown on Figure 3-1 do not affect the selection of COCs.

The review comment also recommended showing the maximum method detection limits (MDLs). The DDD, DDE and DDT concentrations in groundwater were not shown even though there were "spaces" for them to be presented on the plan. The MDLs presented in Table 12 of Appendix E indicate that the MDL for DDE (<0.05 µg/L) exceeds the Table 1 standard of 0.01 µg/L. It would be useful to show the DDD, DDE and DDT results in groundwater on Figure 3-1. The MDL for DDE must be discussed in Section 3.3.2.1, and depending upon the results of the discussion and analysis, DDE in groundwater may be required to be carried forward as a COC.

The concentration of lead in groundwater at MWF-d was not correct on Figure 3-1. It was a typo, the value for cobalt was inserted in error. The concentration of lead in groundwater at MWF-d of 1.21 ug/L (October 14, 2009) and <0.5 ug/L (November 19, 2009) are now shown on Figure 3-1. The concentration of 1.21 ug/L is the highest recorded on site. Based on the concentration of <0.5 ug/L in the repeat sample and the concentrations in the groundwater noted at all of the other monitoring wells, this may be an unnaturally high value due to unusual sampling conditions (i.e. sediment in the sample). The maximum concentration of boron in groundwater at MW-15 (98 ug/L) is now shown on Figure 3-1.

The concentrations of DDT, DDE, and DDD in groundwater are now displayed on Figure 3-1. There were no exceedances of the Table 1 criteria for these parameters in soil, sediment, or groundwater. It is noted that the method detection limit (MDL) for DDE in groundwater of 0.05 ug/L exceeds the Table 1 Standard of 0.01 ug/L. AGAT Laboratories provided the following response:

"The reporting detection limits (RDL) are based on the method detection limits (MDL) which is a theoretical value determined from the variance of a number of low spikes. The MDL, in many cases, is lower than the RDL, however reporting at the MDL is not a reliable detection limit as false positives can occur. This is why an RDL is used as the detection limit, as the RDL is a set value that is slightly higher than the MDL (in most cases by a factor of 10), so it is easily detected by the instrument and is normally the lowest value at which we are confident that false positives will not

occur. DLs can vary, depending on the instrument and method used, so it is possible that another lab/method could detect at the low level.

In regards to the dl of 0.05ug/1 for DDE, that is the lowest we are able to detect. Our DL would only vary if dilutions were required (which would cause the DL to increase)."

Although the MDL for DDE in groundwater exceeds the Table 1 Standard based on the O.Reg. 153/04 criteria, it is consistent with the 0.05 ug/L Standard based on the Table 1 Standards outlined in O.Reg. 511/09, which comes into force in July 2011.

In the opinion of the OPESA the lack of any exceedances of DDT, DDE, and DDD in soil, sediment, and groundwater on the site provides a significant level of confidence that these related compounds are not COC's on this site. No further investigation or assessment is required.

7) The QP's response in Appendix J indicates the maximum depth of contamination corresponds to the maximum depth of topsoil, being 0.55 cm. The text of Section 3.3.2.2 indicates the maximum depth of topsoil is 0.55 m. Given that the QP's response in Appendix J likely contains a typographic error (cm versus m) the QP's response is adequate.

The reviewer is correct, the information contained within the RA report is correct; Appendix J contains a typographical error.

8) Given the QP's explanation of the maximum depth of contamination (comment 7 above) and the inclusion of Figure 3-1 in the main body of the RA showing the soil, sediment, surface water and groundwater sampling locations which exceed Table 1 Standards, the response to comment 8 is adequate.

No response required.

**Human Health Risk Assessment**

9) The response provided is sufficient. In future it is recommended that additional discussion be provided in Section 4.5.3 on the appropriateness of the generic components for the site-specific application. However, as the responses are submitted with the RA, no further response is necessary for this RA.

No response required.

10) The response provided is sufficient. In future it is recommended that the discussion regarding excluding components of the generic standard (e.g. S-GW1) be integrated in the report.

However, as the responses are submitted with the RA, no further response is necessary for this RA.

No response required.

11) The QP's response is satisfactory.

12) The QP's response is satisfactory.

13) The QP's response is satisfactory.

14)

a) The QP's response is satisfactory.

b) The rationale used to justify the use of an SIR for the toddler of 100 mg/day is based on Calabrese's own interpretation of his studies (Stanek and Calabrese, 2000; Stanek et al., 1999) and does not constitute sufficient justification for the use of an alternative SIR. In addition, the US EPA has not expressed confidence in the results or interpretation of these Calabrese *et al.* studies. Until further information (that has not been considered by the MOE) is available in the literature which supports another SIR, the SIR of 200 mg/day for the toddler (which is the 95% Upper Confidence Limit for the Mean (UCLM) as a central tendency estimate of 100 mg/day) should be used as a conservative estimate of the mean due to the toddler's high hand to mouth contacts. This SIR represents the desired level of conservatism to be applied in RAs. Unless a more robust rationale can be provided, it is suggested that the QPRA use the SIR of 200 mg/day in this assessment. The HHRA should also include a discussion regarding acute toxicity at the PSS for soil COCs, where such information is available (e.g. acute toxicity of lead for toddler).

At this time, we are not inclined to argue the Ministry's point, although we do find it flawed and with limited scientific basis, as most regulatory agencies including US EPA, California EPA, Health Canada, and RIVM have moved away for using an SIR of 200 mg/day. We take the comment to indicate that Ministry policy dictates that a SIR of 200 mg/day should be used for toddlers in most situations. The Ministry has indicated that in some circumstances it may be appropriate to consider an alternate value when limited exposure conditions exist. In the current situation, this option was considered due to the restricted parkland scenario (not a playing field or playground) under consideration, where the duration and nature of exposures are significantly limited. In their definition of current SIRs, regulatory agencies such as the US EPA apportion the SIR (rounded to 100 mg/day) to indoor (dust) and outdoor (soil) exposures (60 mg/day and 50 mg/day, respectively). For the current situation, it would be appropriate to adjust the MOE SIR of 200 mg/day, which is intended for soil and dust combined, by the EPA ratio of 50 mg soil/day:100 mg soil + dust/day, resulting in site specific SIR of 100 mg/day for the parkland scenario since this scenario is limited to only outdoor (soil) exposure.

As provided in the original RA report, the Parkland scenario is described below:

***Parkland Visitor***

*The parkland area consists of two distinct types of areas, the forested or wooded areas and the paved and crushed gravel walking trail. While visiting these areas, receptors were assumed to be exposed to COCs via direct exposure to soil (i.e., via inhalation, incidental ingestion and dermal contact). The Site does not contain a sports field, playground area or other amenities that might attract more frequent visits to the area. A visitor regularly (as often as daily) walking along the trail was not assumed to spend significant time straying from the walking path. A two metre clearance ("slashback") is present on either side of the trail, beyond which is thickly wooded areas not conducive to significant play areas or human movement. The Armitage Creek and its tributaries are present on-site, further limiting the potential for a visitor to spend significant time in direct contact with on-site soils. In addition, residential developments exist just to the east of the walking trail.*

*The North and South Forested Areas, as well as the William Thomas Mulock Park parcel, are rugged areas covered in thick vegetation and are therefore relatively inaccessible. Moreover, fences exist at the boundaries between the Site and the residential properties. Therefore, it was assumed that children would only occasionally spend time in these wooded areas with direct access to soil. This assumption included the following frequency on-site:*

- *five days per week during 5-week period of summer months, not including periods where child is away from home (vacation, at camp, etc.); and,*
- *one day per week spent on-site for an additional 34 weeks (does not include 13 weeks of year with assumed snow cover – December to March (MOE, 2009).*

*Therefore, it was assumed that a child parkland visitor would spend a total of 60 days per year in the forested areas (5 days/week x 5 weeks of peak summer + 1 day/week for additional 34 weeks). Although receptors may also visit the Site during the winter months, it was assumed that the snow cover and frozen ground would prday any significant level of exposure to impacted soil.*

*Visitors were assumed to spend significantly more time (as often as daily) on the walking path (including walking, jogging, biking, etc., by all family members and pets). While on the path, visitors were assumed to not be exposed to impacted soils due to the limited potential exposure pathways related to the paved and crushed gravel walking trail and heavily vegetated slashback area. The areas of the slashback thus limit the potential for exposure to uncovered soils.*

The following table provides the SIR utilized for the Parkland Scenario in the RA.

**Soil Ingestion Rates (SIR) Utilized for the Parkland Scenario**

| | September 2010 Risk Assessment | MOE (2009) | US EPA (2008) Soil (dust) | Revised Risk Assessment (April 2011) |
|---|---|---|---|---|
| Parkland | | | | |
| • Infant | 30 mg/day | 30 mg/day | 30 mg/day | 30 mg/day |
| • toddler | 100 mg/day | 200 mg/day | 50 (60) mg/day[a] | 100 mg/day[c] |
| • child | 50 mg/day | 50 mg/day | 50 (60) mg/day | 50 mg/day |
| • adolescent | 50 mg/day | 50 mg/day | 50 (60) mg/day | 50 mg/day |
| • adult | 50 mg/day | 50 mg/day | 50 (-) mg/day[b] | 50 mg/day |

[a]EPA(2008) indicates that total soil and dust ingestion rate is 110 mg/day; rounded to one significant figure it is 100 mg/day
[b]adult SIRs provided by EPA (2009) draft report.
[c]based on MOE (2009), SIR of 200 mg/day for soil and dust combined; adjusted by EPA ratio 50 mg soil/day:100 mg soil + dust/day

Rationale for considering soil only for SIR for parkland users:

- No buildings will be present on-site, the SIR has been modified to account for the fact that exposure to indoor dust will not be occurring. We acknowledge that no buildings on-property is a RMM and this will be identified as such in the HHRA and RMP. A residential scenario, utilizing a SIR of 200 mg/day for toddlers, was considered in the RA. This scenario indicated that residential land-use is not a viable option for the site;
- Site-specific conditions would reduce airborne particulates associated with wind erosion (e.g. continued vegetation cover is assumed across the trail portion of the RA site, with

the remainder of the site being heavily wooded and not conducive to significant particulate release. We acknowledge that this assumption is considered as RMM and this will be identified as such in the HHRA and RMP. As off-site residential exposure scenario was considered in the RA in which receptors were assumed to be exposed to COCs in soil via inhalation of airborne soil and dust migrating from the Site to off-site residential locations with no restrictions as described above;

- The Site does not contain a sports field, playground area or other amenities that might attract more frequent visits to the area or more intensive exposure conditions;
- The majority of the site consists of thickly wooded areas not conducive to significant play areas or human movement.

Furthermore, at the Ministry's request, an acute exposure scenario will be considered as well, utilizing the 1000 mg/day soil-pica ingesting rate provided by EPA. For this evaluation, an acute TRV of 1.5 ug/kg/day was identified for Arsenic, based on the Ministry's Screening Level Health Risk Assessment of the Historical Mining Tour of Cobalt, Ontario conducted in 2005 (http://www.cobaltmininglegacy.ca/studies/SLHRA_Full_Report.pdf). Ministry review comment 14) b) indicates that it is possible to assess acute toxicity of lead for toddlers. As of this time, Intrinsik has been unable to identify an appropriate acute oral TRV for lead. For the purpose of this evaluation an acute TRV for lead of 10 ug/kg/day has been developed based on the following assumption:

- World Health Organization indicates that a blood lead level of 10 ug/dL generally corresponds to a dose of 3.6 ug/kg/day
- The available scientific literature, as summarized by ATSDR (2008) indicates that evidence of acute effects resulting from lead exposure occur at blood lead levels between 30 and 40 ug/dL for children
- Based on this information, an acute TRV for lead of 10 ug/kg/day was assumed

Based on the acute TRVs selected for arsenic and lead, and the soil-pica ingestion rate provided by EPA, no acute effects would be expected at the levels proposed as PSS for Parkland Visitor Scenario.

**NOTE: the above response was provided to the MOE on April 5th, 2011. On April 6th, 2011, MOE provided the following follow-up comment:**

**The site-specific rationale provided is solid in most respects and is expected to be appropriate for this RA so long as the following limitations are addressed in the RA:**

- **The SIR table states that the SIR of 100 mg/day in the revised risk assessment (April 2011) is mainly based on the US EPA (2008) central tendency estimate of 100 mg/day for the toddler. The SIR is dependent on human behaviour and human activity throughout the day, therefore the selection of a site-specific SIR should be based on 1) site-specific conditions and 2) site-specific use. Therefore, the discussion on the selection of the site-specific SIR within the SIR table or elsewhere in the rationale provided should focus on those 2 factors.**
- **The SIR table provides a comparative analysis of SIR from the MOE and the US EPA, it should be noted that those SIR values are not directly comparable, as one is based on a central tendency estimate while the other is based on a conservative estimate of the mean (as stated in the 2009 MOE Rationale Document). Notes could be incorporated at the bottom of the table to highlight these differences if the values are to be used comparatively.**
- **The site-specific discussion mentions the indoor dust vs outdoor soil exposure as a justification for the selection of 100 mg/d SIR. This approach appears to be appropriate for the current risk assessment. However as a side note, there are specific cases where site-specific conditions and site-specific use will support the use of a more conservative**

**SIR estimate for the toddler in outdoor-only soil ingestion scenarios. Examples might comprise of some parkland site uses (e.g. parks with campground, playground, or open land that is accessible) and community site uses (e.g. recreational/ community/ athletic centres with outdoor facilities) where a conservative SIR estimate, given receptor site-specific behaviour and activity levels, might be more appropriate because it will be protective of greater than 50% of the toddler receptors at the site.**

**The supplemental comments provided by the MOE on April 6th, have been considered and addressed in the revised RA report.**

15) The original comment stated that the use of an 80 year averaging time for evaluating carcinogenic effects for workers (construction, maintenance) needs further consideration. As the worker receptors comprise only adults, a less-than lifetime averaging or amortizing period should be considered. This approach would be consistent with guidance provided by Health Canada (2004, 2006) and the MOE (2009 Rationale). To be clear, following Health Canada and MOE guidance, an amortization factor of 7/56 for construction workers and 27/56 for maintenance workers would be used. These amortization factors should be considered for use in the RA.

The RA has been modified to utilize the suggested amortization factors.

16) The QP's response is satisfactory.

17) The QP's response is satisfactory.

18) The QP's response is satisfactory.

**Ecological Risk Assessment**

19) The response provided is sufficient. In future it is recommended that additional discussion be provided in Section 5.5.6 on the appropriateness of the generic components for the site-specific application. However, as the responses are submitted with the RA, no further response is necessary for this RA.

No response required.

20) The QP's response is satisfactory.

21) The QP's response is satisfactory.

22) The QP's response is satisfactory.

23) The QP's response is satisfactory.

24) The QP's response is satisfactory.

25) The QP's response is satisfactory.

26) The QP's response is satisfactory.

27) The explanation with respect to the information provided in Table 5-15 and Table 5-19 for DDD is appropriate. However, there are still inconsistencies in the tables. For example, for arsenic exposure to meadow vole; in Table 5-15 the EBC is stated as 1200 µg/g. In this case it would be expected that the PSS would be set at 10% above the maximum (i.e. 160 µg/g). The PSS is stated as 930 µg/g in this table but this appears to be a typographical error. As shown in Table 5-19 the PSS for plants and soil invertebrates is 160 µg/g, meadow vole is 1200 µg/g, short-tailed shrew is 170 µg/g and 470 µg/g for American robin. These values are consistent with the individual tables but not with the stated approach. As the final PSS are set to 10% above maximum this inconsistency will not affect the overall PSS for the site.

The report has been modified to remove these inconsistencies. As indicated, these changes did not affect the overall PSS for the site.

28) The QP's response is satisfactory.

**Other**

29) The QP's response is satisfactory.

30) The QP's response is satisfactory.

**Summary and Conclusions**

The majority of the comments have been adequately addressed in the risk assessment. The QP has to review the concentrations of lead and DDE in groundwater used in the RA. The QP still has to re-visit the amortization factors for workers and to correct the inconsistencies in Tables 5-15 and 5-19 to improve the transparency of the report.

# Comments On Risk Management

**Comments on the Revised RA document and Proposed Risk Management Measures:**

Appendix J to the RA report includes responses to the Ministry's August 6, 2010 review comments, however the District's previous comments are not included in the Intrinsic responses nor is there any indication they were considered in the revisions to the RA. The RA does now include a certification requiring the implementation of a Risk Management Plan to incorporating a variety of largely administrative controls to reduce or eliminate exposure pathways in response to RA review comment 30. However as the RA itself still states that no RMM are required and the RMP presented in section 7 includes no specific measures.

As such, I am reproducing my previous comments below with additions denoted in italicized text.

**Previous District Comments** (with additions in italics)

The chemicals of concern (COC) have been identified in soil and groundwater are associated with historic pesticide use for orchards historically present on these sites and the RA included arsenic, lead, boron, pesticides DDD and DDE and sodium and chloride in groundwater.

Although No Risk management measures (RMM) have been presented in the RA by Intrinsik to address the potential for unacceptable risks to park visitor and on-site maintenance workers. The RA however will require targeted remediation to occur to reduce COC concentration to property specific standard levels in several locations. In addition, the RA includes a number of fundamental assumptions which may constitute administrative RMM to ensure no unacceptable risks to on and off-site receptors due to the impacted site soils:

- Restriction on residential development on all four parcels
- Restriction on changes in current park configuration on all four parcels
- Fencing and controlled access to parcels 1, 3 and 4
- *A prohibition on construction work on the RA lands*

The MOE appears to want assurances that the "administrative controls" and other needed "actions" to control exposure, as outlined in the RA, will actually be done.

They want RMM established to protect visitors and maintenance workers. We have addressed this concern in Section 7 of the RA.

They recognize that targeted remediation is required.

They want assurances that the assumptions and restriction used in the RA to determine exposures are actually instituted. We note that the remediation that will precede the RSC and CPU, will be done by specialists who do not need to be covered by the RA.

The Risk Management Plan includes:

- Requirement that all activities for remediation prior to the issuance of the RSC and CPU (including RMM) to be done by a contaminated sites specialists contractor with environmental consultant oversight

- Administrative RMM will be included in the CPU.

The RA includes a number of assumptions that constitute administrative RMM to ensure no unacceptable risks to on and off site receptors. These restrictions include:

- Landuse designations limiting the future use and development of the lands (i.e. no residential development)
- Designation of the parklands and their configurations
- Controlling access to the sites by a variety of methods potentially including:
  - Selected areas of fencing
  - Maintenance of restrictive vegetation
  - Other access controls and physical detractions to human use as needed
- Limitations on construction activities and workers, except for superficially skilled remediation specialist's contractors and consultants conducting remediation of the COC's. The contractors and consultants have the skills to address contaminant issues through the use of a Site Specific Health and Safety plan of their specific tasks. This work does not need to be addressed as a RMM and included with the CPU.

These RMM will be included in a CPU.

Targeted remediation prior to the submission of RSC will not be included in the CPU. The CPU will however include RMM to limit the exposure of site workers and the public, to the degree specified in the RA.

The RMM's will include:

- Access limits for site workers conducting forest maintenance for limited periods of time
- Maintenance of natural dense vegetation and enhancement of vegetation, to deter casual visitors and limit exposure.
- Note, that vegetation of remediated areas will be conducted by the remediation contractor and environmental consultant, as part of the remedial activities prior to the RSC and CPU.
- No utilities will be installed on the site and therefore on construction work scenarios
- No construction work will be conducted with the exception of minor maintenance of the forest and lands, to ensure the forest cover stays intact and erosion is minimized
- Limit on development to parkland use only (no residential use)
- Limit parkland use to vegetated woodlands with sufficient density of vegetation to deter access
- Restrict the development of more active park uses such as sports fields
- Maintain current zoning as Oak Ridges Moraine Environmental Protection
- Prohibition on gates from yards backing onto the lands

- Requirements to maintain fencing (without gates) between residential lots and the lands
- Encouraging vegetation and increasing vegetation density across site to deter casual access to the lands
- Limiting the slash back along trails to 2 m
- Establishing fencing, dense vegetation, at strategic locations to deter access to the site.

Communication of the RA, RMM including risk to park visitors, off site residents, and general public is part of the Public Communications Plan in Section 8.0.

The RA assumes limited access to the lands and limited exposure risk, due to the limited activities carried out in the lands and the limited duration of time spent on the land, as well as the maintained condition of the lands (densely vegetated).

The administrative controls/restrictions and physical conditions of the site (maintained in perpetuity) are part of the RMM described above. The remediation work is part of the RMP but the details of the work and restoration of the vegetation are not described in detail as a RMM, as the work will be conducted by contaminated sites specialists prior to filing the RSC and preparing the CPU. The work does not require the protection of the RA and RMM.

The use of risk management measures will require the issuance of a Certificate of Property Use (CPU) for the property if the RA is accepted.

1. The RA indicates targeted soils remediation will be require to achieve the PSS. The RA includes construction workers but did not carry through this receptor in section 4.5.2.6 since an 'administrative restriction' will limit their presence on-site. This administrative restriction itself constitutes a RMM that will be included in a CPU.

The administrative controls/restrictions and physical conditions of the site (maintained in perpetuity) are part of the RMM described above. The remediation work is part of the RMP but the details of the work and restoration of the vegetation are not described in detail as a RMM, as the work will be conducted by contaminated sites specialists prior to filing the RSC and preparing the CPU. The work does not require the protection of the RA and RMM.

A Certificate of Property Use (CPU) will be registered on title detailing the administrative RMM.

*1b. A soils management plan and health and safety plan are recommended to encompass the proposed 'targeted remediation' activities or any future work that may disturb site soils. As the RA assumes that the dense vegetation/forest is a key factor in reducing public use of these lands, re-vegetation of areas disturbed for remediation or other work could also be a requirement in a CPU.*

The remediation work is part of the RMP but the details of the work and restoration of the vegetation are not described in detail as a RMM, as the work will be conducted by contaminated sites specialists prior to filing the RSC and preparing the CPU.

2. The RA notes that there are no current or future utilities on the RA lands which would also ensure no construction work exposure scenarios. This assumption is another administrative control which could be included in a CPU.

Agreed, Section 7 to be modified to reflect these requirements. This restriction will be an administrative control as part of the CPU.

3. The RA has indicated the 4 parcels would not be developed for residential use. This is an administrative control which would be incorporated into a CPU. Similarly, the assumption that the parkland configuration of the sites would not be changed to include more active uses (i.e. sports fields) could also be part of a CPU. *Although the RA notes that the property is currently zoned Oak Ridges Moraine Environmental Protection, the CPU would ensure similar conditions are imposed under that instrument.*

Agreed, Section 7 to be modified to reflect these requirements. The CPU would include the restrictions on park development, and outline the limits and approved uses.

4. The RA notes that there is currently limited access to the wooded RA parcels (1, 3 and 4) and a Newmarket by-law prohibits any resident from installing a gate. While the houses on the north side of Mulock Drive back directly onto William Thomas Mulock Park (parcel 1) it appears there is a clearing between the Summerhill Woods subdivision and the northern and southern forested lands and trail lands. The limited access appears to be a fundamental assumption relating to potential use of the forested lands and consideration to access controls such as fencing or signage should be considered in the RMP. *Similarly, the assumption that the 2m slashback around the trail will not expand will also be required in a CPU.*

Agreed, Section 7 to be modified to reflect these requirements. The CPU will include access restrictions and controls, as well as address the vegetation management requirements to discourage access and uses not consistent with the RA.

5. This RA has been previously designated a Wider Area of Abatement based on the local concern about the project. Many of the questions posed by residents at the Town's 2009 public meeting were about the risks to their properties and risks in using the park lands. Some comment on the RA and communication plan about a Park Visitor who is also an Off-Site Resident should be included.

Agreed, Section 7 to be modified to reflect these requirements.

6. *The RMP requires revisions to set out which RA assumptions correspond to RMM including administrative controls/restrictions or physical requirements at the site (i.e. fencing, undisturbed vegetation). And while remediation work is not a risk management, provisions for those works and restoration of those areas should be incorporated into the RMP.*

Agreed, RA and Section 7 to be modified to reflect these requirements. The RMP is based on the assumptions of the RA, which generates the RMM, including the administrative controls and physical controls. The remediation work is part of the RMP but the details of the work and restoration of the vegetation are not described in detail as a RMM, as the work will be conducted by contaminated sites specialists prior to filing the RSC and preparing the CPU.

7. *The Communications Plan included in Section 8 is out of date and does include recent communication activities initiated by the Town of Newmarket. In addition, while there had been a commitment to including York Health during the RA process, it does not appear a copy of the Sept. 27, 2010 report was forwarded for their review.*

Agreed, Section 8 to be updated. The September 27th version of the report was forwarded to York Health. No comments were received.

**Response to**
**Comments by the Ministry of the Environment**
**On the Risk Assessment of the**
**Former Mulock Property, Newmarket, Ontario**
**(RA 1054-09: IDS Ref No. 8812-7RBMXF)**

**August 6, 2010**

1) **Comment:** The results of the site characterization studies must be summarized within an appendix to the risk assessment. A summary of the Phase II ESA activities undertaken subsequent to the PSF submission would have been very helpful. The contents of Appendix E are considered inadequate to properly describe the results of previously completed ESAs.

**Response**: An updated summary of the site investigation reports is provided in the revised Appendix E.

2) **Comment:** The RA should include a description of the QA/QC activities followed during Phase II ESA studies, as well as an assessment by the QP as to whether the sampling program is sufficient for the purposes of the risk assessment.

**Response**: During the field programs, duplicate sampling and QA/QC activities were followed as required for a Phase II Environmental Site Assessment, as per O.Reg. 153/04 and the MOE document Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario, December 1996. Duplicate samples were taken for QA/QC purposes for various parameters during the soil and groundwater sampling program. Duplicate data is included in the data tables and on the laboratory Certificates of Analysis included with the Phase II ESA and other technical reports. The QA/QC data was reviewed by the $QP_{ESA}$ who confirmed that the data could be relied upon with confidence.

The information stated above is included in Section 3 of the revised RA.

3) **Comment:** The site contaminant distribution drawings and summary tables must be included within the main body of the RA report. This will allow the reviewers to view and understand the site characterization data without having to review the Phase II ESA documents, which is outside the scope of a RA review.

**Response**: A complete set of site contamination distribution drawings and summary tables are included in Appendix E of the revised RA. The figures and tables are taken directly from the Phase II ESA.

**Site Characterization**

4) **Comment:** The surface water findings were not discussed within Section 3 of the RA. Arsenic and lead were detected at maximum concentrations of 3.36 µg/L and 0.7 µg/L respectively in surface water as stated in Burnside's January 2010 Phase II ESA Report. As stated in the Phase II ESA, these results are below the Table 1 SCS. Historic results by MMM were said by Burnside to be related to road and off-site sources but were not included within Burnside's Phase II ESA Report. It should be noted that the QP's response to

Comment 15 of the PSF indicates that the maximum concentrations of arsenic and lead in surface water are 25 and 78 µg/L respectively. This discrepancy needs to be resolved and the maximum concentrations of COCs in surface water must be described, and their locations shown on plan.

**Response**: As mentioned in the above comment, the $QP_{RA}$'s response to Comment #15 of the PSF indicated that the maximum concentrations of arsenic and lead in surface water are 25 and 78 µg/L respectively. However, the $QP_{ESA}$ reviewed the surface water data in the Section 5.2 of the Phase II ESA by Burnside dated January 2010. All results were below the Table 1 Standards, with the exception of sample SWNWSW located in the northwest corner of the northern forested lands, and is interpreted to represent surface water quality flowing onto the RA property from off-Site. The results indicate concentrations of arsenic (25 µg/L) and lead (78 µg/L) (this location is displayed on the site sampling plans presented in Figure 3.1 of the revised RA). The $QP_{ESA}$ determined that the result was not a reflection of the surface water quantify on the RA property but a reflection of road related and off Site activities related sediment laden water from off-Site. The chemical signature of other suites of parameters tested when compared to the results of all other surface water sampling data supports this interpretation. The location has intermittent flow and did not have running water on other occasions when fieldwork was being conducted, so there was not an opportunity to collect a duplicate sample. Additionally, the sample was taken from an intermittent water course upstream of Armitage Creek. The results of all surface water samples taken from on-Site and taken from the discharge leaving the Site were either below the Table 1 Standards or assumed to be not present on-site (refer to Section 3.3.2.4 and Appendix E of the revised RA for a complete summary of surface water sampling data obtained by Burnside). The anomalous sample does not indicate any significant impact to the surface water on the RA property or discharging from the RA property.

Chemicals identified by Burnside as potential COCs in surface water are presented in Section 3.3.2.4 of the revised RA, with a comparison of the maximum surface water concentrations *vs.* available PWQO values. The maximum surface water levels of all pesticide parameters (as represented by their analytical detection limits) were below their respective PWQO values, where available. Since all pesticides were non-detect (at the lowest reasonable detection limit provided by the laboratory) in every sample, it was assumed that no quantitative assessment was necessary for pesticides in surface water. Additionally, the maximum surface water concentrations of all three inorganic parameters (arsenic, boron and lead) were below their respective PWQO values. Therefore, no quantitative assessment was necessary for inorganics as well.

5) **Comment:** Sediment sampling is not addressed within Section 3 of the RA. Sediment samples were analysed as part of the Phase II ESA and were shown in Section 5 of the RA, however the selection of COCs in sediment should also be described within Section 3 of the RA.

**Response**: A COC screening for analysed chemicals in sediment has been included in Section 3 of the revised RA. Sediment data for arsenic, boron, lead and pesticides from MMM (2008a) and Burnside (2010) was used. This new sub-section provides additional introductory information regarding the selection of COCs in sediment for quantitative evaluation in the ERA.

6) **Comment:** The locations of groundwater samples exceeding the Table 1 standards (or are detected above detection limits where no standards exist) must be shown on plan.

**Response**: The $QP_{ESA}$ determined the contaminants of concern after reviewing all of the reports and data. All of the groundwater results for the contaminants of concern in groundwater are displayed on the plan (refer to Figure 3.1 of the revised RA). The data for all other parameters tested are below the applicable criteria and included in the referenced reports. The $QP_{ESA}$ did not feel it was relevant to include any other data on the plan.

7) **Comment:** The maximum depth of contamination has not been shown in the RA document or the supporting documents reviewed. Table 3-2 of the RA shows the depth at which the maximum concentrations of arsenic and lead were found on site. Table 6 of Burnside's 2010 Phase II ESA report shows the gradation of arsenic and lead concentrations with depth at five locations. Neither of these tables indicates the maximum depth of contamination. The maximum depth of contamination must be identified in the RA.

**Response**: The maximum depth of the contamination is the maximum depth of topsoil. The maximum depth of topsoil is approximately 0.55cm. Table 6 in Appendix E (from the Phase II ESA) illustrates the distribution of As and Pb in the topsoil in areas of the Site where the topsoil averaged 0.25cm. Sampling of the Summerhill Woods Development after the topsoil layer had been scrapped off in preparation of construction showed no exceedances of the applicable criteria or even evidence of elevated As and Pb refer to Site plan of all As data. The studies clearly indicate As and Pb impacts are confined to the topsoil. This is consistent with the geochemical properties of the topsoil which tends to adsorb metals and the low solubility of As and Pb, resulting in the low concentrations in groundwater. Since As and Pb have low solubility and the hydraulic conductivity of the underlying silt is also low, contamination migration has not extended below the topsoil horizon and is not expected to do so in the future. A brief discussion related to depth of contamination is included in Section 3.3.2.2 of the revised RA.

8) **Comment:** The lateral and vertical extent of contaminated media must be shown in plan and in section on drawings within the main body of the RA report.

**Response**: The lateral and vertical extent of contaminated media is shown in the site contamination distribution diagrams presented in Appendix E of the revised RA. These are also presented in the Phase II ESA.

**Human Health Risk Assessment**

9) **Comment:** The screening against Site Condition Standards shown in Table 4-1 and 4-2 is considered to be a qualitative risk assessment, especially as it is used for setting PSS. As such, although the tables can remain in Section 4.2, the use of a qualitative approach should be discussed in the RA (in objectives and within Section 4.5.3). It is important to discuss the appropriateness of the generic components for application to this site in Section 4.5.3.

**Response**: Because the use of 2009 SCSs and component values in the HHRA is a qualitative approach to the RA, a brief discussion relating the use of both a qualitative and

quantitative approach has been added to the Human Health Risk Assessment Objectives (Section 4.1.2). To be consistent with current MOE recommendations, recent science is employed in the qualitative RA by using 2009 generic component values. Additional discussion regarding the qualitative RA and how component values are employed as human health PSSs has been added to Section 4.5.3.

10) **Comment:** Details on the selected Table 2 SCS should be provided in Table 4-2 (*i.e*. residential / parkland / institutional property use, medium / fine textured soil). In addition, for completeness the component of Table 2 relating to soil leaching should be retained in the screening process (*e.g*. S-GW1) or a specific rationale provided for its exclusion.

**Response**: Clarification regarding the use of SCSs for residential/parkland/institutional property use for medium/fine textured soil has been added to Table 4-2. The S-GW1 values were not used in the component value screening since it was assumed (based on the recommendations of the $QP_{ESA}$) that groundwater is suitably characterized and that a sufficiently steady state exists on-site related to soil leaching (the use of lead arsenate pesticides ceased over five decades ago).

11) **Comment:** The Human Health Conceptual Site Model (Figure 4-2) should reflect all COC and receptors. Those combinations of receptors, COC and exposure pathways that are determined to not be significant through the qualitative screening should still be reflected in the CSM.

**Response**: The HHCSM has been revised to include all COCs, as defined in Section 3. Although some COCs were not retained for quantitative evaluation in the HHRA based on the secondary screening steps, it is recognized that COCs assessed qualitatively should still be included in the HHCSM. Therefore, for example, direct dermal contact with groundwater is now included as an exposure pathway assessed (the construction worker is the only receptor considered for dermal contact with groundwater). It should be noted that since all groundwater and soil COCs are non-volatile, no vapour inhalation-based pathways were considered in the revised HHCSM.

12) **Comment:** As the Table 2 SCS for boron (hws) value is based on ecological protection, not protection of human health, some discussion on the appropriateness of this value should be provided as this value is used for the human health PSS in Table 4-21.

**Response**: The form of boron investigated in the soil sampling program was the hot water soluble form. The human health based PSS established for boron (HWS) (1.5 µg/g) is the 2009 MOE Table 2 SCS which is based on ecological protection, as commented on above. However, because the Table SCSs were used as a qualitative assessment tool in the problem formulation stage of the HHRA, they are inherently appropriate for use as human health based PSSs for those COCs not retained for quantitative evaluation based on this secondary screening process. Moreover, the SCSs are by definition protective of both ecological and human receptors, and thus their use is an additional source of conservatism. A brief discussion of the use of the Table 2 SCS for boron (HWS) has been added to Table 4-21 of the revised HHRA.

13) **Comment:** Additional discussion should be provided on the bioaccessiblity of arsenic and

lead along with the uncertainty of the application of these values. For example, it appears from the discussion provided in Appendix J that the test used glycine; there are some issues with the use of this buffer. In addition, the appropriateness of the use of a one-phase test should be discussed.

**Response**: Using *in vitro* models to simulate human gastrointestinal conditions is obviously associated with a significant degree of uncertainty regardless of the type of model selected. There are a variety of *in vitro* model parameters which can influence the magnitude of the bioaccessible fraction estimate. *In vitro* models which simulate human physiology can range from simple gastric models, which simulate the mobilization of metals in soil under gastric conditions, to more complex models which simulate the gradual progression through the mouth, gastric and small intestinal conditions. Although other factors such as the presence of food constituents may affect bioaccessibility, Oomen *et al*. (2002) suggests that differences in pH used among different models is most likely the reason behind the variation observed in bioaccessibility estimates. Oomen *et al*. (2002) also concluded that of the five (5) *in vitro* models tested, no single model could be identified as giving the most accurate bioaccessibility values for a human *in vivo* situation.

The method utilized for bioaccessibility testing is consistent with the approach endorsed by the US EPA (EPA, 2008). This method advocates the use of a glycine buffer in a single (gastric) phase *in vitro* study. It should be noted that reported issues with glycine relate to its use with metals other than lead and arsenic (glycine has been found to complex with nickel under some study conditions). Furthermore, other *in vitro* test systems have employed a more complex fluid intended to simulate gastric fluid. For example, Medlin (1997) used a fluid that contained pepsin and a mixture of citric, malic, lactic, acetic, and hydrochloric acids. US EPA (2008) found that when the bioaccessibility of a series of test substances were compared using 0.4 M glycine buffer (pH 1.5) with and without the inclusion of these enzymes and metabolic acids, no significant difference was observed (p=0.196). This indicates that the simplified buffer employed in the procedure is appropriate, even though it lacks some constituents known to be present in gastric fluid.

In addition, it should be noted that EPA has validated this method with *in vivo* data and a better correlation between *in vitro* and *in vivo* studies has been observed with gastric phase results as compared to intestinal phase. From a physiological standpoint, any measure of available metal under the simulated conditions of the small intestine would be of great interest, as it relates to absolute bioavailability of metals, since residency times and absorption *via* the small intestines or intestinal phase (*i.e*., stage 2) is considered significant relative to the stomach or gastric phase (*i.e*., stage 1). DEPA (2003) suggests that bioaccessibility estimates (for use in HHRA) should represent reasonable worst-case conditions within the simulated human gastrointestinal environment. In other words, the method should provide the highest plausible bioaccessibility estimates which are likely to occur. According to Oomen *et al*. (2002), the use of a single-phase gastric model (*i.e*., low pH in the absence of food) will tend to represent worst-case bioaccessibility conditions whereas a two-stage gastrointestinal model would be a more realistic average. This is consistent with the US EPA (2008) approach utilized herein.

*References*

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14) **Comment:** a) From the exposure estimates, it appears that for the toddler and child an additional adjustment was made for exposure *via* incidental ingestion of soil and dust. According to the equation provided in Appendix C, the exposure to a toddler to lead in soil would be:

$$EXP_{ING} = \frac{0.1\ x\ 422\ x\ 1\ x\ 365\ x\ 0.71}{16.5\ x\ 365},$$

which equals 1.82 µg/kg-d. Table 4-10 provides a value of 0.18 µg/kg-d. It is noted that the discussion states that this receptor spends 1.5 h/d outdoors but as this represents 100% of the expected time spent outdoors by this receptor it is anticipated that 100% of the soil/dust ingestion would come from the site. The calculation procedure used for all receptors needs to be clarified.

**Response**: No additional adjustment had been made in the RA for the toddler and child *via* incidental ingestion of soil and dust. The value of 0.18 µg/kg-d of lead provided in Table 4-10 is a typographical error and the correct value of 1.82 µg/kg-d has been inserted in the revised RA. The subsequent risk calculations provided in the RA, as well as the selection of a final PSS, are correct in the RA and thus require no alterations.

**Comment:** b) In addition, the RA appears to have used a SIR of 100 mg/d for the toddler, citing the US EPA Exposure Factors Handbook (2009). The QPRA should note that the significant difference between SIR values presented in the MOE rationale document (2009) and the US EPA Exposure Factors Handbook (2009) is the SIR value of 200 mg/d for the toddler.

Although the US EPA has updated its assessment of SIRs from 1997 to 2009, its assessment of child-specific SIRs is identical between the Child-Specific exposure Factors Handbook (2008) and the Exposure Factors Handbook (2009). In its assessment of a SIR value for the toddler, the MOE analyzed key studies used by the US EPA in the derivation of their child-specific SIR values in the US EPA Handbook (2008) or inadvertently, US EPA Handbook (2009). The SIR value of 200 mg/d for the toddler in the MOE rationale document (2009) is a conservative measure and not a central tendency measure. Given that toddlers have high hand to mouth contacts, the use of a conservative measure was warranted at the time of the MOE assessment. Therefore, if the QPRA wishes to use a SIR value for the toddler that is not a conservative measure, they should provide a rationale that specifically discusses why a conservative measure is no longer relevant, and therefore, why a central tendency should be used

**Response**: It is our understanding that current MOE guidance is to use the underlying exposure parameters used to develop the amended Soil, Ground Water and Sediment Standards provided in O.Reg. 511, when conducting Risk Assessments under O.Reg 153/04. MOE has indicated that current science supports the use of 200 mg/day when assessing the soil ingestion pathways for toddlers and 50 mg/day for all other receptor groups, with the exception of construction and maintenance workers. The Rationale Document (MOE, 2009), and the recently released Tier II Risk Assessment Model, reference US EPA (2008) and US EPA (1997) as the basis for these numbers. Neither of these documents were clearly referenced in the Rationale document; however, they are presumably the Exposure Factors Handbook (US EPA, 1997) and the Child-Specific Exposure Factors Handbook (US EPA, 2008). It is noted that the Exposure Factors Handbook has been updated and should be referenced as US EPA (2009). The Tier II Risk Assessment Model references US EPA (2006), rather than US EPA (2008), as an earlier draft of the Child-Specific Exposure Factors Handbook.

US EPA (2008) recommends 'that when assessing risks for children who are not expected to exhibit soil pica or geophagy behaviour, the recommended central tendency soil + dust ingestion estimate is 100 mg/day for children ages 1 to <6 years. If an estimate for soil only is needed, for exposure to soil such as manufactured topsoil or potted plant soil that could occur in either an indoor or outdoor setting, or when the risk assessment is not considering children's ingestion of indoor dust (in an indoor setting) as well, the recommendation is 50 mg/day.' A soil + dust ingestion rate for younger children (6 to <12 months) of 60 mg/day (30 mg/day soil only) is also recommended. US EPA (2009) provides similar recommendations for children. US EPA (2009) also recommends a soil ingestion rate of 50 mg/day for adults. It is noted that both reviews, the most current scientific reviews completed by US EPA, make no reference to the 200 mg/day value found in earlier versions of the Exposure Factors Handbook. US EPA (2008; 2009) clearly states that the recommended soil ingestion rates are central tendency estimates and no upper bound values are provided. US EPA (2008; 2009) also acknowledges that there is a low degree of confidence the recommended ingestion rates. An earlier version of the Exposure Factors Handbook (US EPA, 1997) indicated a medium level of confidence in central tendency estimates for children, a low level of confidence for adult estimates and insufficient data to recommend upper percentile estimates for both children and adults.

US EPA originally recommended a soil ingestion rate of 200 mg/day in its Risk Assessment Guidance for Superfund (US EPA, 1991) and reiterated that recommendation in its EFH (EPA, 1997) as a "conservative estimate of the mean." The recommendation was based primarily on tracer studies in children (ages 1 through 5) that were undertaken by Calabrese and his coworkers (Calabrese *et al*. 1989; Stanek and Calabrese, 1995a; 1995b). However, updated studies by these same authors (Stanek *et al*., 1999 and Stanek and Calabrese, 2000), conducted using improved methodologies and published since the original US EPA guidance was released, indicate that these previous estimates are overestimates and can be refined and improved. As described by Stanek and Calabrese (2000), this study implemented several improvements in study design and analytical procedures that occurred since the publication of their earlier papers and that led to an improved estimate of the 95th percentile soil ingestion estimate for this age group. The advantages of this recent study included: (1) a relatively large study group (n=64 children); (2) improved particle size measurements that focused attention on soil of smaller particle size; (3) a longer study duration (365 days); (4) randomized selection of participants; (5) the use of a relevant age group (1 to 4 year old children); (6) use of a random sample of the population for that age

group; and (7) better control for input/output error. The soil ingestion rates reported by Stanek and Calabrese (2000) for these children were:

- A 95th percentile rate of 106 mg/day (when evaluated over a 365-day period);
- An arithmetic mean ingestion rate of 31 mg/day; and,
- A median (50th percentile) ingestion rate of 17 mg/day.

This study also calculated the best linear unbiased predictors of the 95th percentile of soil ingestion over different time periods and reported the following results:

- Over a 7-day exposure period, the 95th percentile soil ingestion rate was 133 mg/day;
- Over a 30-day exposure period, the 95th percentile soil ingestion rate was 112 mg/day;
- Over a 90-day exposure period, the 95th percentile soil ingestion rate was 108 mg/day; and,
- Over a 365-day exposure period, the 95th percentile soil ingestion rate was 106 mg/day.

These data suggest that, as the length of time that the children are studied increases and as the precision of the analysis improves (*i.e.*, reduced uncertainty), the daily ingestion rates decline. This is reasonable due to the fact that daily fluctuations in soil ingestion rates will tend to average out over time. This narrowing of the distribution in the soil ingestion estimates when daily variability and uncertainty are reduced is not unexpected and is referred to as “regression to the mean” (Stanek and Calabrese, 2000). As noted by Stanek and Calabrese (2000), these longer-term estimates are more appropriate when assessing risks and hazards associated with chronic exposure, as is the case in the HHRA.

On the basis of this information, which is based on more recent studies, Dr. Calabrese has recommended that the soil ingestion rates to be used for young children should be 100 mg/day for the upper bound and 20 mg/day (based on the median in this study) for the central tendency estimate. As such, the levels selected for the current assessment seem appropriate.

If this rationale is not adequate to address the Ministry’s concerns, we would request further information regarding the Ministry’s concerns as well as the references utilized by the Ministry in determining that 200 mg/day is an appropriate SIR for toddlers. It is understood that current US EPA only provides a central tendency estimate and that they no longer provide upper bound values, presumably due to uncertainties in deriving these estimates and the newer information brought to light by Calabrese and Stanek. If the Ministry insists on using this value, than proper references must be provided so that they can be properly reviewed and considered.

*References*:

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15) **Comment:** The use of an 80 year averaging time for evaluating carcinogenic effects for workers (construction, maintenance) needs further consideration. The impact of a less-than lifetime exposure should be considered in the RA. It is expected that the workers at the site would only comprise adults (55 year duration of life-stage).

**Response**: It is unclear what the reviewer is addressing in this comment. As introduced in Section 4.2.3 of the RA, and discussed throughout the HHRA, the exposure period for the construction worker was defined as 7 years, and it was defined as 27 years for the maintenance worker (MOEE, 1996). The assumed lifetime for all receptors was conservatively assumed to be 80 years (Health Canada, 2006). Therefore, the amortization factor for the construction worker was 7/80 and 27/80 for the maintenance worker – these factors were applied during the risk characterization portion of the HHRA. In conclusion, no alterations to the HHRA were made based on this comment.

16) **Comment:** The toxicity assessment is appropriate with only two minor comments. First, is that in Appendix A reference is made to MOE 2008, this should be updated to the most recent MOE document published in 2009. The second is that the factors used to derive an RfC for lead from the oral RfD should be provided.

**Response**: Appendix A has been updated to reflect the 2009 MOE Rationale. Both this appendix and Section 4.3.2 of the RA has been updated to show the procedure for establishing the lead RfC of 6.5 µg/m$^3$ shown in Table 4-13. The oral $IOC_{pop}$ of 1.85 µg/kg-day (as recommended in the Appendix A) was multiplied by the adult body weight (70 kg) and divided by the adult breathing rate (20 m$^3$/day) to obtain an RfC of 6.5 µg/m$^3$.

17) **Comment:** In the risk characterization section total HQ values and risks are provided that are sums of all exposure routes. A toxicological rationale to support the summation of these values should be provided (the Procedures document states that hazard quotients of contaminants for which the exposure limits are based on different adverse effects and mediated by different mechanisms of action should not be added). It is noted that for HQs, air is considered a separate medium and thus can be compared to a value of 0.2.

**Response**: As discussed in the toxicological profiles provided in Appendix A of the RA, the toxic effects of lead in humans are widely believed to be the same, regardless of the route of entry. The effects from chronic exposure to lead on humans are primarily neurological, renal, hematological, reproductive, and developmental. The most commonly reported and well-studied effects of environmental lead exposure are (1) adverse effects on neurological function and neurobehavioural development in children, and (2) reduced growth rate. Therefore, because the adverse effects of lead exposure are considered the same, regardless of the route of entry, it is considered appropriate to sum the HQs for inhalation and oral/dermal routes for lead and compare them to a value of 0.2, as done in the RA. As such, the approach applied to lead in the RA has not been revised. However, as discussed in Appendix A, the adverse effects associated with exposure to arsenic do differ when considering inhalation *vs* oral/dermal routes, whether considering carcinogenic or non-carcinogenic effects (refer to Section 4.4 or Appendix A of the revised RA for details). Therefore, in the revised RA, the HQs and ILCRs for inhalation of arsenic have been separated from those related to oral/dermal routes of exposure.

18) **Comment:** Risks and hazard quotients associated with the proposed property-specific standards are not calculated (as stated in the Procedures document the concentration proposed as the standard must be evaluated explicitly in the risk assessment). A straight-forward way of incorporating this is to use the PSS as the source concentration in the assessment.

**Response**: An explicit evaluation of risks to both human health and ecological receptors associated with the proposed PSSs is provided in Section 6 of the revised RA (following the presentation of final PSS tables). This evaluation includes both a qualitative and a quantitative assessment, thereby confirming the conclusions of the RA. Specifically, the conclusions are that, other than for arsenic and impacts on human health, no unacceptable risks are present on-site. However, because unacceptable risks to human health may be present in isolated locations in the forested area, soil remediation in the form of targeted soil removal in these isolated areas is required before an RSC can be filed.

**Ecological Risk Assessment**

19) **Comment:** The discussion in Section 5.1 with respect to the use of the components of SCS for screening (soil and groundwater) constitutes a qualitative risk assessment as it is used in setting PSS for some COC. A discussion of the qualitative approach needs to be included in the appropriate sections.

**Response**: Because the use of 2009 SCSs and component values in the Section 5.1 of the ERA is a qualitative approach to the RA, a brief discussion relating the use of both a qualitative and quantitative approach has been added to the Ecological Risk Assessment Objectives (Section 5.1.3). Additional discussion regarding the qualitative RA and how component values are employed as ecological PSSs has been added to Section 5.5.5.

20) **Comment:** The identification of domestic pets such as dogs as ecological receptors should be considered as page 35 of the RA indicates that the site could be used by people and their pets.

**Response**: Domestic pets such as dogs were not considered as ecological receptors in the RA since it is implicitly assumed that people and their pets (*e.g.*, dogs) could use any parkland area. Exposures and risks to pets, such as dogs, are not routinely assessed under O.Reg. 153 or other jurisdictional regulations or guidelines, even for parkland land uses. Moreover, there is no standard methodology to assess risks to pets. For example, guidance on exposure parameters (soil ingestion rates, durations, *etc*.) and acceptable risk levels are lacking. Therefore, domestic pets were not considered as ecological receptors in the revised RA.

21) **Comment:** The discussion related to Table 5.2 with respect to the factor of 10 applied to S-GW3 is not consistent with the derivation of values in the 2009 Rationale. If the intent is to remove the dilution applied to groundwater then additional detail is required since a generic dilution factor of 10 is not consistently applied in the 2009 Rationale. An indication of the dilution factors that were used by the MOE for deriving the ground water standards can be obtained by comparing the aquatic toxicity values based on the protection of aquatic receptors that do not account for dilution provided in Table 3.1 of the 2009 Rationale document (pg 147) to the base GW3 values. For example, for DDD the aquatic toxicity value in Table 3.1 is provided as 0.18 µg/L while the GW3 component of the standard is 16,000,000 µg/L which means that a dilution of approximately $9x10^7$ was used in the derivation of the generic standards.

**Response**: Agreed. The text immediately preceding Table 5-2 has been updated to remove discussions related to S-GW3 values divided by ten. Although the MOE (2009) Table 2 ecotoxicity component values provided in Table 5-2 are appropriate for the qualitative evaluation, the S-GW3 values are not. Because of the presence of on-site surface water bodies, MOE (2009) Table 8 SCSs are inherently protective of the leaching of contaminants in soil to groundwater and the subsequent movement to on-site surface water. Since Table 8 S-GW3 component values are not available, the Table 8 SCSs were used in the revised ERA to provide this protection. Therefore, Table 5-2 in the revised RA (and the discussion around it) has been updated to reflect this change in approach.

22) **Comment:** The ERA does not address potential exposure to surface water. The only discussion of surface water relates to the evaluation of the groundwater sodium concentration through a comparison to a TRV for daphnids. As the maximum measured surface water concentrations of arsenic (25 µg/L) and lead (78 µg/L), as reported in the response to PSF comments, exceed PWQOs, the potential for adverse effects to additional aquatic biota, not just sediment-dwelling organisms through comparison to sediment quality objectives, should be considered.

**Response**: As discussed in the response to Comment # 4, the maximum measured surface water concentrations of arsenic (25 µg/L) and lead (78 µg/L), as reported in the response to PSF comments, are not considered an appropriate representation of on-site surface water impacts. As shown in Table 3-4 of the revised RA and in the Phase II ESA, the maximum concentrations of arsenic and lead were determined to be 3.36 µg/L and 0.7 µg/L, respectively. Table 3-4 of the revised RA presents a comparison of potential COC concentrations in surface water with available PWQO values is presented in Section 3.3.2.4 of the revised RA. Because all maximum concentrations (or highest detection limits) were below available PWQOs for those chemicals with measured concentrations in any sample, it was determined that no further assessment of surface water was required in the RA. Therefore, no additional evaluation of surface water exposure was made in the revised ERA.

23) **Comment:** The regression equations or uptake factors should be checked; for example, the equations for estimating worm concentrations for arsenic, DDD and DDE could not be confirmed with the original literature.

**Response**: The regression equation for soil-to-worm uptake of arsenic presented in Table 5-6 of the RA is a typographical error. The correct equation should be Y = -1.42+0.71x. The correct equation was used in the subsequent calculations in the RA and thus the error did not affect the results or conclusions. The regression equations for DDD and DDE were also typographical errors in that the equations for each were incorrectly given for the other (*i.e.*, the correct equation for DDD was given for DDE and vice-versa). Refer to Figure 6 of Eco-SSL Attachment 4-1 for the regression equations for DDD and DDE used in the revised RA. The correct predicted concentrations of DDD and DDE in soil invertebrates are provided in Table 5-7 of the revised RA.

24) **Comment:** The TRVs provided by MOE (2009) should be considered as the Ministry preferred TRVs. Therefore the rationale for deviations from these values needs to be provided within the RA (*e.g.* DDD and DDE for plants, soil invertebrates and wildlife; arsenic and lead for birds).

**Response**: The response to this comment has been broken into four parts:

- To be consistent with MOE guidance and policy, the plants and soil invertebrates benchmarks for DDD (8.5 µg/g) and DDE (0.33 µg/g) have been updated in the revised RA with values provided in the 2009 Rationale. Subsequent calculations and conclusions are revised to reflect the changes;
- The wildlife TRVs for DDD and DDE provided in Table 5-10 of the RA are typographical errors and have been corrected in the revised RA. Since the correct values were used in the subsequent risk calculations for the shrew, the vole and the

robin, the conclusions remain unchanged for terrestrial mammals and birds;

- The TRV for arsenic and birds recommended by the MOE (7.4 mg/kg-day) is based on studies related to copper acetoarsenite, as provided in Sample *et al*. (1996). Because of the potential additional contribution of copper in the derivation of this TRV, it was assumed in the RA that the TRV related to sodium arsenite and the mallard duck (12.8 mg/kg-day) is the more appropriate value for the current RA. A brief discussion of this is provided in the revised RA; and,
- The initial TRV selected to assess lead exposure to birds was 11.3 mg/kg/d, taken from Sample *et al*. (1996). This TRV was based on an earlier study by Edens *et al*. (1976) on quail. The Ministry, in their Procedures document (MOE, 2005; pages 61, 62) identifies Oak Ridge National Laboratory (*e.g*., Sample *et al*., 1996) as a credible agency source of TRVs. However, the Ministry did not use this TRV when updating the Site Condition Standards (MOE, 2009). The MOE TRV of 3.3 mg/kg/d (MOE, 2009) is based on the quail study of Edens and Garlich (1983). This TRV (the LOAEL from the study) was not used as the TRV for the ERA. However, the data from this study were used as the basis of the TRV, in order to be consistent with the Ministry's preferred study. US EPA (2001) took the data from Edens and Garlich (1983) and fit a dose-response curve to the data. From this curve, they estimated an EC20 of 9.9 mg/kg/d. The EC20 of 9.9 mg/kg/d is used as the TRV in the ERA since it is more scientifically defensible, as it is associated with a particular level of effect.

25) **Comment:** The exposure results shown in the assessment could not be reproduced (*e.g*. arsenic exposure to shrew). A sample calculation should be provided in the assessment. In addition, the procedure used to derive the EBC should be provided, particularly as the equations used to estimate worm and plant concentrations are not necessarily linear. It is not clear how the PSS for DDD exposure to a robin was derived (Table 5-17).

**Response**: A sample calculation for the exposure to arsenic is provided in the revised RA for each relevant VEC (vole, shrew and robin). In the revised RA, the effects-based concentrations for soil COCs were derived by estimating the concentration required to produce an ER=1. As stated in the comment, this was done since the regression equations used to predict uptake into plants and soil invertebrates are not always linear. Where the derived EBC was significantly larger than the maximum on-site concentration, the PSS for that COC and VEC was set as the maximum concentration + 10%. Updated EBCs and PSSs are provided in the revised RA.

26) **Comment:** Additional discussion should be provided to support the contention that there are no effects on biota, particularly plants and soil invertebrates. This could include mapping and an estimate of the areal extent of potential impacts, surveys of the impacted area compared to a reference area, *etc*.

**Response**: As discussed in Section 5.5.3 of the RA, despite an estimated 38% of soil samples having an arsenic concentration in excess of the plant toxicity benchmark, it is still clearly evident on-site that an urban forest community thrives throughout the Site, as well as other diverse vegetation. Evidence of this is shown in photographs taken in August of 2009, many of which were taken in areas of the highest arsenic concentrations (and thus requiring targeted soil removal, as concluded in the RA). Examples of these photos are included in the Revised RA in Section 5.5.3. Additionally, a figure showing the on-site areas with soil concentrations exceeding the human health effects-based concentrations is now presented in Section 7.0.

27) **Comment:** The values shown in Table 5-19 for the values that are protective of individual receptor groups do not match those provided in earlier tables (*e.g*. DDD for meadow vole shown as 560 µg/g in Table 5-15 but is entered as 0.026 µg/g in Table 5-19, there are others as well). This should be clarified.

**Response**: The value of 560 µg/g for DDD in Table 5-15 is a back-calculated effects-based concentration protective of the meadow vole (*i.e*., the maximum soil concentration where ER ≤1). Because this value is significantly larger than the maximum on-site soil concentration (0.024 µg/g), it was deemed inappropriate to adopt a PSS in such excess of the maximum concentration. This approach was taken for other COCs as well (*e.g.*, DDE for the vole). It is important to note that it is the property-specific standards for each COC/VEC from Tables 5-14 to 5-17 that were used in the derivation of final PSSs shown in Table 5-19. Clarification regarding this approach has been made in the discussion regarding the selection of property-specific soil standards (Section 5.5.4).

28) **Comment:** Risks and hazard quotients associated with the proposed property-specific standards are not calculated (as stated in the Procedures document the concentration proposed as the standard must be evaluated explicitly in the risk assessment). A straight-forward way of incorporating this is to use the PSS as the source concentration in the assessment.

**Response**: See the response to Comment #18.

**Other**

29) **Comment:** To be consistent with the expectations of the PSS table, additional information should be added to Tables 6-1 and 6-2. This information should include the dominant exposure pathway for those set to 10% above the maximum (sodium in groundwater, DDD and DDE in soil. Also, if the conclusion is supported that there are no impacts on plants on soil invertebrates from the maximum measured lead concentration this should added to Table 6.2.

**Response**: Tables 6-1 and 6-2 have been updated to include information regarding the dominant pathways for each COC. As stated in the comment above, the PSS for sodium in groundwater, and DDD and DDE in soil, were set as the maximum concentration +10% (to account for variability in sampling and analysis). The dominant exposure pathway for sodium in groundwater is direct contact of on-site aquatic VECs. Because the benchmark concentration for sodium (in effect, the effects-based concentration) is significantly greater than on-site groundwater levels of sodium, the PSS was established as provided. Similarly, the dominant exposure pathways for DDD and DDE in soil are birds and plants / soil invertebrates, respectively. Finally, the additional exposure pathway of exposure of lead to plants and soil invertebrates is included in Table 6.2 of the revised RA; although the maximum concentration of lead exceeded the effects-based concentration derived, because only a limited number of samples were in exceedance (<20% of samples), it was demonstrated in Section 5.5.3 that there are no unacceptable risks to plants and soil invertebrates from exposure to lead in on-site soil.

30) **Comment:** Mandatory Certifications and RMP. The Risk Management Plan (Section 7 of the RA report) includes a restriction on future property use. However, the mandatory certifications included by the QPRA in Appendix H state that no RMP is necessary. The mandatory certifications will need to be updated in order to be consistent with the conclusions of the RA report.

**Response**: Agreed. The Mandatory Certifications have been modified.

**Risk Management comments inadvertently omitted.**