Table 6.3

CAM 5, MACKAR INLET: SOIL ANALYTICAL RESULTS – LANDFILL A

Indicator Chemical (mg/kg)	Quebec Guidelines A	B	C	Background C5-057	C5-058	C5-044	C5-045	C5-046	C5-047
Arsenic	10	30	50	<0.1	0.8	0.2	<0.1	0.4	<0.1
Barium	200	500	2000	43	29	42	29	160	110
Chromium (total)	75	250	800	37	22	11	18	29	44
Lead	50	200	600	<10	<10	<10	17	<10	<10
Nickel	50	100	500	21	11	<5	7	17	27
TPH	100	1000	5000	<5	<5	1600	<5	230	<5
PCB	0.1	1	10	<0.01	<0.01	0.13	<0.01	0.24	<0.01
Cl4 Ethylene	0.1	3	30	<0.001	<0.001	<0.001	0.024	0.004	-
Fluorene	0.1**	10	100	<0.03	<0.03	0.50	<0.03	<0.03	<0.03
Phenanthrene	0.1**	5	50	<0.03	<0.03	0.57	<0.03	<0.03	<0.03
Toluene	0.1	3	30	<0.002	<0.002	<0.002	0.075	0.780	-

TPH=Total Petroleum Hydrocarbon
PCB=Polychlorinated Biphenyls
- = Not Analyzed
** = PAH Total

Samples C5-045 and C5-046 contained detectable levels of Cl_4-ethylene. Sample C5-044 contained fluorene and phenanthrene above Level A.

6.3.1.3 Evaluation of Risk Assessment and Analytical Results

The results of the overall risk assessment show that carcinogenic and non-carcinogenic risks are below the levels established for this study. TPH exceeded the Level B guideline and may also be migrating from the area and pose a hazard. Exposed debris in the area may pose a safety hazard and should be removed. There were no acute risks identified. The site should be redesigned and the drainage rerouted to prevent migration.

6.3.2 LANDFILL B

6.3.2.1 Visual Observations and Sample Locations

A second, much larger abandoned landfill is found east of POL 3 (Plates 5 & 6). The full extent of the filled area is difficult to determine but it appears to underlie much of the present scrap metal and drum storage area. One face of the landfill area (250 m east of the POL 3) slopes steeply to a north-south oriented river valley to the east. Barrels and various types of metal waste, possibly including electrical equipment, were observed in the slope. A second face is located 50 m northeast of the lakeshore POL. Soil in the area is predominantly silty sand with a gravel substrate. No staining or leachate was observed in the vicinity of the landfill.

A water sample was taken near the mouth of the stream draining the most easterly face of the landfill (C5-A) but was not submitted for analysis.

Eight soil samples were taken on the landfill site. Five were collected along the riverbank at the base of the landfill slope. C5-024 was collected from a midslope location at the south end of the landfill area. Samples C5-025, C5-026, C5-027 and C5-028 taken sequentially downstream, north along the streambank. Three samples were taken at the lakeshore face where small drainage channels enter the lake (C5-029, C5-030 and C5-032). Samples C5-030 and C5-026 were submitted for analyses.

The sample locations are provided in Figure 6.1.

6.3.2.2 Analytical Results

Soil samples C5-026 and C5-030 were tested for the complete set of indicator chemicals. No indicator chemicals exceeded the 50 percent Level A study criteria.

6.3.2.3 Evaluation of Risk Assessment and Analytical Results

No indicator chemicals were identified above the Quebec B guideline. Although no evidence of contamination was found in the sample program, the location of this landfill adjacent to the lake represents a potential short and long term risk. The exposed debris could be further eroded by wind and runoff and pose a hazard. There are no acute risks noted on the site. The lake could be impacted from leachate migration from the landfill.

6.3.3 LANDFILL C

6.3.3.1 Visual Observations and Sample Locations

Landfill C is a small abandoned landfill located 250 m south of the POL 3 facility on the shore of the lake at the east end of the Airstrip. Partially exposed buried barrels were noted protruding from the slope at this location.

Soil in this area was a mixture of clay and organic material underlain by a gravelly clay substrate. Drainage away from the landfill is primarily to the north and northeast towards the river valley and lake.

One soil sample was taken immediately northeast of the landfill area (C5-020) and another was collected 50 m downgradient and to the east, adjacent to a small watercourse (C5-022). A third sample was taken 100 m farther downgradient and to the north (C5-023). Sample C5-022 was not submitted for analysis.

The sample locations are provided in Figure 6.1.

6.3.3.2 Analytical Results

Sample C5-020 was tested for the complete set of indicator chemicals. Based on the results of the analyses, sample C5-023 was tested for metals and TPH.

The soil sample results are presented in Table 6.4.

Chromium was above 50 percent of Level A in C5-020 and was consistent with background values. Nickel and chromium were above 50 percent of Level A in C5-023 and slightly higher than the background values. Chromium was within the range given in the literature. No data was available for nickel.

6.3.3.3 Evaluation of Risk Assessment and Analytical Results

No indicator chemicals were identified above the Quebec B guideline.

Although no evidence of contamination was found in the sample program, the location of this landfill adjacent to the lake represents a potential short and long term risk. The exposed debris could be further eroded by wind and runoff and pose a hazard. There are no acute risks noted on the site. The site should be redesigned and the drainage rerouted to prevent migration of leachate into surface waters.

6.4 POL AREAS

6.4.1 POL 1

6.4.1.1 Visual Observations and Sample Locations

POL 1 is located 200 m northeast of the Module Train. The area is characterized by a boulder, cobble and coarse gravel surface, covered mostly by moss and underlain by dark brown, coarse-grained sand.

The area drains to the northwest, joining the same drainage system that the sewage from the station sewage outfall follows. No evidence of hydrocarbon staining was observed on the soil or on water draining from the area.

One soil sample was taken in a small drainage channel on the west side of the POL 1 (C5-054) but it was not submitted for analysis.

6.4.1.2 Evaluation of Risk Assessment and Analytical Results

No staining was observed in the POL area. Sampling should be carried out as part of the clean-up procedure to determine if there is any substantial soil contamination.

Table 6.4

CAM 5, MACKAR INLET: SOIL ANALYTICAL RESULTS – LANDFILL C

Indicator Chemicals (mg/kg)	Quebec Guidelines			Background			
	A	B	C	C5-057	C5-058	C5-020	C5-023
Arsenic	10	30	50	<0.1	0.8	0.4	<0.1
Barium	200	500	2000	43	29	47	70
Chromium (total)	75	250	800	37	22	38	56
Nickel	50	100	500	21	11	19	31

6.4.2 POL 2

6.4.2.1 Visual Observations and Sample Locations

Two 246 m^3 diesel tanks are located on a concrete pad 100 m east of the Module Train. These tanks appeared to have been recently painted and were in good condition. However, strong hydrocarbon odours were present both inside and just outside of the dyke. Staining was observed on sand and gravel on the outer side of the east end of the dyke, it extended northeast. Evidence of hydrocarbon staining was also found on the surfaces of the small ponds to the east and west of the facility.

Soil samples were taken at three locations in the area. C5-048 was taken at the west corner of the dyke. C5-049 was collected southwest of the tanks outside the dyke. Sample C5-050 was taken at the exterior base of the dyke wall at the southeast corner, 1 m above a small pond. Samples from all three locations were submitted for analyses.

The sample locations are shown in Figure 6.1.

6.4.2.2 Analytical Results

Soil sample C5-050 was tested for the complete set of indicator chemicals. Based on the results from these analyses, samples C5-048 and C5-049 were tested for TPH and metals.

The results of the analyses of the soil samples are presented in Table 6.5.

TPH was above Level A criterion in C5-048 and at Level B in C5-050. TPH was not detected in C5-049. Sample C5-050 contained PCBs above Level A. Lead concentrations in excess of 50 percent of Level A were found in C5-049 and C5-050. Lead was not detected in the background samples taken at this site, but according to the literature it may be present at concentration up Level A.

6.4.2.3 Evaluation of Risk Assessment and Analytical Results

The results of the overall risk assessment show that carcinogenic and non-carcinogenic risks are below the levels established for this study.

Hydrocarbons appear to be migrating from the dyked area as indicated by the elevated level outside of the dyke. Low levels of lead were also noted inside and outside the dyke. The hydrocarbon and lead levels do not represent an acute risk at the measured concentrations; however, hazards may be present at depth. Further subsurface investigation should be carried out prior to establishing clean-up requirements.

There were no physical hazards located at the site. The potential for environmental risk is considered low because of the relatively localized contamination.

6.4.3 POL 3

6.4.3.1 Visual Observations and Sample Locations

POL 3 is located 50 m from the shore of the lake at the north end of the site. Two horizontal 69 m^3 diesel tanks are supported by skids to the east of a single 23 m^3 mogas tank. A pipe passes through the northeast corner of the berm to allow water from melted snow to exit. Soils in the area were sand and sandy gravels. A strong fuel odour was present north of the tanks within the dyke and on the north side of the facility.

Table 6.5

CAM 5, MACKAR INLET: SOIL ANALYTICAL RESULTS – POL 2

Indicator Chemical (mg/kg)	Quebec Guidelines			Background				
	A	B	C	C5-057	C5-058	C5-048	C5-049	C5-050
Arsenic	10	30	50	<0.1	0.8	0.7	0.5	0.5
Barium	200	500	2000	43	29	50	49	58
Beryllium	n	n	n	<1	<1	1	1	<1
Chromium (total)	75	250	800	37	22	22	25	26
Lead	50	200	600	<10	<10	13	41	39
Nickel	50	100	500	21	11	12	12	12
TPH	100	1000	5000	<5	<5	272	<5	1000
PCB	0.1	1	10	<0.01	<0.01	<0.01	<0.01	0.14

TPH=Total Petroleum Hydrocarbon
PCB=Polychlorinated Biphenyls
- = Not Analyzed
n = No Guidelines

A soil sample was taken inside the dyke in the northeast corner (C5-036). Sample C5-033 was taken below the pipe passing through the same corner of the dyke, 12 m from the lakeshore. A third sample (C5-034) was taken further downslope from the tanks, 1 to 2 m from the lakeshore. The sample site for C5-035 was located 30 m to the northwest of the tanks, 3 m from the shoreline.

The sample locations are shown on Figure 6.1.

6.4.3.2 Analytical Results

Soil samples C5-033 and C5-036 were submitted for analyses.

The soil sample results are presented in Table 6.6.

TPH concentrations above Level B were found in sample C5-033 and above Level C in C5-036. Sample C5-036 also contained detectable levels of PCBs and fluorene at greater than Level A and phenanthrene in excess of 50 percent of Level A.

6.4.3.3 Evaluation of Risk Assessment and Analytical Results

The results of the overall risk assessment show that carcinogenic and non-carcinogenic risks are below the levels established for this study.

Hydrocarbons appear to be migrating from the POL site towards the lake. The concentration of hydrocarbons down gradient from the POL is lower than inside the dyke but is higher than Level B. The trace levels of PAH are not a significant hazard. The high concentrations of hydrocarbons represent a significant hazard. The proximity of this site to the lake represents an environmental risk due to the potential for long term contaminant migration. This should be considered when the site is decommissioned.

6.4.4 POL 4

6.4.4.1 Visual Observations and Sample Locations

The POL 4 facility lies 200 m south of the lake and POL 3. A single, vertical 246 m^3 diesel tank is supported on a concrete slab. Coarse grained sands and gravels east of the tank showed evidence of staining. Strong fuel smells were also present in this area and soil within the west side of the dyke also had a strong hydrocarbon smell. A film of hydrocarbon was observed on a small pond nearby within the dyke, however an eroded discharge channel below a pipe through the west side of the dyke showed no staining or fuel odour.

Three soil samples were taken in the vicinity of POL 4. Sample C5-014 was taken to the east of the bulk tank, 2 m outside of the dyke. A sample was taken within the west side of the dyke, just upgradient of a small pond (C5-016). A third sample was collected 30 m farther west in an eroded discharge channel below a pipe in the dyke (C5-015).

6.4.4.2 Analytical Results

Soil sample C5-016 was tested for metals, TPH, and PCBs.

The results of the analyses of the soil samples are presented in Table 6.7.

Sample C5-016 had concentrations of lead in excess of Level B. TPH and PCBs were above Level A.

Table 6.6

CAM 5, MACKAR INLET: SOIL ANALYTICAL RESULTS – PQL 3

Indicator Chemicals (mg/kg)	Quebec Guidelines A	B	C	Background C5-057	C5-058	C5-033	C5-036
Barium	200	500	2000	43	29	18	18
Chromium (total)	75	250	800	37	22	16	20
Lead	50	200	600	<10	<10	14	<10
Nickel	50	100	500	21	11	6	6
TPH	100	1000	5000	<5	<5	2600	14000
PCB	0.1	1	10	<0.01	<0.01	<0.01	0.05
Fluorene	0.1**	10	100	<0.03	<0.03	-	0.73
Phenanthrene	0.1**	5	50	<0.03	<0.03	-	0.09

TPH=Total Petroleum Hydrocarbon
PCB=Polychlorinated Biphenyls
- = Not Analyzed
** = PAH Total

Table 6.7

CAM 5, MACKAR INLET: SOIL ANALYTICAL RESULTS - POL 4

Indicator Chemicals (mg/kg)	Quebec Guidelines			Background		
	A	B	C	C5-057	C5-058	C5-016
Arsenic	10	30	50	<0.1	0.8	0.8
Barium	200	500	2000	43	29	35
Chromium (total)	75	250	800	37	22	31
Lead	50	200	600	<10	<10	310
TPH	100	1000	5000	<5	<5	520
PCB	0.1	1	10	<0.01	<0.01	0.49

TPH=Total Petroleum Hydrocarbon
PCB=Polychlorinated Biphenyls

6.4.4.3 Evaluation of Risk Assessment and Analytical Results

The results of the overall risk assessment show that carcinogenic and non-carcinogenic risks are below the levels established for this study.

There was no acute hazards found on this site. No physical hazards were observed. Some evidence of hydrocarbon, lead and PCB contamination was found in the soil sample and confirmed by the observations made on site. The environmental risk is considered low for this site.

6.5 PALLET LINE AREAS

6.5.1 PALLET LINE 1

6.5.1.1 Visual Observations and Sample Locations

Pallet Line 1 consisted of a scrap metal and storage area located on a large previously landfilled area southeast of POL 3. Stored materials were found 200 m southeast of POL 3 and 160 m south of POL 4. No evidence of staining was observed on the pad.

Three soil samples were taken in the vicinity of the storage area. Sample C5-018 was taken directly beside the stored materials, 160 m south of POL 3. The second sample was obtained at the southwest corner of the storage pad (C5-017) and the third, 120 m southeast (C5-019).

6.5.1.2 Analytical Results

Soil sample C5-017 was submitted for metals, TPH and PCBs analyses.

All results were below 50 percent of Level A.

6.5.1.3 Evaluation of Risk Assessment and Analytical Results

The results of the overall risk assessment show that carcinogenic and non-carcinogenic risks are below the levels established for this study.

This site does not represent an acute hazard. Exposed metallic debris represents a physical hazard. It was observed in the field that this area served previously as a landfill. It is not possible to determine the potential for migration of contaminants from this area without further sampling and analyses to determine the extent of the underlying landfill area.

6.6 OUTFALL AREAS

6.6.1 SEWAGE OUTFALL

6.6.1.1 Visual Observations and Sample Locations

Untreated sewage from the Module Train area is disposed of through an outflow pipe at the northeast corner of the building compound (Plate 2). The outflow drains northward through silty clay material and then through an extensive boulder field farther north. The field drains into a delta-like area of clay and silt, splitting into two channels before entering a pond 1 km north of the train.

A strong sewage odour was detected 50 m from the sewage pipe outflow and to a lesser degree 750 m downstream. This odour was present at the more easterly inflow point to the pond but not at the west branch.

A water sample was taken 1.1 km north of the Module Train at the outflow of the pond (C5-F).

Soil samples were taken 50 m north of the outflow pipe (C5-055), 50 m further downstream (C5-056) and 750 m still further downstream (C5-040). Two samples were collected at the south end of the pond (C5-042, C5-043). Two more samples were taken near the outflow at the north end of the pond (C5-038, C5-039). Samples C5-038, C5-039, C5-042 and C5-043 were not submitted for analyses.

The sampling locations are shown in Figure 6.1.

6.6.1.2 Analytical Results

Water sample C5-F was submitted for the first round of analyses and tested for metals, TPH, PCBs, pesticides, and volatile organics.

The water sample contained low levels of benzene and toluene (9.2 μg/l and 2.3 μg/l respectively).

Soil samples C5-040, C5-055, and C5-056 were tested for the complete set of indicator chemicals, with the exception of volatiles in C5-040.

Results of the analyses are presented in Table 6.8.

The concentrations of various metals, PCBs and volatiles exceeded 50 percent of Level A in three samples: C5-040, C5-055 and C5-056. Chromium in sample C5-040 was above 50 percent of Level A, which is slightly higher than the background samples, but still within the range given in the literature. Mercury in sample C5-055 was above Level A. Sample C5-055 also showed lead above the 50 percent of Level A and PCBs exceeding the Level B criteria. PCBs exceeded the Level A criteria in sample C5-056. Sample C5-055 also exceeded the Level A criteria for silver and was twice the maximum value of the range given in the literature. Silver was not detected in the background samples. Cl_4-Ethylene and ethylbenzene were also detected in sample C5-055.

6.6.1.3 Evaluation of Risk Assessment and Analytical Results

The results of the overall risk assessment show that carcinogenic and non-carcinogenic risks are below the levels established for this study.

The levels of metals and PCBs found in the sewage outfall do not represent an acute risk. There were no physical hazards associated with the site. It appears that some contamination may be migrating from the outfall area and entering the pond where the water sample was taken. This cannot be determined with certainty because other sources of contamination could enter the watershed of this pond. The sewage outfall represents a risk to the small pond due to the potential migration of contaminants.

6.7 BUILDING PROXIMITIES

6.7.1 AIRSTRIP

6.7.1.1 Visual Observations and Sample Locations

Stain Area 1 was located near a group of structures including an airstrip hut, an unheated vehicle storage building, a beacon light and a refueler, all of which are located on an apron at the west end of the runway, 750 m from the runway's east end (Plates 3 and 4). The area around the survival shack located 180 m north of the runway apron has also been included. A large stained

Table 6.8

CAM 5, MACKAR INLET: SOIL ANALYTICAL RESULTS – SEWAGE OUTFALL

Indicator Chemicals (mg/kg)	Quebec Guidelines			Background				
	A	B	C	C5-057	C5-058	C5-040	C5-055	C5-056
Arsenic	10	30	50	<0.1	0.8	0.2	0.5	<0.1
Mercury	0.2	2	10	<0.05	<0.05	<0.05	0.33	<0.05
Barium	200	500	2000	43	29	62	63	29
Chromium (total)	75	250	800	37	22	43	36	22
Lead	50	200	600	<10	<10	<10	33	<10
Silver	2	20	40	<5	<5	<5	6	<5
Nickel	50	100	500	21	11	23	14	11
PCB	0.1	1	10	<0.01	<0.01	<0.01	3.3	0.26
Cl4-Ethylene	0.1	3	30	<0.001	<0.001	-	0.003	<0.01
Ethylbenzene	0.1	5	50	<0.002	<0.002	-	0.002	<0.002

TPH=Total Petroleum Hydrocarbon
PCB=Polychlorinated Biphenyls
N/A=Not Analyzed

area exists on the coarse grained sand surface 10 m east of the vehicle storage area and a harsh, slightly sweet odour was observed immediately west of the storage building.

Drainage from this area is to the northeast, parallel to the runway. A film of hydrocarbon was present on water saturated sands 50 m northeast of the storage shed and a harsh odour was detectable. A film of hydrocarbon was present over a large area of pond on the north side of the runway, 400 m northeast of the shed, however no staining or odour was evident northeast toward the lakeshore where the pond outflows.

Soil samples were taken immediately east (C5-002) and northeast of the storage building (C5-001 and C5-003). Two samples were gathered 50 m northeast of the storage shed (C5-005 and C5-006) and two more 100 m downstream; sample C5-007 was taken on the south side of the road parallel to the runway and C5-008 on the north side. A sample was taken 200 m farther northeast adjacent to the south side of the runway (C5-009) and another, 350 m farther northeast (C5-004). One sample was taken at the outflow of the large pond north of the runway (C5-010). Two samples were taken, one 50 m to the north of the east end of the runway (C5-013) and one 80 m northeast of the east end of the runway. One soil sample was taken in the vicinity of the survival shack (C5-037) but was not submitted for analysis.

The soil sampling locations are shown in Figure 6.1.

6.7.1.2 Analytical Results

Soil sample C5-001 was tested for the complete set of indicator chemicals. Samples C5-005 and C5-006 were tested for metals, TPH, and PCBs.

The sample collected at the northeast storage shed (C5-006) contained TPH exceeding the Level A criterion. PCBs in excess of the Level A criteria were present in Sample C5-005. The remaining indicator chemicals were present in concentrations below 50 percent of Level A.

6.7.1.3 Evaluation of Risk Assessment and Analytical Results

The results of the overall risk assessment show that carcinogenic and non-carcinogenic risks are below the levels established for this study.

Although the soil sampling results do not show high levels of contaminants, the visual observations of the site indicate that there is some source of hydrocarbon contamination in the area. There are no acute or physical hazards associated with the site. Further sampling is required to delineate the extent of contamination in this area and define potential environmental risk. The area potentially affected by this stain appears to be quite large.

6.7.2 MAIN MODULE TRAIN

6.7.2.1 Visual Observations and Sample Locations

The stain area was located near the main compound area in which the Module Train, warehouse and garage are located.

Extensive areas of the main compound are comprised of coarse sand and gravel surface which, particularly to the west of the buildings, had stained pockets ranging from 0.5 - 3.0 m^2 (Plate 7). A hydrocarbon film was present in a small stream flowing west, downslope, away from the structures.

Two soil samples were obtained west of the buildings; one 10 m from the garage (C5-052) and a second by a small stream, 40 m farther west (C5-053). Both were submitted for analyses.

Locations of the soil samples are shown in Figure 6.1.

6.7.2.2 Analytical Results

Soil samples C5-052 and C5-053 were analyzed; C5-052 for the complete set of indicator chemicals, and C5-053 for metals, TPH, and PCBs.

Results of the analyses of the soil samples are presented in Table 6.9.

PCBs were detected in two samples (C5-052 and C5-053) in excess of the Level A criterion. Samples C5-052 and C5-053 contained lead concentrations above 50 percent Level A. TPH was above 50 percent of Level A in C5-053 and above Level A in C5-052.

6.7.2.3 Evaluation of Risk Assessment and Analytical Results

The results of the overall risk assessment show that carcinogenic and non-carcinogenic risks are below the levels established for this study. No indicator chemicals were identified above the Quebec Level B guideline.

The sampling results show a moderate degree of contamination from hydrocarbons in the stained area. No acute or physical hazards exist.

Table 6.9

CAM 5, MACKAR INLET: SOIL ANALYTICAL RESULTS – STAIN AREA 2

Indicator Chemicals (mg/kg)	Quebec Guidelines			Background			
	A	B	C	C5-057	C5-058	C5-052	C5-053
Arsenic	10	30	50	<0.1	0.8	0.4	-
Mercury	0.2	2	10	<0.05	<0.05	<0.05	0.07
Barium	200	500	2000	43	29	36	41
Chromium (total)	75	250	800	37	22	22	23
Lead	50	200	600	<10	<10	42	44
Nickel	50	100	500	21	11	9	10
TPH	100	1000	5000	<5	<5	370	58
PCB	0.1	1	10	<0.01	<0.01	0.12	0.20

TPH=Total Petroleum Hydrocarbon
PCB=Polychlorinated Biphenyls
- = Not Analyzed