# Territoires du Nord-Ouest Gouvernement des Northwest Territories Government of



**★**★ Imperial

Product Name UNLEADED GASOLINE Revision Date: 01 Oct 2018 Page 13 of 15

17, 88, 98, 150 Xes Ves Special Provisions: Packing Group: Marine Pollutant:

Footnote: Marine Pollutant designation is applicable only if shipped overwater

LAND (DOT)

GASOLINE Hazard Class & Division: ID Number: 1203 Proper Shipping Name:

128 Packing Group: ERG Number:

Label(s):

UN1203, GASOLINE, 3, PG II Transport Document Name:

SEA (IMDG)

MOTOR SPIRIT or GASOLINE or PETROL Hazard Class & Division: Proper Shipping Name:

EMS Number: FE,SE

1203 UN Number:

Packing Group: Marine Pollutant Label(s):

UN1203, MOTOR SPIRIT or GASOLINE or PETROL, 3, PG II, (40°C c.c. Transport Document Name:

AIR (IATA)

MOTOR SPIRIT or GASOLINE or PETROL Hazard Class & Division: UN Number: 1203 Proper Shipping Name: UN Number:

Packing Group:

Label(s) / Mark(s):

UN1203, GASOLINE, 3, PG II Transport Document Name:

SECTION 15

REGULATORY INFORMATION

CEPA: All components of this product are either on the Domestic Substance List (DSL) or are exempt

Listed or exempt from listinghotification on the following chemical inventories (May contain substance(s) subject to notification to the EPA Active TSCA inventory prior to import to USA): AICS, DSL, ENCS, KECI,

The Following Ingredients are Cited on the Lists Below:

UNLEADED GASOLINE 01 Oct 2018 40 Product Name: Revision Date: ( Page 14 of 15

Chemical Name	CAS Number	List Citations
Berzene	71-43-2	KCS
CUMENE	8-82-8	9
CYCLOHEXANE	110-82-7	9
ETHYL BENZENE	100-41-4	9
n-Hexane	15553	9
Naphthalene	91-20-3	190
Toluene	108-88-3	9
XYLENES	1330-20-7	9

-REGULATORY LISTS SEARCHED-

5 = TSCA 12b 3=TSCA 5e 4=TSCA 6

1=TSCA4 2=TSCA5a2

# SECTION 16

# OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only): H224: Extremely flammable liquid and vapor; Flammable Liquid, Cat 1

H225: Highly flammable liquid and vapor, Rammable Liquid, Cat 2

H226: Flammable liquid and vapour, Flammable Liquid, Cat 3 H302: Hamiful if swallowed; Acute Tox Oral, Cat 4

H303: May be harmful if swallowed, Acute Tox Oral, Cat 5
H304: May be fatal if swallowed and enters airways; Aspiration, Cat 1
H312: Harmful in contact with skin; Acute Tox Demnal, Cat 4
H315: Causes skin intration; Skin Confirmation, Cat 2
H315: Causes serious eye initiation; Serious Eye Damagelin; Cat 2A
H320(2B): Causes eye imitation; Serious Eye Damagelin; Cat 2A
H320(2B): Causes eye imitation; Serious Eye Damagelin; Cat 2B

H332: Hamful if inhaled; Acute Tox Inh, Cat 4

H335. May cause respiratory imfattent, Target Organ Single, Resp Irr H336. May cause drowsness or dizaness, Target Organ Single, Narcotic H340(18) May cause genefic defects, Germ Cell Mutagenicity, Cat 18 H350(14), May cause cancer, Carcinogenicity, Cat 14 H350(16): May cause cancer, Carcinogenicity, Cat 18

H351: Suspected of causing cancer, GHS Cardinogenicity, Cat 2
H35(ID): Suspected of damaging the unborn child; Repro Tox, Cat 2 (Develop)
H35(IP): Suspected of damaging fertility, Repro Tox, Cat 2 (Fertility)
H35(IF): Suspected of damaging fertility, Repro Tox, Cat 2 (Fertility)
H372: Causes damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 1
H373: May cause damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 2
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1

H401: Toxic to aquatic life; Acute Env Tox, Cat 2
H410: Very toxic to aquatic life with long issting effects; Chronic Env Tox, Cat 1
H411: Dox to aquatic life with long lasting effects, Chronic Env Tox, Cat 2
H412: Hamful to aquatic life with long lasting effects, Chronic Env Tox, Cat 3

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

# Northwest Territories Territoires du Nord-Ouest Gouvernement des Government of



Productions UNENCE GASSANE Revision Data 11 Oct 2015

Paper 15

Updates made in accordance with implementation of GHS requiements

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100 Miles (MICH)

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# **APPENDIX F: Monthly Fuel Tank Inspection**

Monthly Fuel Tank Inspection will be performed on IAUDITOR (APP) and is where records will be kept. This form can also be used.



# Monthly Tank Inspection Checklist

eneral inspection Information: nspection Date:	Prior Inspection Date:
pector Name (print):	
pectors Signature:	
nk Inspected or ID #:	

- substantially equivalent (as applicable), Inspections of multiple tanks may be captured on one form as long as This checklist is intended as a model Locally developed checklists are acceptable as long as they are
- For equipment not included in this Standard, follow the manufacturer recommended inspection/testing schedules and procedures.
- Upon discovery of water in the primary tank, secondary containment area, interatice, or spill container, remove promotify or other contaminants and dispose of property.

  Retain the completed checklists for at least 36 months.
- After severe weather (mow, ice, wind storms) or maintenance (such as coating) that could affect the operation of critical components (normal and emergency vents, valves), an inspection of these components is required as

soon as the equipment is safely accessible after the event.	the event.	
ITEM	STATUS	Comments/Date Corrected
Tank	Tanks and Pipes	
Is tank exterior (roof, shell, heads, botton, connections, fitting, valves, etc.) free of visible leaks? Note: It No. 'identify tank and describe leak and actions taken	O Yes	
is the tank liquid level gauge legible and in good working condition?	O Yes	
Is the area around the tank [concrete surfaces, ground, containment, etc.] free of visible signs of leakage?	□ Yes	
Is the primary tank free of water or has another preventative measure been taken?	O Yes	
For double-wall or double bottom tanks, is interstitial monitoring equipment (where applicable) in good working condition?	□ Yes □ No □ NA	
For double-wall tanks or double bottom tanks, is interstice free of liquid? Remove the liquid if it is found, if tank product is found, investigate possible leak.	□ Yes □ No □ NA	
	Equipment on Tank	S 1
Is the spill container (spill bucket) ampty, free of visible leaks and in good working condition?	O Yes	
Are piping connections to the tank (valves, fittings,	□ Yes	-

andon and describe leak.  Interpolationary walkways appear to be a no sign of severe convoition or containment the of access inquid debries, cosion, evolum, fire hazards and other continuent agrees pathways clear and any superable!  Other Conditions that addressed for continued safe and continued safe all Comments:	ontainmen			No	
in origin efference corrotion or Containment inters of excess liquid debris.  Containment inters of excess liquid debris.  The color. evolution for hazards and other color.  The color and excess liquid debris.  The color and excess liquid debris.  Other Conditions to the conditions that addressed for continued safe.	Containment of the of axees forested of the of any of the earest forest and other containment fore of axees inquid debria.  Containment forest forest forest and other containment egress pathways chear and other contained any of operable?  Other Conditions that addressed for continued safe and forest fo	identity location and describe lead.		NA	
of the ofference coronion or  Containment for of excess liquid debria.  Containment for of excess liquid debria.  Containment expens pathways chear and any  superable!  Other Conditions that the ofference of any other conditions that the ofference of any other conditions that the ofference of the continued safe.	Ontaining  Containing  Contain	Do the ladders/platforms/walkways appear to be		Yes	
Containment  Conta	Containment  Conta	Secure with no sign of severe correston or demand		No	
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numit egges pathways clear and any s operable!  Other Conditions that addressed for continued safe	ment eges; pathways clear and any s operable!  Other Conditions that aldressed for continued safe  al Comments:	cracks, corresion, erosion, fire hazards and other		No	
nomit egress pathways clear and any s operable!  Other Condition addressed for continued safe	other Conditions that and any superable!  Other Conditions that addressed for continued safe all Comments:	the Enty to the San		NA	
Other Condition  Other Conditions that addressed for condinced safe	Other Conditions that   Other	Are containment egress pathways clear and any		Yes	
Other Conditions that Conditions that addressed for continued safe	Other Conditions that addressed for continued safe	gates/doors operable?		No	
Uther Conditions that addressed for continued safe	Other Conditions that addressed for continued safe all Comments:	ē		Ma	
n free of any other conditions that addressed for continued safe	addressed for continued safe	Officer	T Condit	1003	
anterse or connect see	al Comments:	Is the system free of any other conditions that		Yes	
Additional Comments:	Additional Comments:	operation?		No	
		Additional Comments:			

16 Revision# 001

# APPENDIX C - REPORTABLE SPILL QUANTITIES

Substance	Reportable Quantity
Explosives Compressed gas (toxic/corrosive) Infectious substances Sewage and wastewater (unless otherwise authorized) Radioactive materials Unknown substances	Any amount
Compressed gas (flammable) Compressed gas (non-corrosive, non-flammable)	Any amount of gas from containers with a capacity grater than 100 L
Flammable liquid	≥100 L
Flammable solid Substances liable to spontaneous combustion Water-reactant substances	≥25 kg
Oxidizing substances	≥50 L or 50 kg
Organic peroxides Environmentally hazardous substances intended for disposal	≥1 L or 1 kg
Toxic substances	≥5 L or 5 kg
Corrosive substances Miscellaneous products, substances, or organisms	≥5 L or 5 kg
Polychlorinated biphenyl mixtures of 5 ppm or more	≥0.5 L or 0.5 kg
Other contaminants, such as crude oil, drilling fluid, produced water, waste or spent chemicals, used or waste oil, vehicle fluids, wastewater	≥100 L or 100 kg
Sour natural gas (i.e., contains hydrogen sulphide) Sweet natural gas	Uncontrolled release or sustained flow of 10 minutes or more
Flammable liquid Vehicle fluid	≥20 L When released on a frozen waterbody that is being used as a working surface
Reported releases or potential releases of any size that:	Any amount

Substance	Reportable Quantity
<ul> <li>are near or in an open waterbody;</li> <li>are near or in a designated sensitive environment or habitat;</li> <li>pose an imminent threat to human health or safety; or</li> <li>pose an imminent threat to a listed species at risk or its critical habitat.</li> </ul>	

Table information from : Report a spill | Environment and Natural Resources (gov.nt.ca)

## **APPENDIX D - NT-NU SPILL REPORT FORM**

# **NT-NU SPILL REPORT**









NT-NU 24-HOUR SPILL REPORT LINE Tel: (867) 920-8130 • Email: spills@gov.nt.ca

	307) 920-0130 • Email. spins@g	jovintioa						REF	PORT LINE USE ONLY
Α	Report Date:	Report Tir	me:		Original Spil	l Report		Re	port Number:
В	Occurrence Date:  MM DD	Occurrence	ce Time:		OR Update #	to	the Original Spill Repor	t	
С	Land Use Permit Number (if app	olicable):		Wa	ter Licence N	lumber (i	f applicable):		
D	Geographic Place Name or Dist	ance and Direction	on from the N	Named Loca	tion:	Region:		ent J	urisdiction or Ocean
Е	Latitude: Degrees	_ Minutes	S	Seconds	Longitude:	Degrees	Minutes		Seconds
F	Responsible Party or Vessel Na	me:	Res	sponsible Pa	rty Address	or Office	Location:		
G	Any Contractor Involved:			ntractor Addı	ess or Office	Location	n:		
Н	Product Spilled: Potential Spill Qu			Litres, Ki <b>l</b> og	rams or Cub	ic Metres	U.N. Number:		
ı	Spill Source: Sp			Spill Cause:			Area of Contamina	Area of Contamination in Square Metres:	
J	Factors Affecting Spill or Recovery:  Describe Any Assistance Required:  Hazards to Persons, Property or Environmental Property of Environmental Pro					perty or Environment:			
К	Additional Information, Comments, Actions Proposed or Taken to Contain, Recover or Dispose of Spilled Product and Contaminated Materials:								
L	Reported to Spill Line by: Position:		Er	Employer: Locat		ocation Calling From:		Telephone:	
М	Any Alternate Contact: Position:		Er	Employer: Altern		ternate Contact Location	rnate Contact Location: Alternate Telephon		
REP	ORT LINE USE ONLY								
N	Received at Spill Line by: Position:			Employer:	oyer: Location Called:		tion Called:	Report Line Number:	
Lead	.ead Agency: ☐ EC ☐ CCG/TCMSS ☐ GNWT ☐ G						File Status: Open Unknown Closed		
Ageı	ncy: Contac	t Name:	Conta	Contact Time: Remai		arks:			
Lead	Agency:								
First	Support Agency:								
Seco	and Support Agency:								
Third	Support Agency:								



## **REPORT**

# **Government of Northwest Territories Department of Infrastructure**

Hay River Harbour Restoration – Waste Management Plan 2023-8356



**MARCH 2023** 





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## **REVISIONS PAGE**

# Hay River Harbour Restoration Waste Management Plan Client: Consultant: Government of Northwest Territories Department of Infrastructure Associated Environmental Consultants Inc.

Revision/ Issue	Date	Description	Prepared by/ Reviewed by	Client Review
1	2023-03-31	Submission for MVLWB water licence application	Associated	GNWT-INF
	Click or tap to enter a date.			
	Click or tap to enter a date.			
	Click or tap to enter a date.			
	Click or tap to enter a date.			
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## LIST OF FIGURES

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Figure 1-1 Proposed Dredging Locations

3

## LIST OF ABBREVIATIONS

Abbreviation	Definition
CCME	Canadian Council of Ministers of the Environment
FAL	Canadian Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life
GNWT	Government of Northwest Territories
INF	Department of Infrastructure
MTS	Marine Transportation Services
MVLWB	Mackenzie Valley Land and Water Board
РЕНН	Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

#### 1 INTRODUCTION

The Government of Northwest Territories (GNWT) – Department of Infrastructure (INF) retained Associated Environmental Consultants Inc. (Associated) to prepare a waste management plan related to dredging works taking place in the Hay River, near its outlet into Great Slave Lake (Dredge Area A, Figure 1-1), and within the three fingers of the East Channel of the river (Dredge Area B, Figure 1-1). The dredging is proposed to begin July 16, 2023 and continue until September 14, 2023. The waste management plan follows the Mackenzie Valley Land and Water Board's (MVLWB) Standard Outline for Management Plans (2021), their Guidelines for Developing a Waste Management Plan (2011), and their draft Waste Management Policy (2022).

#### 1.1 Corporate Contact Information

The GNWT-INF is the primary contact for this project and will be working closely with GNWT – Marine Transportation Services (MTS).

Applicant's Name:	Mark Cronk					
Position:	Director of Design and Technic	al Services				
Company Name:	Government of Northwest Terr	Government of Northwest Territories - Department of Infrastructure				
Mailing Address:	4th floor, Tatsaotįne Building PO Box 1320 5015 – 49th Street					
Community:	Yellowknife Telephone: 867-767-9048 ext. 32060					
Prov/Terr:	NT Email: Mark Cronk@gov.nt.ca					
Postal Code:	X1A 2L9	Other:				

#### 1.2 Project Description

In 2022, the Hay River experienced unusually high-water levels, resulting in increased sediment being deposited in the Hay River Harbour and Great Slave Lake at the river outfall. The sediment, which has not been regularly maintained since 1997, has begun to fill the Dredge Areas. This has caused an emergency scenario, since the shallow water in the navigation channel poses a risk to boats (i.e., sea barge, Coast Guard, fishing, and recreational vessels) getting stuck in the sediment deposit and not being able to enter or exit the Hay River Harbour. Removing sediment so that boats can travel along the navigation channel. If boats cannot enter or exit the harbour, the supply for essential goods, and fuel for power and heat could be interrupted for up to 12 communities who rely on the sea barge system.

The GNWT-INF has proposed dredging the navigation channel to mechanically excavate a 30 m wide and 2.4 m deep navigation channel for emergency use, to be completed by local contractors in coordination with GNWT-MTS. The excavated sediment from the navigation channel would be loaded onto a barge, allowed to passively dewater, and when the barge is at capacity, the sediment would be offloaded to haul trucks located on shore. The haul trucks would transfer the sediment to GNWT-INF property on Vale Island, using a sealed truck bed to mitigate further dewatering on roads. The sediment would be temporarily stored on Vale Island, contained with 1 m berms, for ongoing passive dewatering. Once moved from the barge to land, the sediment will be considered soil (CCME 1999) and may be made available for public use, if appropriate, or would be transferred to a final management area.

<sup>&</sup>lt;sup>1</sup> Sediment is unconsolidated material deposited on the bed of a waterbody or in a low spot or depression on land where the water velocity is insufficient to move the material (CCME 1999).



This emergency dredging program will include removal and temporary storage of the following estimated volumes of sediment:

- Dredge Area A: the shipping lanes approaching the outfall to Great Slave Lake to a width of 30 m, dredging 16,000 m<sup>3</sup>; and
- Dredge Area B: the three fingers in the East Channel, dredging 68,000 m<sup>3</sup>.

#### 1.3 Regulatory Framework

GNWT-INF is committed to the environment and will be following the required environmental processes to mitigate potential environmental impacts from this project. As part of the regulatory processes, environmental planning and mitigation will form part of the regulatory applications. Anticipated regulatory permits or authorizations, parameters, and regulatory criteria are detailed in the Hay River Harbour Restoration – Monitoring Plan (Associated 2023a). Samples collected in the preliminary assessment and during monitoring efforts will be compared to the following guidelines:

- Water quality samples will be compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life.
- Sediment samples taken from the river or barge will be compared to the CCME Canadian Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life (FAL).
- Soil samples taken once material is deposited on land will be compared to the CCME Canadian Soil Quality
  Guidelines for the Protection of Environmental and Human Health (PEHH) and the soil quality standards in the
  GNWT Environmental Guideline for Contaminated Site Remediation.





Dredging Areas

Temporary Soil Storage (GNWT)

Temporary Soil Storage (Town of Hay River)

DRAWN BY CHECKED BY SC JB

SCALE 1:36,000 COORD. SYSTEM NAD 1983 UTM ZONE 11N DATE 2023-03-28 REV 02

DREDGING AND PROJECT AREA

**GOVERNMENT OF** NORTHWEST TERRITORIES-DEPARTMENT OF INFRASTRUCTURE

HAY RIVER HARBOUR **RESTORATION** 

#### 2 TYPES OF WASTE

The two types of waste being considered are 1) waste generated through construction and 2) sediment from Dredge Areas A and B (Figure 1-1).

As a sediment, the dredged material meets the definition of waste in the draft Waste Management Policy (MVLWB 2022)<sup>2</sup>. Once the sediment is removed from the river and placed on land, it will be considered soil<sup>3</sup>. Preliminary *in situ* sampling and analysis have been completed to determine whether there are potential contaminants of concern relative to applicable CCME FAL for sediment and SSME soil guidelines for parkland/residential and industrial/commercial land uses, and PEHH. The results from samples collected on January 19, 2023 are shown in Appendix A. These samples were collected from sediment located in Dredge Area A.

A limited Phase I and Phase II environmental site assessment of GNWT-MTS sites was also conducted by others in 2017 (data included in Appendix A). Although Dredge Area B sediment had arsenic and cadmium concentrations that exceeded CCME FAL guidelines, the samples met criteria for CCME soil guidelines for parkland/residential and industrial/commercial land uses (12 mg/kg).

Background metal concentrations for the sediment are not known at this time.

The sediment is characterized as fine-grained sand and silt, and sandy loam in Dredge Areas A and B.

#### 3 METHODS OF WASTE MANAGEMENT

Waste generated by construction will be the responsibility of the contractor awarded the dredging project; however, waste will be disposed of appropriately at an approved waste management facility. The waste management plan will be updated by the contractor (after project award) to provide a list of waste types and specific details about the management methods related to the project.

The proposed approach to managing the sediment is to contain the material during dredging and storage, with the objective of reducing the amount of sediment that enters the water after dredging and setting a minimum distance between the temporary soil storage sites and the watercourses (i.e., source reduction). This will be managed through project sequencing and the erosion and sediment control measures outlined in the Hay River Harbour Restoration – Sediment and Erosion Control Plan (Associated 2023a) and will be monitored as outlined in the Hay River Harbour Restoration – Monitoring Plan (Associated 2023b). The project is expected to be undertaken in the following sequence:

- 1. The sediment excavated from the dredging areas will be loaded onto a barge and the slurry filtered through geotextile to passively dewater *in situ*.
- 2. When the barge is at capacity, the sediment will be offloaded from the shore and transferred to Vale Island to passively dewater further at multiple storage sites.
- 3. At the Vale Island temporary storage sites, the water from the dewatering process will infiltrate onto underlaying soils, excess water from the piles (if any) will be directed to sumps, where the water will infiltrate

<sup>&</sup>lt;sup>3</sup> The MVLWB(2022) defines waste as "any substance that, if added to water, would degrade or alter or form part of a process of degradation or alteration of the quality of the water to an extent that is determined to its use by people or by any animal, fish, or plant".



 $<sup>^2 \,</sup> https://mvlwb.com/sites/default/files/2022-02/DRAFT\%20LWB\%20Waste\%20Management\%20Policy\%20-\%20Public\%20Review\%20-\%20Feb\%202022.docx$ 

# Government of Northwest Territories Department of Infrastructure

into the ground. Stockpiles will be approximately 3 m high and more than 30 m from monitoring wells and surface water bodies to mitigate the potential for a direct hydraulic connection to groundwater and surface water.

On Vale Island, the material will be temporarily stockpiled on multiple properties, where it will be considered soil once it is on land (no longer sediment). Stockpiles will be placed in grided cells to manage the locations of where the sediment was dredged. This will allow sampling to be geo-referenced and prevent mixing of potentially different materials. The water captured will be managed through infiltration to the ground (Step 3 in project sequence). Because the material currently meets CCME and PEHH guidelines for soil (Appendix A), it is assumed that once dewatered, it will continue to meet guidelines; however, weekly sampling will be conducted and, if needed, waste management will be adapted as outlined in the monitoring plan (Associated 2023b).

To determine the options for soil reuse, once the soil is dry, it will also be tested for contaminants and physical properties. After the material is dewatered, it will be analyzed as outlined in the monitoring plan (Associated 2023b), and the potential for local reuse in and around the Town of Hay River will be reviewed. If the soil continues to meet guidelines, potential options for reuse include using the soil as fill material to raise land in the local area, as capping material at the solid waste disposal facility, or other purposes to be determined.

If the soil is contaminated at levels greater than background concentrations (which may naturally exceed guidelines), *in situ* remediation options will be explored, including remediation standards, using vegetation for phytoremediation, and routine inspection. If contaminated soil does not meet regulatory requirements, it will be transferred to an approved waste handling facility for treatment.

#### **CLOSURE**

This report was prepared for the Government of Northwest Territories – Department of Infrastructure to develop a waste management plan for the emergency works to dredge the Hay River Harbour and manage the dredged material.

The services provided by Associated Environmental Consultants Inc. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practising under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Environmental Consultants Inc.

Prepared by:

Reviewed by:

Melanie Piorecky, P.Ag. Technical Specialist, Reclamation and Restoration Jennifer Brown, P.Eng., MEERL Project Manager

#### **REFERENCES**

Associated Environmental Consultants Inc. (Associated). 2023a. Hay River Harbour Restoration – Sediment and Erosion Control Plan.

Associated Environmental Consultants Inc. (Associated). 2023b. Hay River Harbour Restoration - Monitoring Plan.

Canadian Council of Ministers of the Environment (CCME). 2008. Canada-wide standard for petroleum hydrocarbons (PHC) in soil.

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Total Particulate Matter and Summary Tables.

Canadian Council of Ministers of the Environment (CCME). 1997. Canadian Soil Quality Guidelines.

Mackenzie Valley Land and Water Board (MVLWB). 2011. Guidelines for Developing a Waste Management Plan.

Mackenzie Valley Land and Water Board (MVLWB). 2021. Standard Outline for Management Plans. Available at: <a href="https://mvlwb.com/sites/default/files/2021-06/LWB%20Standard%20Outline%20for%20Management%20Plans%20-%20Approved%20-%20Jun%2010\_21\_0.pdf">https://mvlwb.com/sites/default/files/2021-06/LWB%20Standard%20Outline%20for%20Management%20Plans%20-%20Approved%20-%20Jun%2010\_21\_0.pdf</a>

Mackenzie Valley Land and Water Board (MVLWB). 2022. Waste Management Policy (Draft).

## **APPENDIX A - PRELIMINARY SEDIMENT SAMPLING RESULTS**

#### Hay River Harbour Legend for Soil Quality Results

<	Less than reported detection limit
CCME Sediment FAL	CCME. Canadian sediment quality guidelines for the protection of freshwater aquatic life.
CCME SO CL CS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Commercial Land Use and Coarse-grained Soil.
CCME SO CL FS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Commercial Land Use and Fine-grained Soil.
CCME SO IL CS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Industrial Land Use and Coarse-grained Soil.
CCME SO IL FS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Industrial Land Use and Fine-grained Soil.
CCME SO RL/PL CS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Residential/ parkland Land Use and Coarse-grained Soil.
CCME SO RL/PL FS	CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Residential/ parkland Land Use and Finegrained Soil.
N	Narrative type of guideline or standard, or Result Note.
NG	No Guideline
CCME Sediment FAL	Highlighted value exceeds CCME Sediment FAL
CCME SO CL CS	Highlighted value exceeds CCME SO CL CS
CCME SO CL FS	Highlighted value exceeds CCME SO CL FS
CCME SO IL CS	Highlighted value exceeds CCME SO IL CS
CCME SO IL FS	Highlighted value exceeds CCME SO IL FS
CCME SO RL/PL CS	Highlighted value exceeds CCME SO RL/PL CS
CCME SO RL/PL FS	Highlighted value exceeds CCME SO RL/PL FS

Hay River Harbour Soil Quality Results

							Samoli	Sampling Location   Sample 01-A   Sample 01-B   Sample 01-B	ample 01-A S	ample 01-B S	ample 01-B	Sample 2	Sample 3	SED-019-01	SED-019-02	SED-019-03   SED-019-04		SED-019-05   SED-019-06	SED-019-06
							ă	Date Sampled	18-Jan-23	18-Jan-23	18-Jan-23	18-Jan-23		14-Oct-17		14-0ct-17		14-0ct-17	14-Oct-17
							La 3	Lab Sample ID Sample Type	BKQ530 Normal	BKQ531 Normal	BKQ532 Duplicate	BKQ533 Normal	BKQ534 Normal						
					Guideline						-								
Analyte	Unit	CCME Sediment	CCME SO CL CCME SO CL	CCME SO CL FS	CCME SO	CCME SO	CCME SO RL/PL CS	CCME SO RL/PL FS											
Lab Results		FAL					+												
General																			
Anion sum	med/L	S	ŊĊ	Ŋ	ŊĊ	Ő N	9 N	Ŋ						14	20	15	10	41	=
Boron (hot water soluble)	mg/kg	NG	NG	NG	NG	ŊĊ	NG	NG	0.08	0.065	0.054	0.056	0.1	0.27	0.46	0.45	0.27	0.22	0.5
Boron (in saturated paste)	mg/L	NG	NG	NG	NG	9 N	NG	NG	0.22	0.2	0.18	0.17	0.23						
Calcium (in saturated paste)	mg/L	NG	NG	NG	NG	NG	S <sub>N</sub>	NG						160	220	200	150	200	170
Calcium (in saturated paste) (mass/mass)	mg/kg	NG	NG	ŊĠ	NG	9 N	NG	ŊĠ						56	120	100	59	69	100
Cation sum	med/L	NG	NG	NG	NG	ŊŖ	NG N	ŊĠ						12	16	15	12	15	13
Cation/EC ratio		NG	ŊŖ	ŊĠ	NG	© N	S <sub>Q</sub>	D'N						12	12	12	12	12	12
Chloride (in saturated paste)	mg/L	Ŋ	9 N	ŊĠ	S	Ŋ	9 N	NG						110	130	83	26	53	32
Chloride ion	mg/kg	9 :	S NG	S S	o i	g .	o l	ON.						39	69	41	21	19	50
Conductivity (in saturated paste)	ms/cm	9 2	4000	4000	4000	4000	2000	2000	0	0	0	0	0	1000	1300	1200	970	1200	1100
oralli size		2 2	2 2	D (2	2 2	2 2	2 2	2 2	Coalse	Coalse	Coalse	Coalsa	COallse	Coalse	D 6	D 0	Coalse	Coalse	ב ב
Nome of the second sector of the sector of the second sector of the sect	1	2 2	5 C	5 C	2 2	5 2	2 2	D (2						0.80	18.0	0.90	6	<u> </u>	7. 1.2
Magnesium (in saturated paste)	mg/lc	2 2	2 2	9 2	2 2	2 2	2 2	2 2						5 5	8 8	17	7 7	7 4 7	23
Magnesium (in saturated paste) (mass/mass)	mg/kg	D (2	2 2	D C	2 2	5 2	5 0	9 9	6	ç	Ç	1	6	- 6	02 6	- 5	- 1	6 6	73
Moisture	% 3	2 2	D (2	D (2	5 2	5 0	5 2	D (2	5 6	D (	2 00		3 ;	77	8	20	77	30	42
Percent clay	% &	2 2	2 2	D C	2 2	2 2	2 2	D (2	2 6	0.0	7.7	7.0	4 5						
Percent said	% à	2 2	2 2	2 2	2 2	2 2	2 2	2 2	7 07	ò	80 -	30	7 7						
Percent sin	0,0	2 2	5 °C	o o	5 °	5 °	5 0	D 0	0	4.0	4	-	4	7 24	7 4 4	7.4	7.16	13	7 11
Dotaccium (in caturated pacta)	1/08	2 2	2 2	2 2	2 2	2 2	2 2	2 0						11	- 4	- 4	2 5	11	
Potassium (in saturated paste) (mass/mass)	ma/ka	2 2	2 2	2 9	2 2	2 9	2 2	2 2						4.1	2 2 2	7.7	5.4	. 4	6.5
Percent saturation	%	92	92	9 2	92	2 2	2 2	. ON	37	33	30	33	46	36	23	20	38	35	62
Sieve - Pan	%	Ŋ	9N	9N	NG	© N	S <sub>C</sub>	9N N	25	15	15	13	56	59	26	58	31	14	89
Sieve analysis - #10 (>2.00mm)	%	ŊĠ	NG	NG	Ŋ	NG	Ŋ	ŊĊ	<0.20	<0.20	4.8	<0.20	<0.20						
Sieve analysis - #200 (>0.075mm)	%	ŊĊ	Ŋ	NG	Ŋ	© N	D N	ŊĠ	99	85	85	87	74	72	44	42	69	98	32
Sodium (in saturated paste)	mg/L	ŊĊ	NG	NG	NG	© N	NG	NG						34	35	33	27	32	30
Sodium adsorption ratio		NG	12	12	12	12	2	5						99'0	0.57	0.57	0.52	0.54	0.55
Sodium ion	mg/kg	NG	NG	NG	SR	9 N	S	ON.						12	18	17	10	=	19
Sulphate (in saturated paste) (mass/mass)	mg/kg	S S	S G	S S	D C	5 Z	S S	D 2						190	400	310	160	210	300
Sulphate (in saturated paste)	mg/L	5 2	9 G	9 C	9 S	5 Z	5 2		_					930	0//	029	420	089	480
lexture	TON	5 2	9 Q	9 Q	9 0	5 G	5 2	9 Q	Sandy Loam	Loamy Sand	Sand	Sand	Sandy Loam	o o	o o	C C	C C	9	9
mediencal gypsum requirement	I IS/ha	2	2	2	5	9	5	2						02.0>	02.0>	02.0>	02.0	02.0>	02.00
Glycols	:	9			9	9	9	9								9	5	9	9
Diemylene glycol	mg/kg	2	2	פ	2	5	2	5						2	01.4	01.	01.	01.	OI.
Ethylene glycol	mg/kg	S	096	096	096	096	096	096						<10	<10	<10	<10	<10	<10
Propylene glycol	mg/kg	S	NG N	ON.	9 S	9 N	9 N	9 N						<10	<10	<10	<10	<10	<10
Tetraethylene glycol	mg/kg	S S	S	S S	S	© Z	S S	ڻ ق						<10	<10	<10	<10	<10	<10
Triethylene glycol	mg/kg	NG	NG	ŊĊ	ŊĊ	D N	D D	D D						<10	<10	<10	<10	<10	<10
History																			
Dozzas	200	2	2.1	3.1	1.4.000	5.1	61	7, 0000 0	0	0	0000	0.00	000	000	0000	0000	0000	0000	0100
Denzene Ethylbonzono	mg/kg	פ פ	0.030	0.0068	0.030	0.0068	0.0095	0.0068	<0.000	<0.0050	<0.000	<0.000	×0.0030	<0.0050 0.0050	×0.0030	<0.0050	×0.0050	\$0.0050 010	\$0.0050 010
E1 (C8 C10)	mg/kg	2 2	0.002	0.00	0.082	0 000	0.082	0 0	0.07	2007	2007	7.00	0.00	0.00	0.00	7.00	200	7.00	7.00
F1 (CCME): (C6-C10) (less BTEX)	ma/ka	2 2	240 2.3	170 3.3	240 4.3	170 5.3	30 6.3	170 7.3	×10 ×10	01.0	0 0	2 0	012	10, 10	01,0	70 710	70, 70	210	707
F2 (C10-C16)	ma/ka	2 2	260 <sup>2.4</sup>	230 3.4	260 4:4	230 5.4	150 6.4	150 74	<10	210	<10	\$10	× 10	×10	10	×10	×10	21.05	¢10
F3 (C16-C34)	mg/kg	D D	1700 2.5	2500 3.5	1700 4.5	2500 5.5	300 6.5	1300 7.5	<50	<50	<50	<50	52	<50	95	8 8	<50	<50	120

Hay River Harbour Soil Quality Results

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							Samplii Da	o	ample 01-A S. 18-Jan-23	sample 01-B S 18-Jan-23	Sample 01-B 18-Jan-23	Sample 2 18-Jan-23		SED-019-01	SED-019-02	SED-019-03 14-Oct-17	SED-019-04 14-Oct-17	SED-019-05 14-Oct-17	SED-019-06 14-Oct-17
							S	Lab Sample ID Sample Type	BKQ530 Normal	BKQ531 Normal	BKQ532 Duplicate	BKQ533 Normal	BKQ534 Normal						
					Guideline														
Analyte	Unit	CCME Sediment FAI	CCME SO CL CCME SO CL	CCME SO CL FS	CCME SO	CCME SO IL FS	CCME SO RL/PL CS	CCME SO RL/PL FS											
F4 (CCME): (>C34-C50)	mg/kg	ŊĊ	3300 2.6	978 0099	3300 4.6	975 0099	2800 6.6	5600 7.6	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Reached baseline at C50	mg/kg	ŊĊ	NG	ŊĊ	ŊĊ	Ŋ	NG	NG	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Styrene	mg/kg	Ŋ	90	90	20	20	2	2						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Toluene	mg/kg	NG	0.37 2.7	0.08 3.7	0.37 4.7	0.08 5.7	0.37 6.7	0.08 7.7	<0.050	<0.050	<0.050	<0.050	<0.050	<0.020	<0.020	<0.020	<0.020	0.038	<0.020
Xylene	mg/kg	υď	11 2.8	2.4 3.8	11 4.8	2.4 5.8	11 6.8	2.4 7.8	<0.045	<0.045	<0.045	<0.045	<0.045	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
m,p-Xylene	mg/kg	NG	ŊĊ	Ŋ	NG	9N	Ŋ	ŊĊ	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
o-Xylene	mg/kg	ŊĊ	NG	Ŋ	NG	9 S	NG	9 S	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Miscellaneous Organic Substances																			
Atrazine + desethylatrazine	ma/ka	9 N	ŊŊ	9 N	9 N	ŐN.	9N NG	9N ON						<0,0080	<0.0080	<0.0080	<0.0080	<0.0080	<0.0080
Bromacil	mg/kg	Ŋ	NG	© N	S <sub>N</sub>	9 N	9N NG	NG						<0.0090	0600.0>	0600.0>	<0.0090	0600.0>	0600.0>
Diuron	mg/kg	SN	NG	9 N	S	9N	NG	NG						<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Linuron	mg/kg	NG	NG	Ŋ	NG	NG	Ŋ	NG						<0.0070	<0.0070	<0.0070	<0.0070	<0.0070	<0.0070
Simazine	mg/kg	ŊŖ	NG	ŊĊ	NG	9N	NG	NG						<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Tebuthiuron	mg/kg	NG	NG	NG	NG	NG	NG	NG						<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phenolic Substances							L							0	0	0	0	0	c c
2-Chlorophenol	mg/kg	5 S	o (	۵ (	a (	۵ ب	6.0	6.0						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
3 + 4-Cnloropnenol	mg/kg	D 0	D C	D C	S G	. N	. S	. NG						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cresol	mg/kg	D 0	2 .	2	2 .	2 .	- 0	- "						<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071
Z,4-Dichlorophenol	mg/kg	5 C	n 4	n 14	n u	o 4	0.0	0.5						<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2,5-Dimethylphenol	mg/kg	ם מ	o 5	o 5	0 5	o 5	0.0	6.0						×0.0050	×0.0050	00000	<0.0050	00000	×0.0050
2.4-Dinitrophenol	ma/ka	2 2	5 6	2 5	2 6	2 6		-   -						<0.0000	<0.0000	<0.050	<0.000 <0.050 <0.050	<0.050	\$0.050 \$0.050
2-Methyl-4,6-dinitrophenol	ma/kg	. DN	10	10	10	0 0	-	-						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
4-Chloro-3-methylphenol	mg/kg	9 N	NG	9 N	S	0 N	9 N	NG						<0.0050	<0,0050	<0.0050	<0.0050	<0.0050	<0.0050
2-Methylphenol	mg/kg	NG	NG	9 N	9 N	9 N	ŊĠ	NG						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
3 + 4-Methylphenol	mg/kg	NG	NG	© N	S N	S S	9 N	NG						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2-Nitrophenol	mg/kg	ŊĊ	10	10	10	10	-	-						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
4-Nitrophenol	mg/kg	0 2	10	10	10	10	- :	-						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Pentachiorophenol	mg/kg	5 2	9.7	9.7	9.0	9. 0	9.7	9.7						<0.0050	<0.0050 0.005E	00000	<0.0050	0,0000	<0.0050
234 6 Totroblombia	mg/kg	5 2	0.0	0.0	0.0	0.0	0.00	0.0						0.0010	0.0039	0.003	0.0010	0.0032	0.000
2,3,4,9-1 ettacillotophenol	By/bill	2 2	o u	n u	o 14	n 4	0.5	5.00						0.0030	00000	V0.0030	00000	V0.0030	00000
2.3.4-Trichlorophenol	ma/ka	2 2	o 10	0 10	0 10	0 10	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,3,5-Trichlorophenol	mg/kg	SN	NG	© N	S	Ø <sub>Z</sub>	9 N	NG						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4,5-Trichlorophenol	mg/kg	NG	2	2	2	5	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4,6-Trichlorophenol	mg/kg	NG	2	2	2	2	0.5	0.5						<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Polycyclic Aromatic Hydrocarbons (PAHS)	400	11	2.9	39	6.4	6	69	7.6	0	0.00	000	0	000	0	0	0100	0	0	0.00
Acenaphthylene	mg/kg	0.006/1	0.28	0.28	0.28	0.28	0.28	0.28	<0.0050 <0.0050	V0.0030	×0.0030	V0.0050	V0.0030	V0.0030	V0.0050	000000	×0.0030	00000	×0.0030
Acridina	_	/90000 UND	020 UN	020 UN	SZC NG	026 CNG	OZC UNG	OZC UN	-0.0000 -0.0000	0,000	01000	01000	0,000	0.000	,0,000 010 010	01000	0.000	01000	0,000
Authracene	ma/kg	0.0460 1.3	22 2.11	32 3.11	32 4.11	32 5.11	2,5 6.11	2 5 7.11	<0.010 <0.010 <0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	<0.010 <0.0040	<0.010	<0.010
Benzlalanthracene	ma/ka	0.0317	32 10 <sup>2.12</sup>	32 10 3:12	10 4.12	10 5.12	1 6.12	1 7.12	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(c)phenanthrene	mg/kg	9N N	. SN	ő	. S	. SN	. S	. DN	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo[a]pyrene	mg/kg	0.0319	72 2.13	72 3.13	72 4.13	72 5.13	20 6.13	20 7.13	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0062	<0.0050	<0.0050	<0.0050	0.0052
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg	9 N	NG	Ŋ	S S	9 S	NG	Ŋ	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.011	0.017	0.01	0.011	0.0065	0.016
Benzo[e]pyrene	mg/kg	D D	NG	D D N	SQ.	9	NG	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0077	0.013	0.0086	0.0098	0.0058	0.012

Hay River Harbour Soil Quality Results

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							Sampl	Sampling Location S	4	m	Sample 01-B	Sample 2			٥.	~	SED-019-04		SED-019-06
							<u> </u>	Date Sampled	18-Jan-23 BKO530	18-Jan-23	18-Jan-23 BK0532	18-Jan-23 BKO533	18-Jan-23	/1 <b>-</b> 100-11/	14-0ct-17	14-0cf-1/	/1-00-4.	14-0ct-17	14-Oct-1/
							i "	Sample Type	Normal	Normal	Duplicate	Normal	Normal						
	Ľ				Guideline														
Analyte	Unit	CCME	CCME SO CL	CCME SO CL	OS EWOO	CCME SO	CCME SO	CCME SO											
Donate Hillson	20/100	FAL	214	2 81	3 414	F 75	NE/PE CO	7.734	0300	0	0100	0100	0	0000	200	0000	0000	1900	200
Derizolg, it, ilper ylene Renzolk Hioranthene	6 04/6 W	2 5	10 2.15	70 3.15	N 4.15	N 10 5.15	1 6.15	7 7.15	<0.0030	×0.0050	<0.0030	<0.0030	<0.0030	0.0079	0.013	0.0007	V.0002	0.0001	0.000
Chrysene	ma/ka	0.0571	N 2.16	N 3.16	N 4.16	2 Z	6.2 6.16	6.2 7.16	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0,0062	900'0	<0,0050	<0.0050	<0,0050	<0.0050
Dibenz[a,h]anthracene	mg/kg	0.00622 1.4	10 2.17	10 3.17	10 4.17	10 5.17	1 6.17	1 7.17	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	mg/kg	0.111	180 2.18	180 3.18	180 4.18	180 5.18	50 6.18	50 7.18	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.013	0.017	0.0093	0.0066	<0.0050	0.0081
Fluorene	mg/kg	0.0212 1.5	0.25 2.19	0.25 3.19	0.25 4.19	0.25 5.19	0.25 6.19	0.25 7.19	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0066	0.0059	<0.0050	<0.0050	0.0063
IACR (CCME)		NG	1.0 2.20	1.0 3.20	1.0 4.20	1.0 5.20	1.0 6.20	1.0 7.20						0.12	0.17	0.11	0.11	<0.10	0.15
Indeno[1,2,3-cd]pyrene	mg/kg	NG	10 2.21	10 3.21	10 4.21	10 5.21	1 6.21	1 7.21	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0058	<0.0050	<0.0050	<0.0050	0.0079
1-Methylnaphthalene	mg/kg	NG	9 N	0N N	S S	NG	NG	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050	<0.0050	<0.0050
2-Methylnaphthalene	mg/kg	0.0202 1.6	DN N	ŊĊ	Ŋ	Ŋ	D N	Ŋ	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Naphthalene	mg/kg	0.0346 1.7	0.013 2.22	0.013 3.22	0.013 4.22	0.013 5.22	0.013 6.22	0.013 7.22	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Carcinogenic PAHs (as B(a)P TPE)	mg/kg	ŊĊ	0.6 2.23	0.6 3.23	0.6 4.23	0.6 5.23	0.6 6.23	0.6 7.23	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	0.012	<0.0071	<0.0071	<0.0071	0.011
Carcinogenic PAHs (IACR for coarse soil, AB Tier 1)		S	9 N	S S	S S	O N	9 N	DN D	<0.10	<0.10	<0.10	<0.10	<0.10						
Carcinogenic PAHs (IACR for fine soil, AB Tier 1)		NG	S S	S	S N N	S N	S N	NG N	<0.10	<0.10	<0.10	<0.10	<0.10						
Perylene	mg/kg	ŊĠ	S	SON	S	SG.	SG.	NG	0.041	0.031	0.025	0.016	0.05	0.092	0.23	0.17	0.11	0.11	0.25
Phenanthrene	mg/kg	0.0419	0.046 2.24	0.046 3.24	0.046 4.24	0.046 5.24	0.046 6.24	0.046 7.24	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0065	0.013	0.008	<0.0050	<0.0050	0.0088
Pyrene	mg/kg	0.053	100 2.25	100 3.25	100 4.25	100 5.25	10 6.25	10 7.25	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.013	0.018	0.011	0.012	0.0053	0.011
Quinoline	mg/kg	Ŋ	9 V	Ő	9 N	9 N	9 N	Ŋ	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.019
Volatile Organic Compounds																			
Bromodichloromethane	mg/kg	NG	D N	Ŋ	S S	9 N	S S	NG						<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Bromoform	mg/kg	SG	S S	S S	S	S N	SG	NG						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Bromomethane	mg/kg	NG	S S	S	S N	DQ N	S N	NG N						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Carbon tetrachloride	mg/kg	NG	20	20	20	20	2	S						0.00086	<0.00050	0.0018	0.0019	0.0033	<0.0011
Chlorobenzene	mg/kg	9 N	10	10	10	10	-	-						0.003	0.0028	0.0042	0.0049	9600.0	<0.0010
Chloroform	mg/kg	S	20	20	20	20	co	S						<0.0012	<0.00080	0.0023	0.0025	0.004	<0.00080
Chloromethane	mg/kg	D N	S S	O N	S S	© N	9 N	O N						<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Dibromochloromethane	mg/kg	SG	S N	O N	S S	© N	9 N	S						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,2-Dibromoethane	mg/kg	9 Ne	S S	S N	S S	S N	S N	NG						<0.0020	<0.0020	<0.0067	<0.0060	<0.0093	<0.0020
1,2-Dichlorobenzene	mg/kg	9 9	10	10	10	0 ;		<del>-</del> ,						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,3-Dichlorobenzene	mg/kg	2 2	0. 5	2 5	0. 5	2 6		- 4						<0.020	<0.020	070.070	020.020	<0.020	<0.020
1.1-Dichloroethane	54/5	2 2	2 2	2 2	2 2	2 6	- u	- u						0.020	0.020	0.020	0.020	0.020	020.02
1, 1-Dichloroethane	gy/gm	2 2	9 2	25	9 2	8 6	ם ני	o 10						<0.020	<0.020 <0.0020	020.020	~0.020 <0.000	0.020	<0.020
1 1-Dichloroethylene	mg/kg	2 2	2 2	8 6	32 8	8 6	o 10	o 40						<0.0020	<0.0020	<0.0020	<0.0020	<0.000	<0.020
cis-1,2-Dichloroethylene	mg/kg	2 2	9 9	9	9 9	S S	, o	ŊŊ						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
trans-1,2-Dichloroethylene	mg/kg	ŊĊ	9 N	9N	S <sub>N</sub>	NG	9N N	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Dichloromethane	mg/kg	NG	20	50	20	20	2	2						<0.030	<0.030	<0.030	0.063	0.46	<0.030
1,2-Dichloropropane	mg/kg	NG	20	50	20	90	2	2						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
cis-1,3-Dichloropropene	mg/kg	ŊĊ	9 N	Ŋ	Ŋ	Ŋ	Ŋ	Ŋ						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
trans-1,3-Dichloropropene	mg/kg	ŊĊ	9 N	Ŋ	Ŋ	Ŋ	Ŋ	Ŋ						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,3-Dichloropropene (cis + trans) (calculated)	mg/kg	NG	9 N	Ŋ	S <sub>Q</sub>	ŊĊ	9 N	NG						<0.028	<0.028	<0.028	<0.028	<0.028	<0.028
Ethyl chloride	mg/kg	NG	9 N	NG	S N	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Methyl methacrylate	mg/kg	ŊĠ	Ŋ	Ŋ	Ŋ	Ŋ	9 N	ŊŊ						<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Methyl tert-butyl ether	mg/kg	NG	D N	ŊĊ	Ŋ	Ŋ	S N	NG						<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
1,1,1,2-Tetrachloroethane	mg/kg	9	S 8	S S	S :	S S	<u>ي</u>	υ υ						<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
1,1,2,2-l etrachloroethane	mg/kg	S S	90	50	90	90	D (	n (						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
l etrachloroethylene 1.2.3-Trichlorobenzene	mg/kg	9 9 2	10	0.5	9.0	9.0	0.2	0.2	+					<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2,4,0	55	2	?	?	?	?	1	1			-			2	?	2	,	2	,

Hay River Harbour Soil Quality Results

						Da							14-0ct-17	14-Oct-17	14-Oct-17	14-0ct-17		14-0ct-17 14-0ct-17
						Lat	Lab Sample ID Sample Type	BKQ530 B	BKQ531 Normal	BKQ532 Duplicate	BKQ533 Normal	BKQ534 Normal						
				Guideline														
Analyte	Unit CCME Sediment FAI		CCME SO CL CCME SO CL	CCME SO	CCME SO IL FS	CCME SO RL/PL CS	CCME SO RL/PL FS											
1,2,4-Trichlorobenzene m	mg/kg NG		10	10	10	2	2						<0.040	<0.040	<0.040	<0.040	V	<0.040
			10	10	10	2	2						<0.040	<0.040	<0.040	<0.040	V	<0.040
1,1,1-Trichloroethane	mg/kg NG		20	20	90	20	2						<0.020	<0.020	<0.020	<0.020	8	<0.020
1,1,2-Trichloroethane			20	20	20	22	2						<0.020	<0.020	<0.020	<0.020	0	<0.020
Trichloroethylene			0.01	0.01	0.01	0.01	0.01						<0.010	<0.010	<0.010	<0.010	0.0	<0.010
Trichlorofluoromethane	mg/kg NG	9N N	NG	SN	NG	NG	NG						<0.020	<0.020	<0.020	<0.020	<0.020	20
1,3,5-Trimethylbenzene			0 N	NG	υ	ŊĠ	9N						<0.50	<0.50	<0.50	<0.50	<0.50	00
Trimethylbenzene (mixed isomers)	mg/kg NG		Ŋ	ŊĊ	Ŋ	NG	NG						<0.50	<0.50	<0.50	<0.50	<0.50	00
Vinyl chloride m	mg/kg NG	9 N	ON NG	NG	Ŋ	Ŋ	Ŋ						<0.0012	<0.00030	<0.0020	<0.0037	<0.0084	84
Metals																		
Antimony	mg/kg NG		40	40	40	20	20	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0
Arsenic m	mg/kg 5.900		12	12	12	12	12	9.9	6.1	5	5	7	9	8.2	8.6	6.9	6.1	
Barium	mg/kg NG	2000	2000	2000	2000	200	200	150	130	130	140	160	120	170	140	100	66	
Beryllium	mg/kg NG		00	80	80	4	4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.43	<0.40	<0.40	<0.40	0:
Cadmium	mg/kg 0.600	10 22	22	22	22	10	10	0.3	0.21	0.23	0.16	0.3	0.2	0.58	0.59	0.33	0.37	_
Chromium	mg/kg 37.300		87	87	87	99	64	7.5	5.7	5.5	5.5	8.4	5.8	11	9.1	7.4	9	
Chromium (hexavalent)	mg/kg NG	1.4	1.4	1.4	1.4	0.4	0.4	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	90
Cobalt	mg/kg NG		300	300	300	20	20	5.8	4.8	4	4.1	6.9	4.7	6	8.2	5.9	5.9	
Copper	mg/kg 35.700		91	91	91	63	63	8.3	6.4	4.7	5.4	9.1	7.3	17	15	6.6	13	
Lead	mg/kg 35.000		260	009	009	140	140	4.5	3.7	က	က	5.1	4.1	8.3	7	4.8	4.7	
Mercury	mg/kg 0.170		24	20	20	9.9	9.9	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.068	0.062	<0.050	0.054	4
Molybdenum	mg/kg NG		40	40	40	10	10	0.97	0.83	69.0	0.64	-	0.78	1.4	1.3	0.92	0.93	
Nickel m	mg/kg NG	68	88	88	88	45	45	13	9.7	8.2	8.5	13	1	21	19	13	13	
Selenium	mg/kg NG		2.9	2.9	2.9	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	99.0	0.65	<0.50	<0.50	0
Silver	mg/kg NG	40	40	40	40	20	20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.
Thallium	mg/kg NG	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	0.17	0.15	<0.10	0.11	_
Tin	mg/kg NG	300	300	300	300	20	90	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0
Uranium	mg/kg NG		33	300	300	23	23	1.2	0.95	-	0.75	96.0	0.88	1.2	1.3	1.1	-	
Vanadium	mg/kg NG			130	130	130	130	14	11	9.4	6.6	15	11	19	16	12	=	
Zinc	mg/kg 123.000	410 2.26	5 410 <sup>3.26</sup>	410 4.26	410 5.26	250 6.26	250 7.26	49	35	40	29	47	43	83	75	50	52	



#### 1. Notes for CCME. Canadian sediment quality quidelines for the protection of freshwater aquatic life. (CCME Sediment FAL)

#### General Notes

The CCME sediment quality guidelines for the protection of freshwater aquatic life provide Interim sediment quality guidelines (ISQGs) and probable effect levels (PELs). The Interim sediment quality guidelines have been used in this report.

#### Note 1.1 for Acenaphthene:

Provisional; adoption of marine ISQG developed using the modified NSTP approach.

#### Note 1.2 for Acenaphthylene:

Provisional; adoption of marine ISQG developed using the modified NSTP approach.

#### Note 1.3 for Anthracene:

Provisional; adoption of marine ISQG developed using the modified NSTP approach.

#### Note 1.4 for Dibenz[a,h]anthracene:

Provisional; adoption of marine ISQG developed using the modified NSTP approach.

#### Note 1.5 for Fluorene:

Provisional; adoption of marine ISQG developed using the modified NSTP approach.

#### Note 1.6 for 2-Methylnaphthalene:

Provisional; adoption of marine ISQG developed using the modified NSTP approach.

#### Note 1.7 for Naphthalene:

Provisional; adoption of marine ISQG developed using the modified NSTP approach.

# 2. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Commercial Land Use and Coarse-grained Soil. (CCME SO CL CS)

#### **General Notes:**

There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.

#### Note 2.1 for Benzene:

The guideline for benzene is 0.030 mg/kg for the following:

- Surface soil (≤1.5m) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5).
- Subsoil (>1.5m) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5).
- Surface soil (≤1.5m) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).
- Subsoil (>1.5m) with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).

#### Note 2.2 for Ethylbenzene:

The guideline for ethylbenzene is 0.082 mg/kg for the following:

- Surface soil (≤1.5m) with coarse soil texture
- Subsoil (>1.5m) with coarse soil texture

#### Note 2.3 for F1 (CCME): (C6-C10) (less BTEX):

This Tier 1 Level is for coarse, surface soil; and includes protection of potable groundwater. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes.

Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008.

Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.

#### Note 2.4 for F2 (C10-C16):

This Tier 1 Level is for coarse, surface soil.

"Coarse" means coarse-textured soil having a median grain size of >75  $\mu$ m as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 2.5 for F3 (C16-C34):

This Tier 1 Level is for coarse, surface soil.

"Coarse" means coarse-textured soil having a median grain size of >75  $\mu$ m as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 2.6 for F4 (CCME): (>C34-C50):

This Tier 1 Level is for coarse, surface soil.

"Coarse" means coarse-textured soil having a median grain size of  $>75 \mu m$  as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 2.7 for Toluene:

The guideline for toluene is 0.37 mg/kg for the following:

- Surface soil (≤1.5m) with coarse soil texture
- Subsoil (>1.5m) with coarse soil texture

#### Note 2.8 for Xylene:

The guideline for xylenes is 11 mg/kg for the following:

- Surface soil (≤1.5m) with coarse soil texture
- Subsoil (>1.5m) with coarse soil texture

#### Note 2.9 for Acenaphthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 2.10 for Acenaphthylene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 2.11 for Anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Anthracene is 32 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.12 for Benz[a]anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[a]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.13 for Benzo[a]pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[a]pyrene is 72 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.14 for Benzo[g,h,i]perylene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.

#### Note 2.15 for Benzo[k]fluoranthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.16 for Chrysene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.

#### Note 2.17 for Dibenz[a,h]anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.18 for Fluoranthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Fluoranthene is 180 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.19 for Fluorene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 2.20 for IACR (CCME):

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

#### Note 2.21 for Indeno[1,2,3-cd]pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.22 for Naphthalene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.23 for Carcinogenic PAHs (as B(a)P TPE):

Guideline for B(A)P Total Potency Equivalent is 0.6 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 1,000,000 (10-6). Guideline for B(A)P Total Potency Equivalent is 5.3 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10-5). Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

For soil contaminated with coal tar or creosote mixtures, the calculated Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) concentration for soil samples should be multiplied by a safety factor of 3 prior to comparison with the guideline to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalence Factor (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential. / The most stringent guideline was used in this report.

#### Note 2.24 for Phenanthrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Phenanthrene is 0.046 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.25 for Pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Pyrene is 100 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 2.26 for Zinc:

Reference: Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health; Factsheet for Zinc, 2018. Data are sufficient and adequate to calculate guidelines for human health and environmental health. Therefore, the soil quality guideline is the lower of the two and supersedes the 1999 soil quality guideline and the 1991 interim remediation criteria for soil.

3. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Commercial Land Use and Fine-grained Soil. (CCME SO CL FS)

#### General Notes:

There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.

#### Note 3.1 for Benzene:

The guideline for benzene is 0.0068 mg/kg for the following:

- Surface soil (≤1.5m) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5).
- Subsoil (>1.5m) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5).
- Surface soil (≤1.5m) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).
- Subsoil (>1.5m) with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).

#### Note 3.2 for Ethylbenzene:

The guideline for ethylbenzene is 0.018 mg/kg for the following:

- Surface soil (≤1.5m) with fine soil texture
- Subsoil (>1.5m) with fine soil texture

#### Note 3.3 for F1 (CCME): (C6-C10) (less BTEX):

This Tier 1 Level is for fine, surface soil and includes protection of potable groundwater. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes.

Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.

#### Note 3.4 for F2 (C10-C16):

This Tier 1 Level is for fine, surface soil and includes protection of potable groundwater.

"Fine" means fine-textured soil having a median grain size of  $<75 \mu m$  as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent standard was used in this report.

#### Note 3.5 for F3 (C16-C34):

This Tier 1 Level is for fine, surface soil.

"Fine" means fine-textured soil having a median grain size of  $<75 \mu m$  as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 3.6 for F4 (CCME): (>C34-C50):

This Tier 1 Level is for fine, surface soil.

"Fine" means fine-textured soil having a median grain size of <75  $\mu$ m as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008.

Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 3.7 for Toluene:

The guideline for toluene is 0.08 mg/kg for the following:

- Surface soil (≤1.5m) with fine soil texture
- Subsoil (>1.5m) with fine soil texture

#### Note 3.8 for Xylene:

The guideline for xylenes is 2.4 mg/kg for the following:

- Surface soil (≤1.5m) with fine soil texture
- Subsoil (>1.5m) with fine soil texture

#### Note 3.9 for Acenaphthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 3.10 for Acenaphthylene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 3.11 for Anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Anthracene is 32 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.12 for Benz[a]anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[a]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.13 for Benzo[a]pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[a]pyrene is 72 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.14 for Benzo[g,h,i]perylene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.

#### Note 3.15 for Benzo[k]fluoranthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.16 for Chrysene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.

#### Note 3.17 for Dibenz[a,h]anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.18 for Fluoranthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Fluoranthene is 180 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.19 for Fluorene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 3.20 for IACR (CCME):

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

#### Note 3.21 for Indeno[1,2,3-cd]pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.22 for Naphthalene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.23 for Carcinogenic PAHs (as B(a)P TPE):

Guideline for B(A)P Total Potency Equivalent is 0.6 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 1,000,000 (10-6). Guideline for B(A)P Total Potency Equivalent is 5.3 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10-5). Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

For soil contaminated with coal tar or creosote mixtures, the calculated Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) concentration for soil samples should be multiplied by a safety factor of 3 prior to comparison with the guideline to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalence Factor (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential. / The most stringent guideline was used in this report.

#### Note 3.24 for Phenanthrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Phenanthrene is 0.046 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.25 for Pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Pyrene is 100 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 3.26 for Zinc:

Reference: Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health; Factsheet for Zinc, 2018. Data are sufficient and adequate to calculate guidelines for human health and environmental health. Therefore, the soil quality guideline is the lower of the two and supersedes the 1999 soil quality guideline and the 1991 interim remediation criteria for soil.

4. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Industrial Land Use and Coarse-grained Soil. (CCME SO IL CS)

#### **General Notes:**

There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.

#### Note 4.1 for Benzene:

The guideline for benzene is 0.030 mg/kg for the following:

- Surface soil with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5).
- Subsoil with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5).
- Surface soil with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).
- Subsoil with coarse soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).

#### Note 4.2 for Ethylbenzene:

The guideline for ethylbenzene is 0.082 mg/kg for the following:

- Surface soil with coarse soil texture
- Subsoil with coarse soil texture

#### Note 4.3 for F1 (CCME): (C6-C10) (less BTEX):

This Tier 1 Level is for coarse, surface soil and includes protection of potable groundwater. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes.

Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.

#### Note 4.4 for F2 (C10-C16):

This Tier 1 Level is for coarse, surface soil.

"Coarse" means coarse-textured soil having a median grain size of >75  $\mu$ m as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 4.5 for F3 (C16-C34):

This Tier 1 Level is for coarse, surface soil.

"Coarse" means coarse-textured soil having a median grain size of >75  $\mu$ m as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 4.6 for F4 (CCME): (>C34-C50):

This Tier 1 Level is for coarse, surface soil.

"Coarse" means coarse-textured soil having a median grain size of >75  $\mu$ m as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 4.7 for Toluene:

The guideline for toluene is 0.37 mg/kg for the following:

- Surface soil with coarse soil texture
- Subsoil with coarse soil texture

#### Note 4.8 for Xylene:

The guideline for xylenes is 11 mg/kg for the following:

- Surface soil with coarse soil texture
- Subsoil with coarse soil texture

#### Note 4.9 for Acenaphthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 4.10 for Acenaphthylene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 4.11 for Anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Anthracene is 32 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.12 for Benz[a]anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[a]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.13 for Benzo[a]pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[a]pyrene is 72 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.14 for Benzo[g,h,i]perylene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.

#### Note 4.15 for Benzo[k]fluoranthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.16 for Chrysene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.

#### Note 4.17 for Dibenz[a,h]anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.18 for Fluoranthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Fluoranthene is 180 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.19 for Fluorene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 4.20 for IACR (CCME):

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

#### Note 4.21 for Indeno[1,2,3-cd]pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.22 for Naphthalene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.23 for Carcinogenic PAHs (as B(a)P TPE):

Guideline for B(A)P Total Potency Equivalent is 0.6 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 1,000,000 (10-6). Guideline for B(A)P Total Potency Equivalent is 5.3 mg/kg based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10-5). Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected. Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

For soil contaminated with coal tar or creosote mixtures, the calculated Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) concentration for soil samples should be multiplied by a safety factor of 3 prior to comparison with the guideline to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalence Factor (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential. / The most stringent guideline was used in this report.

#### Note 4.24 for Phenanthrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Phenanthrene is 0.046 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.25 for Pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Pyrene is 100 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 4.26 for Zinc:

Reference: Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health; Factsheet for Zinc, 2018. Data are sufficient and adequate to calculate guidelines for human health and environmental health. Therefore, the soil quality guideline is the lower of the two and supersedes the 1999 soil quality guideline and the 1991 interim remediation criteria for soil.

5. Notes for CCME. Canadian Soil Quality Guidelines; and Canada-Wide Standards for Petroleum Hydrocarbons in Soil - for Industrial Land Use and Fine-grained Soil. (CCME SO IL FS)

#### **General Notes:**

There are different guidelines based on site-specific factors for some analytes. The most stringent guidelines were used.

#### Note 5.1 for Benzene:

The guideline for benzene is 0.0068 mg/kg for the following:

- Surface soil with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5).
- Subsoil with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 100,000 (10-5).
- Surface soil with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).
- Subsoil with fine soil texture, and based on a lifetime incremental cancer risk of 1 in 1,000,000 (10-6).

#### Note 5.2 for Ethylbenzene:

The guideline for ethylbenzene is 0.018 mg/kg for the following:

- Surface soil with fine soil texture
- Subsoil with fine soil texture

#### Note 5.3 for F1 (CCME): (C6-C10) (less BTEX):

This Tier 1 Level is for fine, surface soil and includes protection of potable groundwater. The standard for F1 excludes benzene, toluene, ethylbenzene and xylenes.

Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.

#### Note 5.4 for F2 (C10-C16):

This Tier 1 Level is for fine, surface soil and includes protection of potable groundwater.

"Fine" means fine-textured soil having a median grain size of  $<75 \mu m$  as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil. / The most stringent guideline was used in this report.

#### Note 5.5 for F3 (C16-C34):

This Tier 1 Level is for fine, surface soil.

"Fine" means fine-textured soil having a median grain size of  $<75 \mu m$  as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 5.6 for F4 (CCME): (>C34-C50):

This Tier 1 Level is for fine, surface soil.

"Fine" means fine-textured soil having a median grain size of  $<75~\mu m$  as defined by the American Society for Testing and Materials. Reference: Canadian Council of Ministers of the Environment, Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008. Table 1 - Summary of Tier 1 Levels for surface soil.

#### Note 5.7 for Toluene:

The guideline for toluene is 0.08 mg/kg for the following:

- Surface soil with fine soil texture
- Subsoil with fine soil texture

#### Note 5.8 for Xylene:

The guideline for xylenes is 2.4 mg/kg for the following:

- Surface soil with fine soil texture
- Subsoil with fine soil texture

#### Note 5.9 for Acenaphthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Acenaphthene is 0.28 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 5.10 for Acenaphthylene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Acenaphthylene is 320 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 5.11 for Anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Anthracene is 32 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 5.12 for Benz[a]anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[a]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 5.13 for Benzo[a]pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[a]pyrene is 72 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 5.14 for Benzo[g,h,i]perylene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

An environmental Soil Quality Guideline for Benzo[g,h,i]perylene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.

#### Note 5.15 for Benzo[k]fluoranthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Benzo[k]fluoranthene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 5.16 for Chrysene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

An environmental Soil Quality Guideline for Chrysene based on non-carcinogenic effects is not available in Table 1 and 2 of CCME PAHs Factsheet 2010.

#### Note 5.17 for Dibenz[a,h]anthracene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Dibenz[a,h]anthracene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 5.18 for Fluoranthene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Fluoranthene is 180 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 5.19 for Fluorene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Fluorene is 0.25 mg/kg based on non-carcinogenic effects (from Table 2 of CCME PAHs Factsheet 2010).

#### Note 5.20 for IACR (CCME):

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

#### Note 5.21 for Indeno[1,2,3-cd]pyrene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Indeno[1,2,3-cd]pyrene is 10 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).

#### Note 5.22 for Naphthalene:

Assess the hazard to human health from carcinogenic effects of PAHs by doing steps 1 and 2. Step 1 is: Calculate a Benzo[a]pyrene Total Potency Equivalents (B[a]P TPE) to ensure that humans are protected from direct contact with contaminated soil. Step 2 is: Calculate the Index of Additive Cancer Risk (IACR) to ensure that potable water resources are protected.

Assess the hazard to environmental health from non-carcinogenic effects of PAHs by doing step 3. Step 3 is: Compare PAHs individually to the appropriate environmental Soil Quality Guideline which were developed based on non-carcinogenic effects.

The environmental Soil Quality Guideline for Naphthalene is 0.013 mg/kg based on non-carcinogenic effects (from Table 1 of CCME PAHs Factsheet 2010).