INDIAN AND NORTHERN AFFAIRS CANADA
BLANCHARD RIVER STATION
SUMMARY OF 2000 WORK ACTIVITIES

MARCH, 2001

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March 30, 2001

Indian and Northern Affairs Canada
Waste Management Program
345 – 300 Main Street
Whitehorse, Yukon
Y1A 2B5

Attention: **Brett W. Harshorne, Manager**

Dear Brett:

Reference: **Summary of 2000 Work Activities, Blanchard River Maintenance Camp**

UMA Engineering Ltd. and Royal Roads Applied Research Division are pleased to submit the following report summarizing the work activities and results of the shop drainage improvements and environmental monitoring carried out at the Blanchard River Maintenance Camp between September 21-25, 2000. These activities involved:

1. Inspection and status of modifications to the Maintenance Shop drainage system;
2. Investigation and rehabilitation of a non-functional seepage pit located on the west side of the Maintenance Building; and
3. Environmental monitoring of groundwater, surface water and river sediments at the Blanchard River location.

We have also identified the outstanding work activities for completion in 2001.

Should you have any questions, contact either of the report authors or Tom Wingrove at 204-284-0580. We look forward to completing the outstanding work items in 2001.

Respectfully submitted,

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1.0 INTRODUCTION

As a result of the previous investigation and remedial work undertaken at the Blanchard Grader Station, decisions were made to implement improvements in the management of drainage generated within the maintenance shop and to implement an environmental monitoring program.

Specifications for the shop drainage work were developed in 1999 and materials purchased through Champagne-Aishihik. In September of 2000, UMA were asked to assist with the commissioning of the shop drainage system and oil-water separator as well as the seepage disposal system. Given the lateness of the year and some material shortages, the drainage collection system was only partially completed with some drainage by-passing the separator and the welding shop still discharging to the original seepage system south of the shop.

The decision was made to rehabilitate the primary seepage system to improve capacity and eliminate the backup of water into the shop. Given the success of this work, the new infiltration gallery can be deleted as an outstanding work item.

Groundwater, surface water and sediment sampling/analysis was completed as per the recommendations from the 1999 site work to demonstrate the effectiveness of sources removed at the Burn Pit and monitor the magnitude and extent of dissolved hydrocarbons in the groundwater system, in particular the potential for impact on the Blanchard River.

2.0 CHRONOLOGY OF SITE WORK

September 20/2000

- Tim Starodub arrived on site and reviewed the work performed to date on the shop drainage collection and treatment system. The work completed included the concrete work related to the sump pits and pump bases.

September 21/2000

- The equipment and material on site was inventoried relative to the pre-purchase specification list. (List attached in Appendix A).
- The sump pits in the lower floor area were filling and the lower floor was flooding. Water was being pumped out into the yard. The water level in the new sump pits and at the drain cleanouts was monitored to determine how the water was getting into the sump pits. By draining one pit and monitoring the water levels it was determined that one pit was still piped into the existing drainage system. (Floor water was entering the second pit). This monitoring also confirmed that the existing seepage pit was not accepting the flow rate from the garage.
- Brett Hartshorne and Werner from Indian and Northern Affairs and Jackie McBride from Champagne Aishihik arrived. The status of materials for the new infiltration gallery (to replace the current seepage pit) was discussed. Jackie advised that a truckload of material was being delivered to site this day but could not advise which material. (A truckload of geomembrane arrived at the station later in the day). It was decided that no work would be performed on the new infiltration gallery until the required materials were on site. It appeared that the specified materials for this work had not been ordered. Work on the installation of the system in the shop could proceed as materials were available.
- The decision was made to rehabilitate the existing seepage pit to increase its capacity. INAC arranged to have a backhoe available on site for September 22, 2000.
- Sam Dion, the camp formeman provided culvert sections to use in expanding the seepage pit.

September 22/2000

- INAC was requested to have 30 yards of 75 mm clean rock delivered for the rehabilitation of the seepage pit.
- The backhoe was used to locate and excavate around the vertical culvert section that made up the existing seepage pit.
- A trench was created during the work to locate the seepage pit.
- When the seepage pit was initially uncovered, water flowed out over the top of the vertical culvert section and the full height of the vertical culvert section was observed to be full of water/waste.
- The material installed adjacent to the culvert section appeared to be native backfill consisting of silty sands and gravels.
- After excavating to a depth of 2 m along the side of the culvert and with less than 150 mm of fill adjacent to the culvert remaining, there was no water flow out of the culvert. When the remaining material against the culvert was removed, a large flow of water was observed. The material immediately adjacent to the culvert was discoloured (grey) and appeared to be thick and sticky. While the seepage pit was draining, the covers were shoveled off and removed. The material in the culvert section included water and a thick dark grey material.
- The water flow to the seepage pit from the water treatment system was redirected to stop the flow of water into the excavation.
- The perimeter of the culvert section was excavated to its base.

- The backhoe and one of the front end loaders from the grader station were positioned to prevent vehicle access to the excavation and work ended for the day.
- Andrew Passalis (UMA) arrived on site.

September 23/2000

- Excavation of the existing seepage pit was continued. Obviously impacted soils were segregated outside the excavation, the vertical culvert section was removed and all rock and soil in vicinity of the seepage pit was excavated.
- The vertical culvert section from the seepage pit was salvaged, steam cleaned and the remaining billets removed. Holes were cut by torch in the new 600 mm culvert section and additional construction materials obtained from site personnel.
- The rehabilitated seepage pit was constructed by installing the vertical culvert section to its pre-existing elevation. Additional horizontal drainage components consisting of a 1.5 m long 600 mm and 2.7 m long 200 mm perforated sections were installed to the north of the vertical section.
- A temporary containment cell was constructed approximately 10 m southeast of the containment cell constructed in 1999. Approximately 25 m3 of hydrocarbon impacted soils excavated from the seepage pit were placed into the lined cell for storage pending characterization and treatment/disposal.
- The vertical section of culvert was backfilled with round rock previously removed during the excavation. Approximately 15 m^3 of imported 75 mm drain rock was placed around the drainage sections. A seepage test was performed on the rehabilitated seepage pit.

September 24/2000

- Filter cloth was placed over the drain rock and the cover over the vertical culvert was reinstalled. Insulation was placed over the influent pipe and top of the vertical culvert section to protect against freezing. The remainder of the excavation was backfilled to existing grade.
- All monitoring wells identified for additional monitoring were located and water levels were recorded. Purging of the wells was started.

September 25/2000

- Completed purging and sampling of all designated wells and collected water and sediment samples from the Blanchard River locations.

3.0 OIL WATER SEPARATOR SYSTEM AND MAINTENANCE SHOP DRAINAGE UPGRADES

3.1 *Separator Installation: Current Status*

The separator has been installed and piped in a temporary manner (see Appendix A) for details. Under the present installation a portion of the floor drainage from the upper garage, the wastewater from the softener and the washwater from the washing machine are piped directly to the drain, by-passing the separator. The floor drainage in the welding shop still discharges to the seepage pit at the south end of the building.

The current pump in use is a centrifugal pump. This type of pump will emulsify any oil present which may not permit removal by the separator.

3.2 *Work Remaining*

As indicated in Section 3.1 Current Status, there are several sources of potential oil contamination that discharge directly to one of the two seepage pits. Additionally, there is no ability to deal with the washwater generated from washing vehicles. The lower floor area was discussed with site personnel as being designated as a vehicle wash area. (Note: not represented on the construction drawings is the requirement to redirect the wastewater from the washing machine to the same sump pit in the lower floor area).

There are two options to complete the final installation.

- Install the system as per the original construction drawings.
- Delete the bulk tank proposed for soap emulsion release and use a non-emulsifying soap. Highland, the manufacturer of the oil/water separator, has a cleaner that they indicate is acceptable for use with their separators. It would be possible to test a sample of the soap with the temporary separator installation to determine the soap's effectiveness as a cleaner. If the soap is acceptable as a cleaner, it could be adopted as a standard for use and the bulk tank deleted from the system.

The total vehicle washing through the year is minimal with a peak period in the fall when equipment returning to the station is cleaned.

To permit the system installation in this manner there would be some minor redesign needed. Generally, the work would include:

- Cleaning of the sump pit, insertion of a tank and installation of a pump (Jabsco pump with control panel) and piping for the welding shop drainage.
- Direction of all drain lines in the upper garage area to the lower garage drain pit. Installation of a transfer pump (Jabsco pump).
- Redirection of the washwater from the washing machine to the second pit in the lower garage area. This is premised on using the new soap. A submersible sump pump (such as one of the pumps currently in use) would be installed to transfer this washwater directly to the seepage pit using the existing drainage line. The pit would collect some of the grit and other solid materials and prevent them from reaching the seepage pit.

- For this option, the materials required would include the motors, bases, couplings and specified impellers for the two pumps on site and obtaining the second 120V pump control panel that is not on site. The 3-phase pump control panel on site would not be used. The larger pump (to match the 3-phase pump control panel) is not currently on site and would not be needed.

In addition to being a simpler, less expensive installation, the deletion of the large holding tank will result in a reduced operational and space requirement.

Photo 1: Concrete work, floor drains and oil water separator (not commissioned).

4.0 SEEPAGE PIT

Following the 1986 addition to the Maintenance Garage, the majority of runoff from the building floor drains was directed to a seepage pit located on the west side of the building. Reports by YTG personnel over the past few years have identified operational problems with the existing drainage system (i.e., the system would not provide adequate drainage). In September, 2000 the drainage system was reported to be non functional, resulting in water backing up inside the building. UMA were notified and mobilized to the site on September 21, 2000 to assess the problem(s) and take corrective actions as necessary to restore the shop drainage disposal system.

Excavation and rehabilitation of the existing seepage pit was completed between September 22 - 24, 2000. Excavation was completed using a rubber-tire backhoe contracted by Champagne & Aishihik First Nation.

The following is a description of site observations and corrective actions taken in rehabilitation of the seepage pit.

4.1 Excavation of the Existing Seepage pit

Investigation and excavation of the seepage pit located on the west side of the Maintenance Garage was completed between September 22 - 23, 2000. The original seepage pit was constructed of a vertically mounted perforated corrugated steel culvert section measuring 1.8 m deep and 1677 mm in diameter. Liquid effluent from the building floor drain system is directed to the seepage pit via a 100 mm steel pipe buried approximately 1.5 m below grade. Construction of the seepage pit also included placement of rounded cobbles and boulder sized material inside the culvert section for structural and drainage purposes. The material surrounding the seepage pit consisted of silty sand and gravel materials similar to native soils observed during previous investigations in the area.

At the time of the excavation, subsurface soils located immediately above the seepage pit (1.4 m below grade) were saturated with liquid effluent that was emanating upwards through the top of the seepage pit. Upon further investigation, the seepage pit was found to be at capacity and contained a viscous, dark grey sludge-type material with a distinct heavy hydrocarbon odour (Photo 2). Subsurface soils immediately surrounding the seepage pit (within 0.3 m) were observed to be similarly stained and odourous. Impacted soils were excavated to an elevation of 825.8 m (3.5 m below grade). Groundwater seepage into the excavation was observed at an elevation of 826.3 m.

Photo 2: Excavation of hydrocarbon impacted material from the seepage pit location.

Decommissioning of the seepage pit involved the removal of the steel culvert section, sludge, cobble and boulder sized material from within the culvert, and obvious hydrocarbon impacted soil located proximate to the culvert section. Approximately 25 m^3 of hydrocarbon impacted material was transported via truck to a temporary lined containment located east of the existing containment cell, and within the YTG Right-of-Way (see Drawing 01). The temporary containment consisted of a 7 m x 7 m bermed cell that was lined with 15 mil reinforced polyethylene (RPE) and covered with a standard construction tarpaulin. The cell was constructed to promote positive drainage away from the cell.

During excavation and inspection of the seepage pit, it was observed that the majority of perforations on the culvert section were obstructed with sludge. In addition, approximately 30% of the perforation billets were still attached, causing further obstruction.

4.2 Rehabilitation of Seepage Pit

Based on site conditions and construction materials available at the site, installation of the proposed infiltration gallery on the southwest side of the maintenance building was abandoned. Instead, efforts were directed towards re-establishing an infiltration gallery at the existing seepage pit location on the west side of the maintenance garage (see Drawing No. 01 and 02).

4.2.1 Design and Construction

Efforts to re-use existing seepage pit construction materials were made wherever possible, including:

- vertical perforated culvert section; and
- cobble and boulder sized materials used for structural support inside the culvert section.

Additional materials required for the construction of the seepage pit were obtained from INAC and directly from YTG Services on-site, including:

- 15 m^3 of 50 mm drain rock from Whitehorse;
- 600 mm diameter x 1.5 m long perforated culvert section;
- 200 mm diameter x 2.7 m long perforated culvert section;
- Steel adaptor and end plates (discarded road signs).

The design and construction details of the infiltration gallery are shown on Drawing 02 and illustrated in Photo 3. To increase the surface area of the original construction design, the excavation was extended to the northwest by approximately 6 m.

The seepage pit was constructed with the existing 1677 mm diameter steel culvert section mounted vertically on the native subgrade, approximately 3.2 m below grade. Two perforated steel culvert sections (600 mm and 200 mm diameter) were placed end to end horizontally in the excavation to the north and connected to the vertical section. The horizontal sections were coupled with a steel adaptor plate. The open end to the north was covered with a highway sign. The inverts of both horizontal sections were installed approximately 2.6 m below grade. Cobble and boulder sized materials recovered from the excavation were placed into the base of the vertical section to provide structural stability during backfilling.

The infiltration gallery excavation was backfilled with imported rounded drain rock to within 2 m from finished grade. Filter cloth was placed above the drain rock prior to backfilling the remainder of the excavation with native sand and gravel material. Due to the relatively shallow depth of the infiltration gallery, sheets of R10 rigid insulation were placed immediately above the infiltration gallery and influent pipe from the shop drainage system to provide protection against freezing.

4.2.2 Infiltration Rate Estimate

Following installation of the vertical and horizontal culvert sections and placement of the drain rock around the seepage pit, a percolation test was completed. Infiltration rates in the native and fill materials were determined by pumping a known volume of water into the seepage pit and measuring the change in water level with time. The percolation (infiltration) test involved injecting 4,800 L of water into the system over a four hour period at a rate of 45 lpm (10 gpm). The water level fluctuated between 2.4 m to 2.9 m below grade (826.9 m to 826.4 m elevation) which allow for an additional 1 m rise (safety factor) inside the seepage pit before water backs up into the shop drain system. Based on the results of the seepage test, infiltration rates should accommodate the average shop drainage requirements of 4-15 lpm.

Photo 3: Looking north during infiltration gallery installation. Note influent pipe from shop in front right.

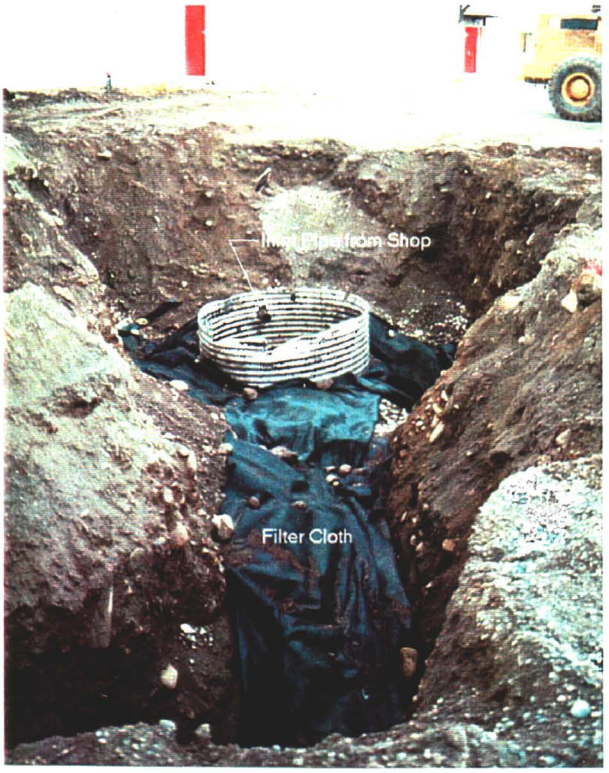


Photo 4: (left) Looking south at the infiltration gallery following placement of drain rock and filter cloth.

5.0 ENVIRONMENTAL MONITORING

On September 23-24, 2000, an environmental monitoring program was carried out to assess groundwater, surface water and sediment quality at pre-selected locations at the Blanchard River Maintenance Camp. Based on conclusions derived from the site investigations and remediation and the pattern of distribution of various hydrocarbon constituents in the subsurface soils and groundwater (*Detailed Site Investigation and Site Restoration of Blanchard River Station, Draft, May 1999*), recommendations for continued monitoring of the site included:

- Collection of groundwater samples from monitoring wells located downgradient from the historic burn pit area on the north side of the site (TH95-1, TH95-2 and TH99-8);
- Collection of groundwater samples from monitoring wells located within or in the vicinity of the petroleum hydrocarbon plume located southwest of the Maintenance Building (TH95-5, TH99-9, TH99-10, TH99-13, TH99-18, TH99-19 and MP3); and
- Collection of surface water and sediment samples from the Blanchard River, including collection of background samples.

5.1 *Sampling Protocols*

Each well was purged and sampled using dedicated Waterra™ tubing and foot valve. At least three well volumes were withdrawn from the well and discarded. Following removal of three well volumes, the temperature, pH and conductivity parameters were monitored using an Orion Model 122 Conductivity Meter and a Hanna Instruments HI 8424 pH Meter. Purging was continued until the temperature, pH and conductivity parameters had stabilized (i.e., consecutive readings within 10% of each other). Once stabilized, a representative groundwater sample was collected. The probes were rinsed with distilled water and wiped with Kimwipes™ between sampling stations.

A Solinst Model 122 Interface probe was used to measure the depth to water and check for the presence and thickness of any free phase hydrocarbon product at each monitoring well location. Static water levels, free phase product, temperature, pH and conductivity are summarized on Table 5.1.

Table 5.1: Summary of Environmental Monitoring Field Results

Location	Depth to Water (m)	Collar Elevation (m)	Water Elevation (m)	Free Product (mm)	Volume Purged (l)	Field Measurements		
						pH	Temp °C	Conductivity (uS/cm)
TH95-1	2.851	828.141	825.290	0	60	7.67	5.6	276
TH95-2	2.462	828.071	825.609	0	60	7.82	6.5	315
TH95-5	8.842	829.434	820.592	0	60	7.35	4.6	864
TH99-8	2.047	827.615	825.568	0	40	7.55	6.1	315
TH99-9	3.797	823.076	819.279	0	60	7.56	6.3	518
TH99-10	3.423	823.818	820.395	0	60	7.20	5.1	448
TH99-13	9.311	829.095	819.784	0	60	7.63	5.6	417
TH99-18	3.369	822.277	818.908	0	60	7.61	5.2	420
TH99-19	3.041	822.764	819.723	0	60	7.23	6.2	794
MP3	0.465	820.229	819.764	0	3	7.90	8.5	426
BLW-5	Blanchard River					7.87	8.5	127
BLW-6	Blanchard River					8.18	8.7	57
BLW-7	Blanchard River					8.08	8.3	36

5.2 Water Samples

Samples designated for organic analysis (extractable hydrocarbons and polycyclic aromatic hydrocarbons) were placed into 1 litre amber glass jars with Teflon lids. Sample aliquots for BETX and volatile organic compound analyses were placed into three 40 ml vials containing sulphuric acid preservative and sealed with Teflon–lined septum lids. A total of 9 groundwater monitoring wells, one mini-piezometer and three surface water samples were collected during the environmental monitoring program.

5.3 Blanchard River Surface Water and Sediment Samples

As part of the environmental monitoring program, one sample each of river water and sediment was collected from an upstream reference location (BLW-7), immediately adjacent to the south side of the site (BLW-6) and downstream of the site where seepage from the north side of the site enters the Blanchard River (BLW-5).

Monitoring well and Blanchard River sediment and water sample locations are noted on Drawing No. 01. Photos 5 through 7 illustrate the locations where surface water and sediment samples were collected from the Blanchard River.

Photo 5: BLW-5 located downstream of the site where groundwater seepage from the north end of the site discharges into the Blanchard River.

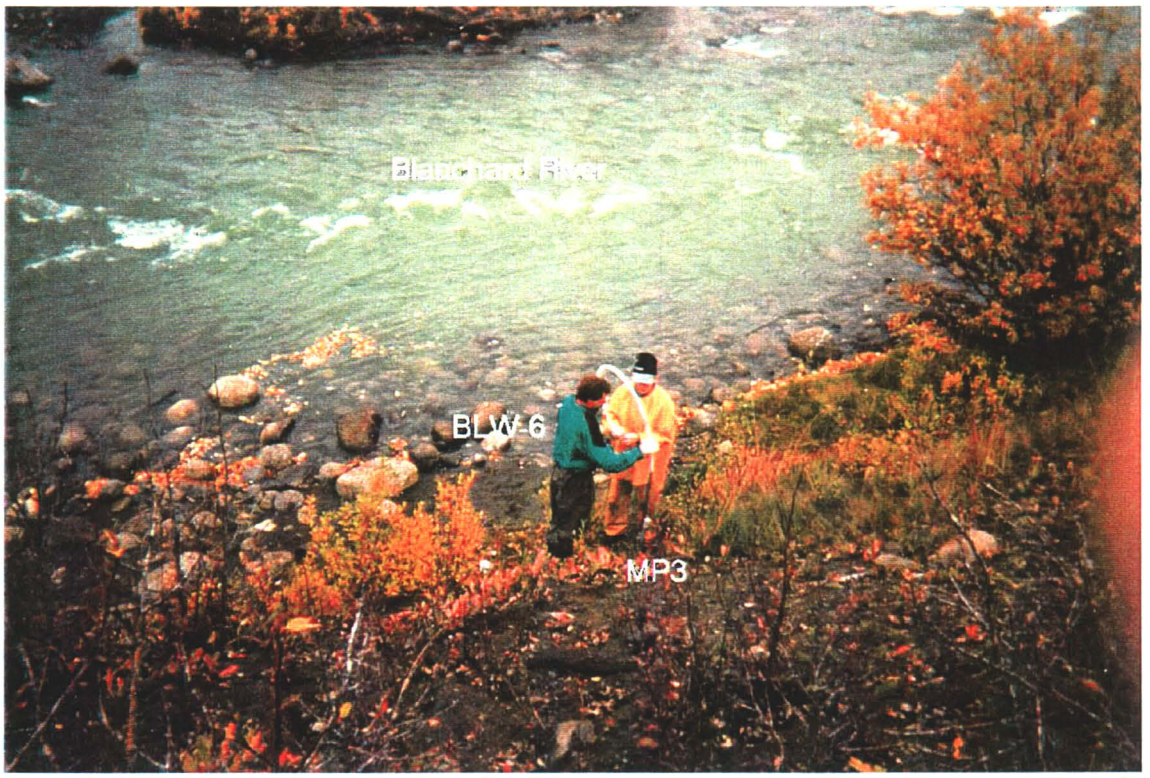


Photo 6: BLW-6 located immediately south of the site and southeast of MP3. Reference photo from 1999.

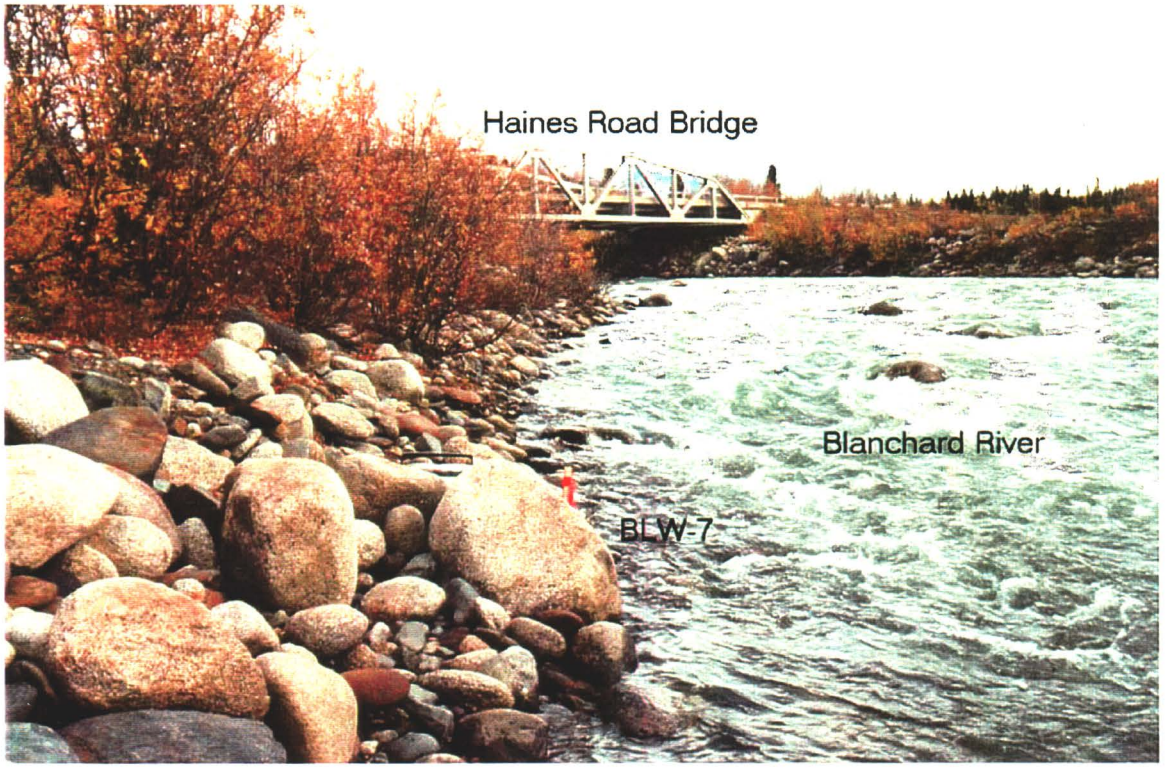


Photo 7: BLW-7 located upstream of the site approximately 100 m west of the bridge.

following removal of contaminated substrate from the burn pit. The concentrations of hydrocarbons in groundwater samples obtained from the three wells down gradient of the burn pit (**MW-1, MW-2 and MW-8,** Drawing No. 01) are given in Table 5.2; data from the 1999 remediation program data is included in this table for comparison.

Detectable levels of hydrocarbons that exceeded the aquatic life standard were found in TH95-2, the first well located down gradient of the burn pit (1400 µg/L of LEPH). The concentration was however lower than that obtained in the sample collected from this well in 1999 (5,800 µg/L of LEPH) indicating a decrease in groundwater hydrocarbon contamination levels. Similar results were obtained for TH95-1, further down gradient of the former burn pit, in that the LEPH concentration of 400 µg/L obtained in 2000 was much lower than the 1999 value of 1100 µg/L. As with the 1999 data, no hydrocarbons were detected in TH99-8.

Apart from naphthalene and VPH concentrations in the 2000 samples from TH95-2, detectable levels of the remaining analytes followed a similar decreasing trend. The higher VPH obtained in 2000 (1700 µg/L) compared to 1999 (1400 µg/L) is attributable to the lower concentrations of the BTEX components in the 2000 sample; VPH is obtained by subtracting the concentrations of BTEX components from VH.

Table 5.2: Concentrations of Hydrocarbons (µg/L) in Water Samples Collected from Boreholes North of the Maintenance Building in 1999 and 2000

Sample #	TH95-1		TH95-2		TH99-8		Yukon Standard	
Date	1999	2000	1999	2000	1999	2000	AW	DW
Non-halogenated Volatiles								
Benzene	**19.8**	1	**42.7**	1	<0.5	<0.5	3,000	5
Ethylbenzene	**76.9**	**19.6**	**160**	**130**	<0.5	<0.5	7,000	2.4
Toluene	0.8	0.5	11.5	0.5	<0.5	<0.5	3,000	24
meta- & para-Xylene	54.6	11.3	**319**	178	<0.5	<0.5	-	300
ortho-Xylene	2.2	0.5	195	4.3	<0.5	<0.5	-	-
VH (C6-10)	1000	500	2100	2000	<100	<100	15,000[3]	-
VPH	800	500	1400	**1700**	<100	<100	1,500[3]	-
PAHs								
Acenaphthene	0.18	0.125	<0.4	0.3	<0.05	<0.05	60	
Acenaphthylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Acridine	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.5	-
Anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1	-
Benz(a)anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	-
Benzo(a)pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Benzo(g,h,i)perylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Benzo(k)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Chrysene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Dibenz(a,h)anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	2	-
Fluorene	0.11	0.095	0.19	0.29	<0.05	<0.05	120	-
Indeno(1,2,3-c,d)pyrene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Naphthalene	**16.5**	<0.08	**34.7**	**50.8**	<0.05	<0.05	10	-
Phenanthrene	<0.05	<0.05	<0.06	<0.05	<0.05	<0.05	3	-
Pyrene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	-
Extractable Hydrocarbons								-
EPH C10-19	1100	400	5800	1400	<300	<300	5,000[3]	
EPH C19-32	<1000	<1000	<1000	<1000	<1000	<1000	-	-
LEPH	**1100**	400	**5800**	**1400**	<300	<300	500[3]	-
HEPH	<1000	<1000	<1000	<1000	<1000	<1000	-	-

Notes:

- Shaded areas indicate parameters that are equal to or exceed the Yukon Renewable Resources CSR Standards for Aquatic Life (AW) and/or Drinking Water (DW) use.
- Aquatic life assumes minimum 1:10 dilution is available.
- Values taken from BC CSR (BC MELP, 1999).

5.5.3 *Results for Southwest of Maintenance Building*

As with the 1999 groundwater results, hydrocarbon contamination was found in TH95-5 and TH99-13, situated on the upper bench and down gradient of the seepage pit. These wells contained LEPH (10,700 and 300 µg/L respectively). The former level exceeded the proposed BC CSR standard of 500 µg/L. Elevated levels of HEPH were also detected in TH95-5 (Table 5.3). A number of PAHs including naphthalene, phenanthrene, and pyrene in TH95-5 exceeded the Yukon CSR standard for aquatic life. In addition, the concentration of ethylbenzene was greater than the Yukon standard for drinking water use. These detectable concentrations were however, lower than the 1999 results indicating an overall decrease in hydrocarbon contamination at the upper level.

LEPH concentrations in samples from wells located on the lower terrace TH99-9, TH99-10, TH99-18 and TH99-19 were also lower than the corresponding data obtained during the 1999 investigation (Tables 5.3 and 5.4).

Hydrocarbons from the residual in-place contamination in this area are discharged into Blanchard River as groundwater discharges to the river. This is suggested by results for the sample collected from the mini-poiezometer (MP-3) installed near the Blanchard River shoreline to intercept groundwater flow from the southwest side of the site, just before it enters the river. The groundwater sample collected from MP-3 in September 2000 contained high levels of LEPH (39,000 µg/L) and HEPH (6000 µg/L). The LEPH value exceeded the BC CSR standard for aquatic life (500 µg/L). Unlike the samples collected from the groundwater wells, LEPH and HEPH concentrations in samples taken from MP-3 were higher in September 2000 compared to the September 1999 results. It should be noted that the sample collected from MP-3 in September, 2000 contained an appreciable amount of suspended sediment compared to the September, 1999 sample. The elevated LEPH and HEPH concentrations in the 2000 sample are therefore attributable to the adsorption of these hydrocarbons on particulate matter in the sample.

The concentrations of hydrocarbons in water samples collected from the river, adjacent to MP-3 (BLW-6), upstream of the site (BLW-7) and down gradient of the site (BLW-5) were all below detection (Table 5.5). Thus following mixing of the groundwater with the river water, the hydrocarbon levels are reduced to background river concentrations, and below levels of concern based on the Yukon CSR standards. In addition, there is no evidence of elevated levels of petroleum hydrocarbons in sediment samples from the Blanchard River since they were all below their respective detection limits and less than the Interim Sediment Quality Guidelines (ISQG) and Probable Effect Level (PEL) values (Table 5.6).

Table 5.3: Concentrations of Hydrocarbons (µg/L) in Water Samples Collected from Boreholes Southwest of the Maintenance Building in Sept 1999 and 2000

Sample #	TH95-5		TH99-13		TH99-9		TH99-10		Yukon Standard	
Date	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**	**AW**	**DW**
Volatiles										
Benzene	0.8	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3,000	5
Ethylbenzene	**37.3**	**25.5**	<0.5	<0.5	<0.5	1.0	<0.5	<0.5	7,000	2.4
Toluene	1.15	<0.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3,000	24
meta- & para-Xylene	55.75	47.8	<0.5	<0.5	<0.5	1.6	<0.5	<0.5	-	300
ortho-Xylene	48.25	24.4	13.6	2.1	<0.5	2.9	<0.5	<0.5	-	-
VH (C6-10)	1000	900	100	<100	<100	<100	<100	<100	15,000[3]	-
VPH	850	800	<100	<100	<100	<100	<100	<100	1,500[3]	-
PAHs										
Acenaphthene	8.6	<0.4	0.28	0.36	<0.05	<0.05	<0.05	<0.05	60	
Acenaphthylene	2.4	<0.09	<0.05	<0.06	<0.05	<0.05	<0.05	<0.05	-	-
Acridine	<0.5	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.5	-
Anthracene	1.6	<0.6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1	-
Benz(a)anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	-
Benzo(a)pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Benzo(g,h,i)perylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Benzo(k)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Chrysene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Dibenz(a,h)anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Fluoranthene	<0.05	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	2	-
Fluorene	13.2	5.0	0.22	0.42	<0.05	<0.05	<0.05	<0.05	120	-
Indeno(1,2,3-c,d)pyrene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Naphthalene	**342**	**83.2**	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	10	-
Phenanthrene	**21**	**7.3**	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	3	-
Pyrene	**0.98**	**0.84**	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	-
Extractables										-
EPH C10-19	**23,700**	**10,700**	800	400	400	300	<300	<300	5,000[3]	
EPH C19-32	**3600**	**2000**	200	<1000	<1000	400	<1000	<1000	-	-
LEPH	**23,300**	**10,600**	800	400	400	<300	<300	<300	500[3]	-
HEPH	**4000**	**2000**	<1000	<1000	<1000	<1000	<1000	<1000	-	-

Notes:

- Shaded areas indicate parameters that are equal to or exceed the Yukon Renewable Resources CSR Standards for Aquatic Life (AW) and/or Drinking Water (DW) use.
- Aquatic life assumes minimum 1:10 dilution is available.
- Values taken from BC CSR (BC MELP, 1999).

Table 5.4: Concentrations of Hydrocarbons (µg/L) in Water Samples Collected from Boreholes Southwest of the Maintenance Building in Sept 1999 and 2000 (Continued)

Sample #	TH99-18		TH99-19		MP-3		Yukon Standard	
Date	1999	2000	1999	2000	1999	2000	AW	DW
Volatiles								
Benzene	<0.5	<0.5	5.8	2.1	<0.5	<0.5	3,000	5
Ethylbenzene	<0.5	1.0	44.4	51.7	<0.5	<0.5	7,000	2.4
Toluene	<0.5	<0.5	4.2	<0.5	<0.5	<0.5		24
meta- & para-Xylene	<0.5	1.6	38.4	42.7	<0.5	<0.5	3,000	300
ortho-Xylene	<0.5	2.9	2.5	0.6	<0.5	<0.5	-	-
VH (C6-10)	<100	<100	300	300	100	200	15,000[3]	-
VPH	<100	<100	200	200	100	200	1,500[3]	-
PAHs								
Acenaphthene	<0.05	<0.05	1.5	1.5	<0.3	<0.3	60	
Acenaphthylene	<0.05	<0.05	<0.05	<0.05	<0.5	<0.1	-	-
Acridine	<0.05	<0.05	<0.05	<0.05	<0.5	<0.1	0.5	-
Anthracene	<0.05	<0.05	<0.05	<0.05	0.58	<0.1	1	-
Benz(a)anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	0.1	-
Benzo(a)pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Benzo(g,h,i)perylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Benzo(k)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Chrysene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	-	-
Dibenz(a,h)anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.2	<1	2	-
Fluorene	<0.05	<0.05	1.2	1.4	2.46	<0.3	120	-
Indeno(1,2,3-c,d)pyrene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Naphthalene	<0.05	<0.05	**53.7**	**18.5**	<5	<4	10	-
Phenanthrene	<0.05	<0.05	<0.5	<0.05	**3.46**	**3**	3	-
Pyrene	0.12	<0.05	<0.05	<0.5	0.86	2	0.2	-
Extractables								-
EPH C10-19	1700	<300	5600	2600	**19,200**	**39,000**	5,000[3]	
EPH C19-32	400	<1000	800	<1000	3000	6000	-	-
LEPH	**1700**	<300	**5600**	**2600**	**19,200**	**39,000**	500[3]	-
HEPH	<1000	<1000	<1000	<1000	3000	6000	-	-

Notes:

- Shaded areas indicate parameters that are equal to or exceed the Yukon Renewable Resources CSR Standards for Aquatic Life (AW) and/or Drinking Water (DW) use.
- Aquatic life assumes minimum 1:10 dilution is available.
- Values taken from BC CSR (BC MELP, 1999).

Table 5.5: Concentrations of Hydrocarbons (µg/L) in Surface Water Samples Collected from Blanchard River in Sept 1999 and 2000

Sample #	BLW-5		BLW-6		BLW-7		Yukon Standard	
Date	1999	2000	1999	2000	1999	2000	AW	DW
Non-halogenated Volatiles								
Benzene	<0.5	<0.5	<0.5	<0.5	-	<0.5	3,000	5
Ethylbenzene	<0.5	<0.5	<0.5	<0.5	-	<0.5	7,000	2.4
Toluene	<0.5	<0.5	<0.5	<0.5	-	<0.5		24
meta- & para-Xylene	<0.5	<0.5	<0.5	<0.5	-	<0.5	3,000	300
ortho-Xylene	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	-
VH (C6-10)	<100	<100	<100	<100	-	<100	15,000[3]	-
VPH	<100	<100	<100	<100	-	<100	1,500[3]	-
PAHs								
Acenaphthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	60	
Acenaphthylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Acridine	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.5	-
Anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1	-
Benz(a)anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	-
Benzo(a)pyrene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Benzo(g,h,i)perylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Benzo(k)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Chrysene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Dibenz(a,h)anthracene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	2	-
Fluorene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	120	-
Indeno(1,2,3-c,d)pyrene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Naphthalene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	10	-
Phenanthrene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	3	-
Pyrene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	-
Extractable Hydrocarbons								-
EPH C10-19	<300	<300	<300	<300	<300	<300	5,000[3]	
EPH C19-32	<1000	<1000	<1000	<1000	<1000	<1000	-	-
LEPH	<300	<300	<300	<300	<300	<300	500[3]	-
HEPH	<1000	<1000	<1000	<1000	<1000	<1000	-	-

Notes:

- Shaded areas indicate parameters that are equal to or exceed the Yukon Renewable Resources CSR Standards for Aquatic Life (AW) and/or Drinking Water (DW) use.
- Aquatic life assumes minimum 1:10 dilution is available.
- Values taken from BC CSR (BC MELP, 1999).

Table 5.6: Concentrations (µg/g) of Hydrocarbons in Sediment Samples Collected from the Blanchard River

Sample #	BLW-5		BLW-6		BLW-7		CCME Sediment Guidelines	
	1999	2000	1999	2000	1999	2000		
Volatiles							ISQG[1]	PEL[2]
Benzene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	-	-
Ethylbenzene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Styrene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
Toluene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
meta- & para-Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
ortho-Xylene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-
VH C6-10	<100	<100	<100	<100	<100	<100	-	-
VPH C6-10 calculated)	<100	-	<100	-	<100	-	-	-
CWS Fraction 1 (C6-10)	-	<100		<100		<100		
PAHs								
Acenaphthene	<0.01	-	<0.01	-	<0.01	-	0.00671	0.0889
Acenaphthylene	<0.01	-	<0.01	-	<0.01	-	0.00587	0.128
Anthracene	<0.01	-	<0.01	-	<0.01	-	0.0469	0.245
Benz(a)anthracene	<0.01	-	<0.01	-	<0.01	-	0.0317	0.385
Benzo(a)pyrene	<0.01	-	<0.01	-	<0.01	-	0.0319	0.782
Benzo(b)fluoranthene	<0.01	-	<0.01	-	<0.01	-	-	-
Benzo(g,h,i)perylene	<0.01	-	<0.01	-	<0.01	-	-	-
Benzo(k)fluoranthene	<0.01	-	<0.01	-	<0.01	-	-	-
Chrysene	<0.01	-	<0.01	-	<0.01	-	0.0571	0.862
Dibenz(a,h)anthracene	<0.01	-	<0.01	-	<0.01	-	0.00622	0.135
Fluoranthene	<0.01	-	<0.01	-	<0.01	-	0.111	2.355
Fluorene	<0.01	-	<0.01	-	<0.01	-	0.0212	0.144
Indeno(1,2,3-c,d)pyrene	<0.01	-	<0.01	-	<0.01	-	-	-
Naphthalene	<0.01	-	<0.01	-	<0.01	-	0.0346	0.391
Phenanthrene	<0.01	-	<0.01	-	<0.01	-	0.0419	0.515
Pyrene	<0.01	-	<0.01	-	<0.01	-	0.053	0.875
Extractables								
EPH (C10-18)	<200	-	<200	-	<200	-	-	-
EPH (C19-31)	<200	-	<200	-	<200	-	-	-
LEPH	<200	-	<200	-	<200	-	-	-
HEPH	<200	-	<200	-	<200	-		
CWS Fraction 2 (C10-16)	-	<50	-	<50	-	<50		
CWS Fraction 3 (C16-34)	-	<50	-	<50	-	<50		
CWS Fraction 4 (C34-50)	-	<50	-	<50	-	<50	-	-

Notes:

- ISQG = Interim Sediment Quality Guidelines
- PEL = Probable Effect Level
- CWS = CCME Canada Wide Standard for Hydrocarbons

5.5.4 *Evaluation of Quality Control Samples*

One field duplicate sample, identified as BD-1 was obtained from TH95-1 and submitted for BTEX, VPH, PAH, LEPH and HEPH determination. The data obtained was evaluated by using relative percent difference (RPD). The RPD is expressed mathematically as:

$$RPD = 100\ [(x_1 - x_2) / \{(x_1 + x_2) / 2\}]$$

where x_1 and x_2 are the concentrations of the analytes above the detection limits.

Values of RPD less than 30% indicate reasonable to good precision, while those exceeding this value are considered fair to poor. Relatively good to fair reproducibility was obtained for laboratory samples as indicated by the RPD of 0 to 40% (Table 5.7).

Table 5.7: Concentrations (ug/L), Mean and Relative Percent Differnece (RPD) of Hydrocarbons in Water Samples

Parameter	Field Duplicate		Mean	RPD
	TH95-1	BD-1		(%)
Benzene	0.0008	0.0012	0.001	40
Ethylbenzene	0.0189	0.0204	0.01965	7.6
meta- & para-Xylene	0.0108	0.0118	0.0113	8.8
VPH	0.5	0.5	0.5	0.0
Acenaphthene	0.00011	0.00014	0.00013	24.0
Fluorene	0.00009	0.0001	0.000095	10.5
LEPH	0.4	0.4	0.4	0

One trip blank, prepared by ASL, accompanied the samples bottles from Vancouver to Blanchard River and back with the collected samples from Blanchard River back to the laboratory in Vancouver. All parameters analyzed were below the method detection limit indicating that sample handling did not result in contamination of the groundwater samples.

5.5.5 *Summary*

The results of the 2000 monitoring program presented in the preceding sections suggest a general decrease in hydrocarbon contamination in groundwater down gradient of the former burn pit. A similar decrease in hydrocarbon contamination was also noted in samples collected from wells at the southwest end of the site. The only exception was LEPH concentrations in the mini-piezometer (MP-3) installed near the Blanchard River shoreline to intercept groundwater flow from the southwest side of site, just before it enters the river; LEPH concentration was higher in September 2000 due to the presence of suspended sediment in the sample. The concentrations of LEPHs are summarized in Figure 5.1 below.

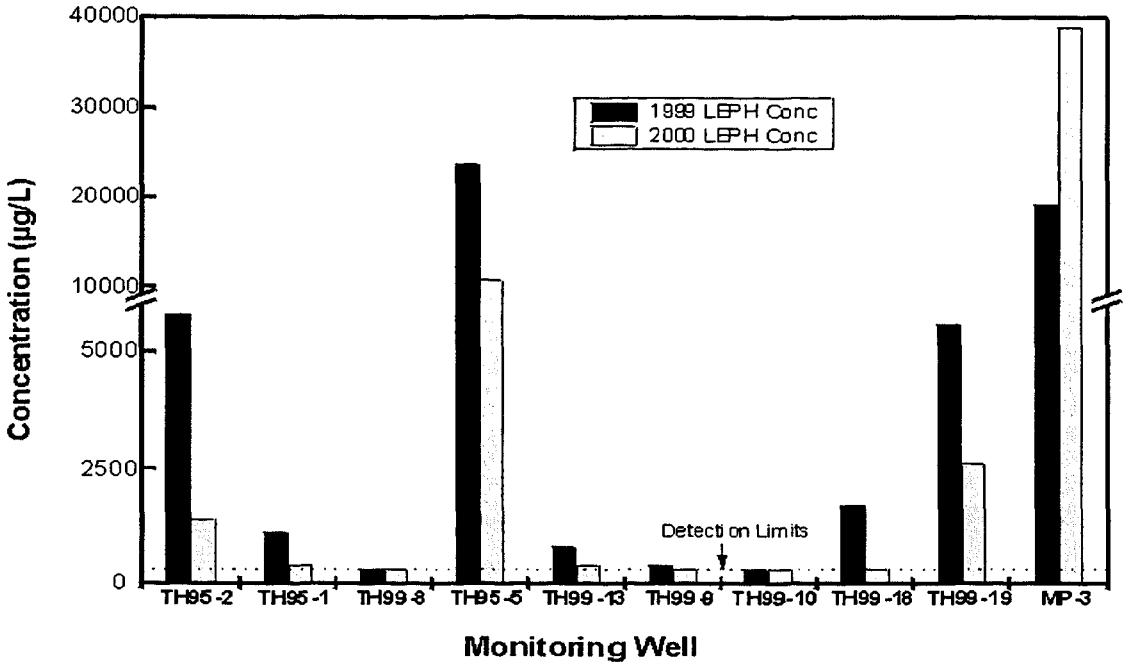


Figure 5.1: Light Extractable Hydrocarbon (LEPH) Concentrations in Groundwater Collected from Blanchard River Maintenance Camp in 1999 and Sept 2000

Even though elevated LEPH levels were found in some of the wells and the mini-piezometer on the southwest side of the side, analytical data for river water and sediment samples, did not provide any evidence for concentrations in the aquatic environment that would result in risks to aquatic life.

6.0 SUMMARY OF OUTSTANDING WORK ACTIVITIES

As part of the ongoing remedial and monitoring activities identified for the Blanchard River Maintenance Camp, several work tasks remain outstanding. The following is a list of activities that should be completed during the 2001 season.

1. Construction of the Land Farm – It was determined that hydrocarbon impacted soil excavated from remedial activities would be managed and treated on-site in a designated land farm facility. A parcel of land suitable for construction of the land farm has been identified, within the Haines Cut-Off Road Right-of-Way (Lot 2, Group 753), northeast of the Blanchard River Maintenance Camp.
   - At last discussion, the issue of land use northeast of the Maintenance Camp had not been resolved. It is recommended that INAC obtain the necessary permits and/or approvals governing the land use for the construction and operation of the land farm facility.
   - It is understood that Champagne & Aishik ("the contractor") has ordered and received certain materials to construct the land farm. These materials were delivered to site the week of September 18, 2000 and subsequently moved by INAC to the Mule Creek Grader Station the following week. Inspection of the materials delivered to site indicated the liner system was not as specified for construction. As a minimum, a list of materials delivered and performance specifications for those materials should be obtained for review.
   - Assuming construction of the land farm proceeds in 2001, a large quantity of select aggregate material will be required from the borrow pit located at KM 157.0 on the Haines Road. Permits for material extraction from this location are in effect until September 2001.
   - Develop and implement operational/management plan for the treatment of soil within the landfarm, including identifying provisions for excess water and a sampling and performance monitoring program.

2. Shop Drainage Upgrades – Based on the acceptability of the oil/water separator "friendly" soap identified, the original design can be simplified somewhat which will result in a simpler installation and easier system to operation. The work required includes:
   - Installation of the pump (Jabsco pump with control panel) in the weld shop sump pit complete with piping to the oil/water separator.
   - Direction of all drain lines in the upper garage area to the lower garage drain pit. Installation of a lift pump (Jabsco pump with control panel) discharging to the oil/water separator.
   - Pipe the discharge from the washing machine to the second pit in the lower floor area. Use of one of the existing temporary sump pumps to pump the wash water directly to the leaching pit.
   - Electrical to suit the installation of the 3 pumps.
   - Termination of the separator vents outside the building.
   - Additional materials need to be obtained including the specified motors, bases, couplings and specified impellors for the two pumps on site, obtaining the second specified 120V pump control panel, and the tank for insertion into the existing welding shop sump.

3. Disconnect the seepage pit on the south side of the Maintenance Garage

4. Characterization of materials excavated from seepage pit

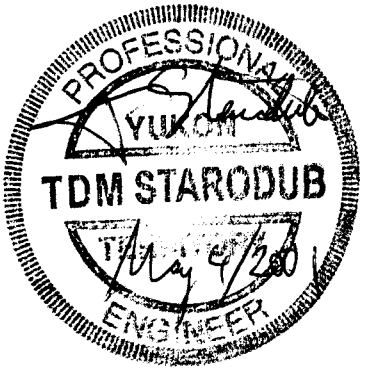
5. Complete annual environmental monitoring program

Respectively Submitted,

UMA ENGINEERING LTD.

Andrew Passalis, EIT
Geological Engineering
Earth and Water

Tim Starodub, P.Eng.
Chief Mechanical Engineer
Industrial



DRAWINGS

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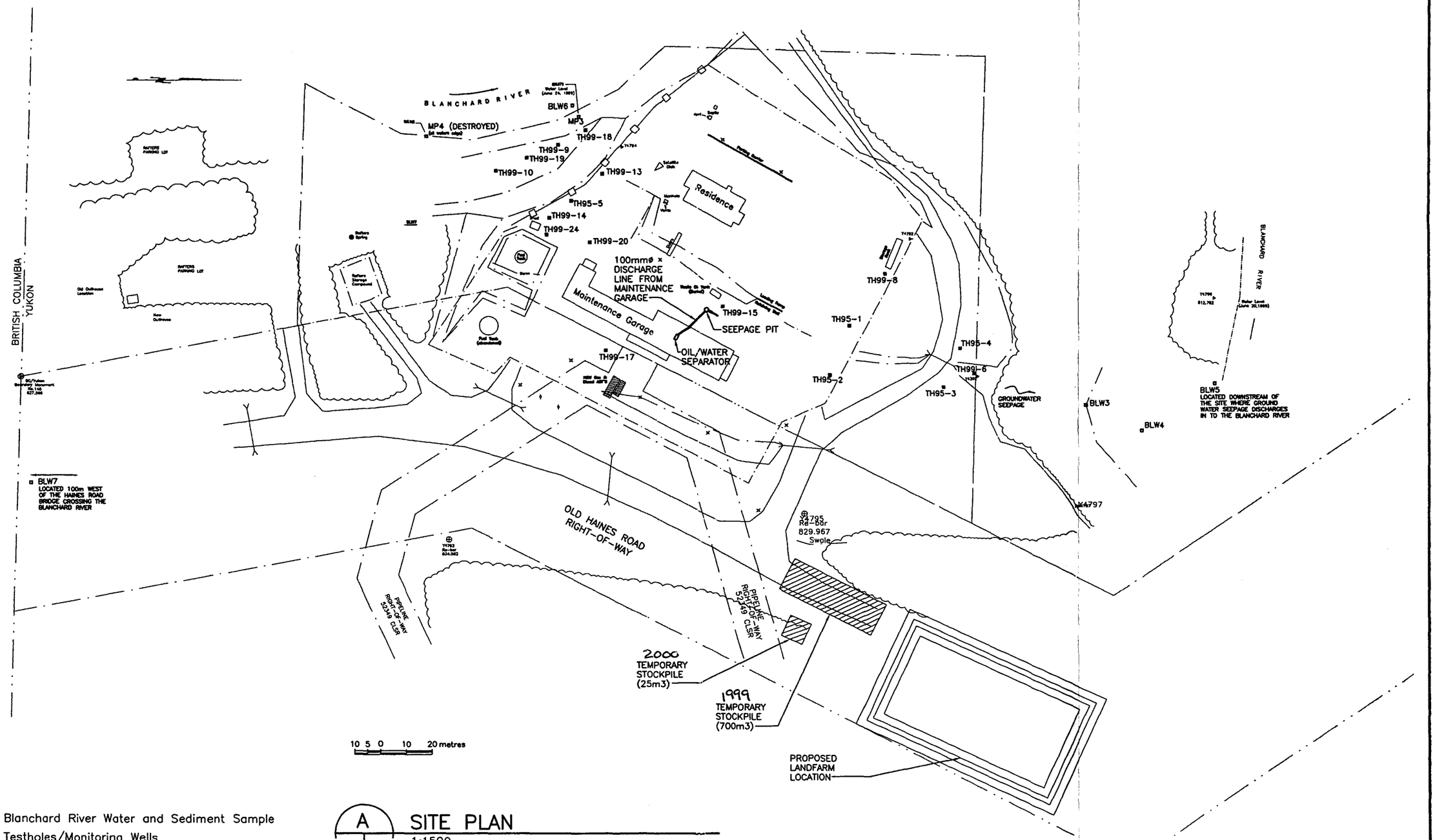


LEGEND

- BLW5 – Blanchard River Water and Sediment Sample
- – Testholes/Monitoring Wells
- MP3 – Mini Piezometer
- – Yard Light Standards
- – Flag Poles
- – Lot Boundary
- – Culvert

A SITE PLAN
1:1500

REV	DESCRIPTION	DWN	APP	DATE	ISSUED
0		ALS		00/12/01	AS CONSTRUCTED

UMA Engineering Ltd.
Engineers & Planners
1479 Buffalo Place, Winnipeg, Manitoba, Canada R3T 1L7

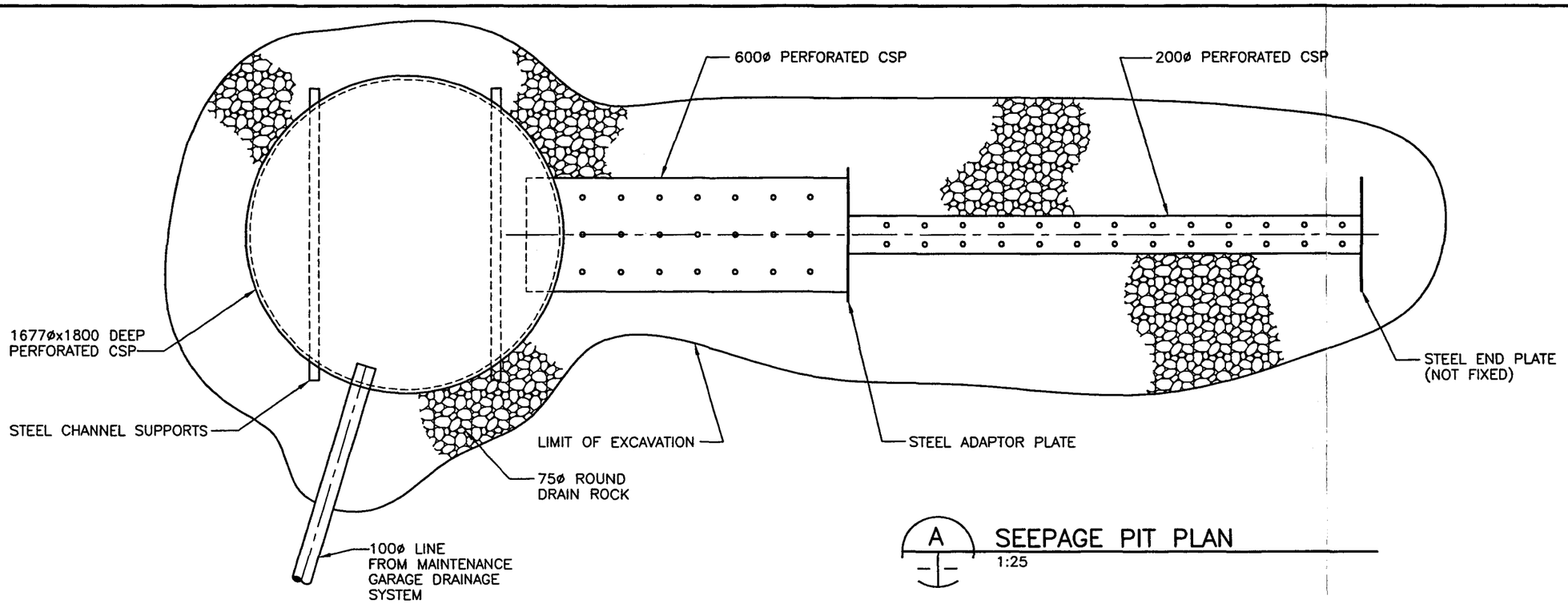
INDIAN AFFAIRS and NORTHERN DEVELOPMENT
BLANCHARD GRADER STATION

TITLE: SITE PLAN
JOB No. 4440-040-00
DATE: 00/11/30
DRAWN: ALS
DWG. No. 01
CHECKED:

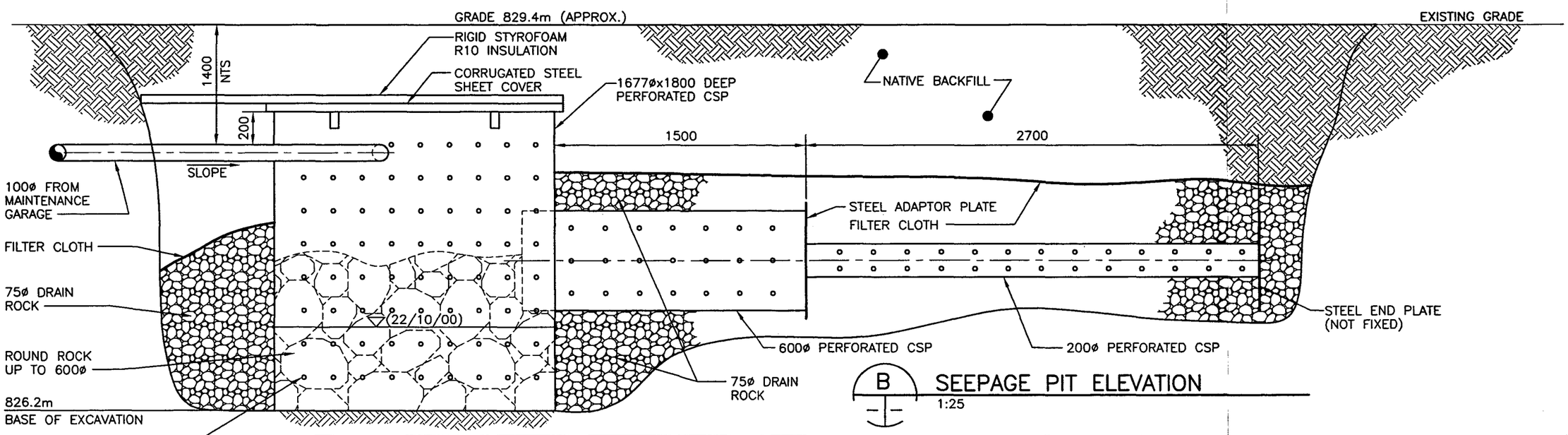
00/11/30

BlanInfilGal01dwg

B size



A SEEPAGE PIT PLAN
1:25



B SEEPAGE PIT ELEVATION
1:25

REV	DESCRIPTION	DWN	APP	DATE	ISSUED
0		ALS		00/12/01	AS CONSTRUCTED

UMA Engineering Ltd.
Engineers & Planners
1479 Buffalo Place, Winnipeg, Manitoba, Canada R3T 1L7

INDIAN AFFAIRS and NORTHERN DEVELOPMENT
BLANCHARD GRADER STATION

TITLE: SEEPAGE PIT REHABILITATION

JOB No. 4440-040-00	DATE: 00/11/30
DRAWN: ALS	DWG. No. 02
CHECKED:	

00/11/30

BlanInfilGal.02.dwg

APPENDIX A

- LIST OF EQUIPMENT AND MATERIAL ON SITE

- TEMPORARY OIL/WATER SEPARATOR INSTALLATION

BLANCHARD RIVER
GRADER STATION
SUMMARY OF MATERIALS ON SITE

The following materials related to the oil water separator system were observed on site during the week of September 21,2000:

1. Monarch Rotary Hand Pump Model 0100 (this is for transfer of the collected oil out of the separator to oil drums for disposal)
2. Two (2) Jabsco Pumps 01673-1001 (Note, these pumps were provided "bare" and did not come with the specified motors, couplings and bases)
3. Meyers Pump Control Panel CP15-03, Customer P.O 14795, TAG 1128479. This is 3 phase control panel for the pump that was not on site.
4. Meyers Pump Control Panel CP4-11 This is a single phase panel that can be used for either of the Jabsco pumps. Reference info includes: Drwg M1047-15309 and Ref Drwg CP4-11 J15309 (I think these were with the unit/packaging)
5. Six (6) Meyers Float Controls S25-10 Number 4426312
6. Highland Oil Water Separator

Shop drawings were never received when the equipment was ordered. A comparison of the equipment on site with the specified equipment indicates:

1. The motors, etc. on the Jabsco pumps. The impellers installed with the pumps are Neoprene, not the specified nitrile. Neoprene is not compatible with oil and deteriorates quite quickly. These pumps were also to be provided with 3 spare impellers as they are a normal maintenance item.
2. There should be three pump control panels. A second 120V panel is required (CP4-11).
3. One of the specified pumps is not on site. The Lineo pump is not on site.
4. Steel grates for the new pits should be obtained as soon as possible. The wooden covers in place are not suitable for long term use.

Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

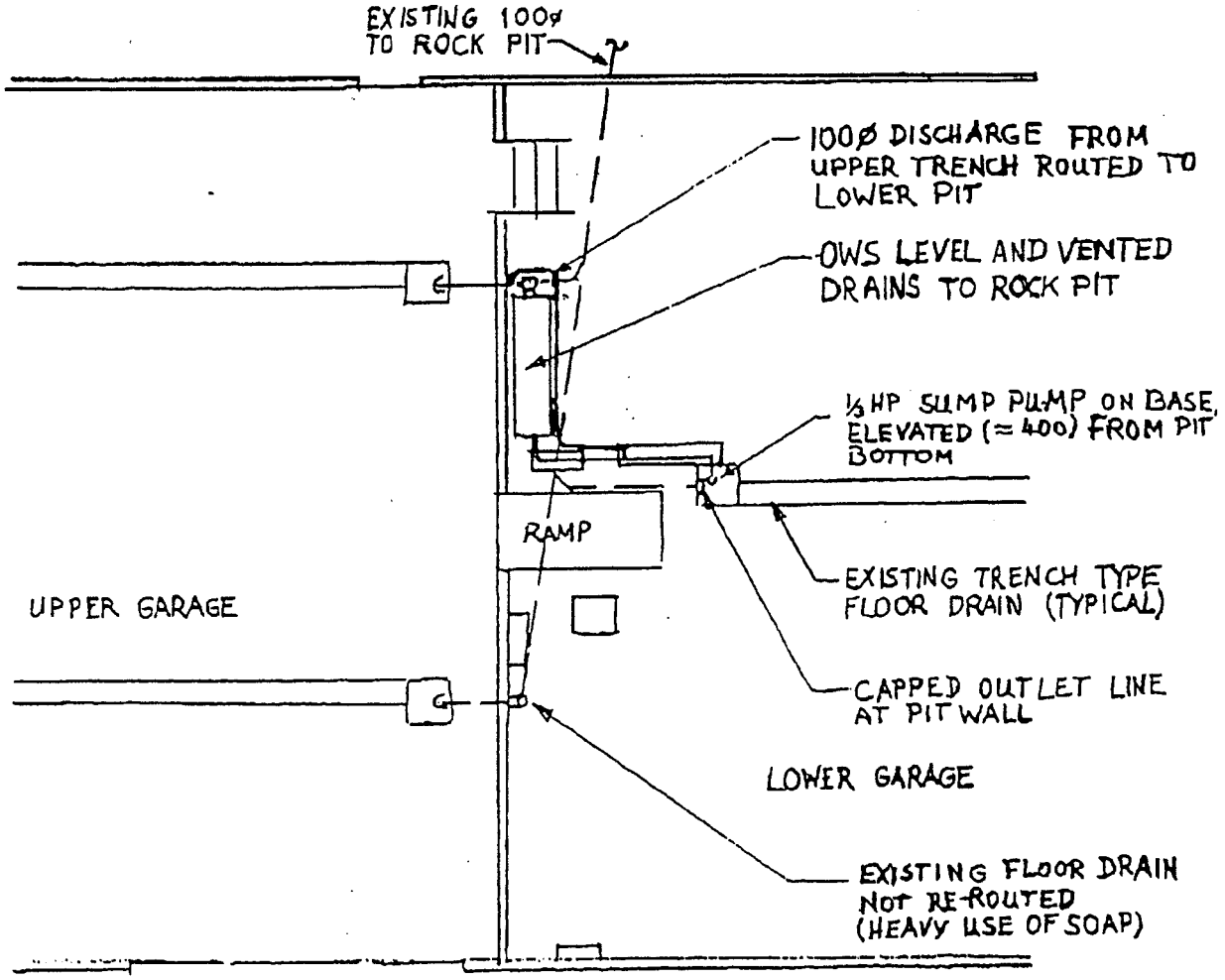
WASTE MANAGEMENT OCT. 06, 2000

Your file Votre référence

Our file Notre référence

YTG BLANCHARD RIVER

TEMPORARY OIL/WATER SEPARATOR INSTALLATION



Canada

APPENDIX B
LABORATORY CERTIFICATES

1988 Triumph Street, Vancouver, BC Canada V5L 1K5

analytical
service
laboratories
ltd.

FAX: (604) 253-6700 TEL: (604) 253-4188

xc: A Passalis
Orig - Ber File
4440-040-01

CHEMICAL ANALYSIS REPORT

Date: November 1, 2000

ASL File No. M2565

Report On: Blanchard River Water Analysis

Report To: **UMA Engineering Ltd.**
1479 Buffalo Place
Winnipeg, MB
R3T 1L7

Attention: **Mr. Andrew Passalis**

Received: September 26, 2000

ASL ANALYTICAL SERVICE LABORATORIES LTD.
per:

Miles Gropen, B.Sc. - Project Chemist
Frederick Chen, B.Sc. - Manager, Special Projects

REMARKS

File No. M2565

Detection limits were increased for some polycyclic aromatic hydrocarbons because of interferences encountered during analysis.

RESULTS OF ANALYSIS - Water[1,2,3]

File No. M2565

Sample ID	BD-1	TH99-8	TH95-1	TH95-2	TH95-5
Sample Date	00 09 24	00 09 24	00 09 24	00 09 24	00 09 24
ASL ID	*1*	*2*	*3*	*4*	*5*
Non-halogenated Volatiles					
Benzene	0.0012	<0.0005	0.0008	0.0010	<0.0005
Ethylbenzene	0.0204	<0.0005	0.0189	0.130	0.0255
Toluene	<0.0005	<0.0005	0.0005	0.0005	<0.0005
meta- & para-Xylene	0.0118	<0.0005	0.0108	0.178	0.0478
ortho-Xylene	0.0005	<0.0005	<0.0005	0.0043	0.0244
Volatile Hydrocarbons (VH6-10)	0.5	<0.1	0.5	2.0	0.9
VPH	0.5	<0.1	0.5	1.7	0.8
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.00014	<0.00005	0.00011	0.00030	<0.004
Acenaphthylene	<0.00005	<0.00005	<0.00005	<0.00005	<0.0009
Acridine	<0.00005	<0.00005	<0.00005	<0.00005	<0.002
Anthracene	<0.00005	<0.00005	<0.00005	<0.00005	<0.0006
Benz(a)anthracene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Benzo(a)pyrene	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Benzo(b)fluoranthene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Benzo(g,h,i)perylene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Benzo(k)fluoranthene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chrysene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Dibenz(a,h)anthracene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Fluoranthene	<0.00005	<0.00005	<0.00005	<0.00005	0.00012
Fluorene	0.00010	<0.00005	0.00009	0.00029	0.0050
Indeno(1,2,3-c,d)pyrene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Naphthalene	<0.002	<0.00005	<0.0008	0.0508	0.0832
Phenanthrene	<0.00005	<0.00005	<0.00005	<0.00005	0.0073
Pyrene	<0.00005	<0.00005	<0.00005	<0.00005	0.00084
Extractable Hydrocarbons					
EPH10-19	0.4	<0.3	0.4	1.4	10.7
EPH19-32	<1	<1	<1	<1	2
LEPH	0.4	<0.3	0.4	1.4	10.6
HEPH	<1	<1	<1	<1	2

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
VPH = Volatile Petroleum Hydrocarbons.
[1]Results are expressed as milligrams per litre except where noted.
[2]LEPH & HEPH = Light and Heavy Extractable Petroleum Hydrocarbons.
[3]EPH10-19 is equivalent to EHw10-19.

RESULTS OF ANALYSIS - Water[1,2,3]

File No. M2565

Sample ID	TH99-9	TH99-10	TH99-18	TH99-19	BLW-5
Sample Date	00 09 24	00 09 24	00 09 24	00 09 24	00 09 24
ASL ID	*6*	*7*	*8*	*9*	*10*
Non-halogenated Volatiles					
Benzene	<0.0005	<0.0005	<0.0005	0.0021	<0.0005
Ethylbenzene	0.0010	<0.0005	<0.0005	0.0517	<0.0005
Toluene	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
meta- & para-Xylene	0.0016	<0.0005	<0.0005	0.0427	<0.0005
ortho-Xylene	0.0029	<0.0005	<0.0005	0.0006	<0.0005
Volatile Hydrocarbons (VH6-10)	<0.1	<0.1	<0.1	0.3	<0.1
VPH	<0.1	<0.1	<0.1	0.2	<0.1
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	<0.00005	<0.00005	<0.00005	0.0015	<0.00005
Acenaphthylene	<0.00005	<0.00005	<0.00005	<0.0005	<0.00005
Acridine	<0.00005	<0.00005	<0.0001	<0.0005	<0.00005
Anthracene	<0.00005	<0.00005	<0.00005	<0.0005	<0.00005
Benz(a)anthracene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Benzo(a)pyrene	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Benzo(b)fluoranthene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Benzo(g,h,i)perylene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Benzo(k)fluoranthene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chrysene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Dibenz(a,h)anthracene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Fluoranthene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Fluorene	<0.00005	<0.00005	0.00006	0.0014	<0.00005
Indeno(1,2,3-c,d)pyrene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Naphthalene	<0.00006	<0.00005	<0.0001	0.0185	<0.00005
Phenanthrene	<0.00005	<0.00005	<0.00005	<0.0005	<0.00005
Pyrene	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Extractable Hydrocarbons					
EPH10-19	0.4	<0.3	<0.3	2.6	<0.3
EPH19-32	<1	<1	<1	<1	<1
LEPH	0.4	<0.3	<0.3	2.6	<0.3
HEPH	<1	<1	<1	<1	<1

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
VPH = Volatile Petroleum Hydrocarbons.
[1]Results are expressed as milligrams per litre except where noted.
[2]LEPH & HEPH = Light and Heavy Extractable Petroleum Hydrocarbons.
[3]EPH10-19 is equivalent to EHw10-19.

RESULTS OF ANALYSIS - Water[1,2,3]

File No. M2565

Sample ID	BLW-6	BLW-7	TH99-13	MP3	ASL Travel Blank
Sample Date	00 09 24	00 09 24	00 09 24	00 09 24	00 09 24
ASL ID	*11*	*12*	*13*	*14*	*18*
Non-halogenated Volatiles					
Benzene	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ethylbenzene	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Toluene	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
meta- & para-Xylene	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
ortho-Xylene	<0.0005	<0.0005	0.0021	<0.0005	<0.0005
Volatile Hydrocarbons (VH6-10)	<0.1	<0.1	<0.1	0.2	<0.1
VPH	<0.1	<0.1	<0.1	0.2	<0.1
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	<0.00005	<0.00005	0.00036	<0.003	-
Acenaphthylene	<0.00005	<0.00005	<0.00006	<0.001	-
Acridine	<0.00005	<0.00005	<0.00005	<0.001	-
Anthracene	<0.00005	<0.00005	<0.00005	<0.001	-
Benz(a)anthracene	<0.00005	<0.00005	<0.00005	<0.001	-
Benzo(a)pyrene	<0.00001	<0.00001	<0.00001	<0.00001	-
Benzo(b)fluoranthene	<0.00005	<0.00005	<0.00005	<0.00005	-
Benzo(g,h,i)perylene	<0.00005	<0.00005	<0.00005	<0.00005	-
Benzo(k)fluoranthene	<0.00005	<0.00005	<0.00005	<0.00005	-
Chrysene	<0.00005	<0.00005	<0.00005	<0.001	-
Dibenz(a,h)anthracene	<0.00005	<0.00005	<0.00005	<0.00005	-
Fluoranthene	<0.00005	<0.00005	<0.00005	<0.001	-
Fluorene	<0.00005	<0.00005	0.00042	<0.003	-
Indeno(1,2,3-c,d)pyrene	<0.00005	<0.00005	<0.00005	<0.00005	-
Naphthalene	<0.00005	<0.00005	<0.002	<0.004	-
Phenanthrene	<0.00005	<0.00005	0.00007	0.003	-
Pyrene	<0.00005	<0.00005	<0.00005	0.002	-
Extractable Hydrocarbons					
EPH10-19	<0.3	<0.3	0.4	39.0	-
EPH19-32	<1	<1	<1	6	-
LEPH	<0.3	<0.3	0.4	39.0	-
HEPH	<1	<1	<1	6	-

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
VPH = Volatile Petroleum Hydrocarbons.
[1]Results are expressed as milligrams per litre except where noted.
[2]LEPH & HEPH = Light and Heavy Extractable Petroleum Hydrocarbons.
[3]EPH10-19 is equivalent to EHw10-19.

RESULTS OF ANALYSIS - Sediment/Soil[1]

File No. M2565

Sample ID	BLW-5	BLW-6	BLW-7
Sample Date	00 09 24	00 09 24	00 09 24
ASL ID	*15*	*16*	*17*
Physical Tests			
Moisture %	21.9	27.6	41.8
Non-halogenated Volatiles			
Benzene	<0.04	<0.04	<0.04
Ethylbenzene	<0.05	<0.05	<0.05
Styrene	<0.05	<0.05	<0.05
Toluene	<0.05	<0.05	<0.05
meta- & para-Xylene	<0.05	<0.05	<0.05
ortho-Xylene	<0.05	<0.05	<0.05
Volatile Hydrocarbons (VH6-10)	<100	<100	<100
CWS Fraction 1-BTEX	<100	<100	<100

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
VPH = Volatile Petroleum Hydrocarbons.
[1]Results are expressed as milligrams per dry kilogram except where noted.

RESULTS OF ANALYSIS - Sediment/Soil[1]

File No. M2565

Sample ID	BLW-5	BLW-6	BLW-7
Sample Date	00 09 24	00 09 24	00 09 24
ASL ID	*15*	*16*	*17*
Extractable Hydrocarbons			
CWS Fraction 2 (C10-16)	<50	<50	<50
CWS Fraction 3 (C16-34)	<50	<50	<50
CWS Fraction 4 (C34-50)	<50	<50	<50
Extractables			
Mineral Oil & Grease	<100	<100	<100

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
VPH = Volatile Petroleum Hydrocarbons.
[1]Results are expressed as milligrams per dry kilogram except where noted.

Outlines of the methodologies utilized for the analysis of the samples submitted are as follows:

Volatile Organic Compounds and Volatile Hydrocarbons in Water

This procedure involves the purge and trap extraction of the sample prior to analysis for Volatile Hydrocarbons (VH) by capillary column gas chromatography with flame-ionization detection (GC/FID) and for specific Volatile Organic Compounds (VOC) by capillary column gas chromatography with mass spectrometric detection (GC/MS). The VH analysis is carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Volatile Hydrocarbons in Water by GC/FID" (Version 2.1, July 1999). The VOC analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 8260, published by the United States Environmental Protection Agency (EPA).

Recommended Holding Time:
Sample: 7 days Extract: NA
Reference: BCMELP
For more detail see ASL "Collection & Sampling Guide"

Volatile Petroleum Hydrocarbons (VPH) in Water

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, and Xylenes) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Water by GC/FID" (Version 2.1, July 20, 1999).

Recommended Holding Time: Not Applicable

Polycyclic Aromatic Hydrocarbons in Water

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3510, 3630 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure

involves extraction of the entire water sample with dichloromethane. The extract is then solvent exchanged to toluene prior to analysis by capillary column gas chromatography with mass spectrometric detection (GC/MS).

Recommended Holding Time:
Sample: 7 days Extract: 40 days
Reference: EPA
For more detail see ASL "Collection & Sampling Guide"

Extractable Hydrocarbons in Water

This analysis is carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Extractable Petroleum Hydrocarbons in Water by GC/FID" (Version 2.1, July 1999). The procedure involves extraction of the entire water sample with dichloromethane. The extract is then solvent exchanged to toluene and analysed by capillary column gas chromatography with flame ionization detection (GC/FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).

Recommended Holding Time:
Sample: 7 days Extract: 40 days
Reference: BCMELP
For more detail see ASL "Collection & Sampling Guide"

Light and Heavy Extractable Petroleum Hydrocarbons in Water

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated by subtracting selected Polynuclear Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Acenaphthene, Acridine, Anthracene, Fluorene, Naphthalene, and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, and Pyrene are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Water by GC/FID" (Version 2.1, July 20, 1999).

Recommended Holding Time: Not Applicable

Moisture in Sediment/Soil

This analysis is carried out gravimetrically by drying the sample at 103 C for a minimum of six hours.

Recommended Holding Time:
Sample: 14 days
Reference: Puget
For more detail see:ASL "Collection & Sampling Guide"

Volatile Organic Compounds and Volatile Hydrocarbons in Sediment/Soil

This analysis involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then analyzed for Volatile Hydrocarbons (VH) by capillary column gas chromatography with flame-ionization detection (GC/FID) and for specific Volatile Organic Compounds (VOC) by capillary column gas chromatography with mass spectrometric detection (GC/MS). The methanol extraction and VH analysis are carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1 July 1999). The VOC analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 8260, published by the United States Environmental Protection Agency (EPA).

Recommended Holding Time:
Sample: 7 days Extract: 40 days
Reference: BCMELP
For more detail see ASL "Collection & Sampling Guide"

Volatile Petroleum Hydrocarbons (VPH) in Solids

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

Recommended Holding Time: Not Applicable

Petroleum Hydrocarbons in Sediment/Soil (Canada Wide Standard)

This analysis is carried out in accordance with the CCME Reference Method for the Canada Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Revision 5.0, June 1, 2000. The various extraction fractions are analysed as follows:

CWS Fractions 1 and 1-BTEX:
This procedure involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then analysed by capillary column gas chromatography with flame-ionization detection (GC/FID), and by capillary column gas chromatography with mass spectrometric detection (GC/MS) for BTEX compounds.

CWS Fractions 2, 2-PAH, 3, 3-PAH, 4 and 4G+SG
The procedure uses an automated system at high temperature and pressure (Accelerated Solvent Extractor - ASE) or a Soxhlet system to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is concentrated and undergoes a silica-gel clean-up to remove polar material. The final extract is analysed by high temperature capillary column gas chromatography with flame ionization detection (GC/FID). Gravimetric Heavy Hydrocarbons (F4G+SG) are analysed gravimetrically.

Reported results include the following:
CWS Fraction 1 (C6-10):
sum of all petroleum hydrocarbon compounds that elute between nC6 and nC10 obtained by GC/FID analysis
CWS Fraction 1-BTEX:
CWS Fraction 1 (C6-10), minus selected BETX compounds
CWS Fraction 2 (C10-16):
sum of all petroleum hydrocarbon compounds that elute between nC10 and nC16 obtained by GC/FID analysis
CWS Fraction 2-PAH:
CWS Fraction 2 (C10-16), minus selected PAH compounds
CWS Fraction 3 (C16-34):
sum of all petroleum hydrocarbon compounds that elute between nC16 and nC34 obtained by GC/FID analysis
CWS Fraction 3-PAH:
CWS Fraction 3 (C16-34), minus selected PAH compounds
CWS Fraction 4 (C34-50):
sum of all petroleum hydrocarbon compounds that elute between nC34 and nC50 obtained by GC/FID analysis

CWS Fraction 4G+SG (GHH + SG):
GHH = Gravimetric Heavy Hydrocarbons SG = Silica Gel
Results obtained by gravimetric analysis after silica gel clean-up

Recommended Holding Time:
Sample: 14 days Extract: 7 days
Reference: CCME
For more detail see ASL "Collection & Sampling Guide"

Mineral Oil & Grease In Sediment/Soil

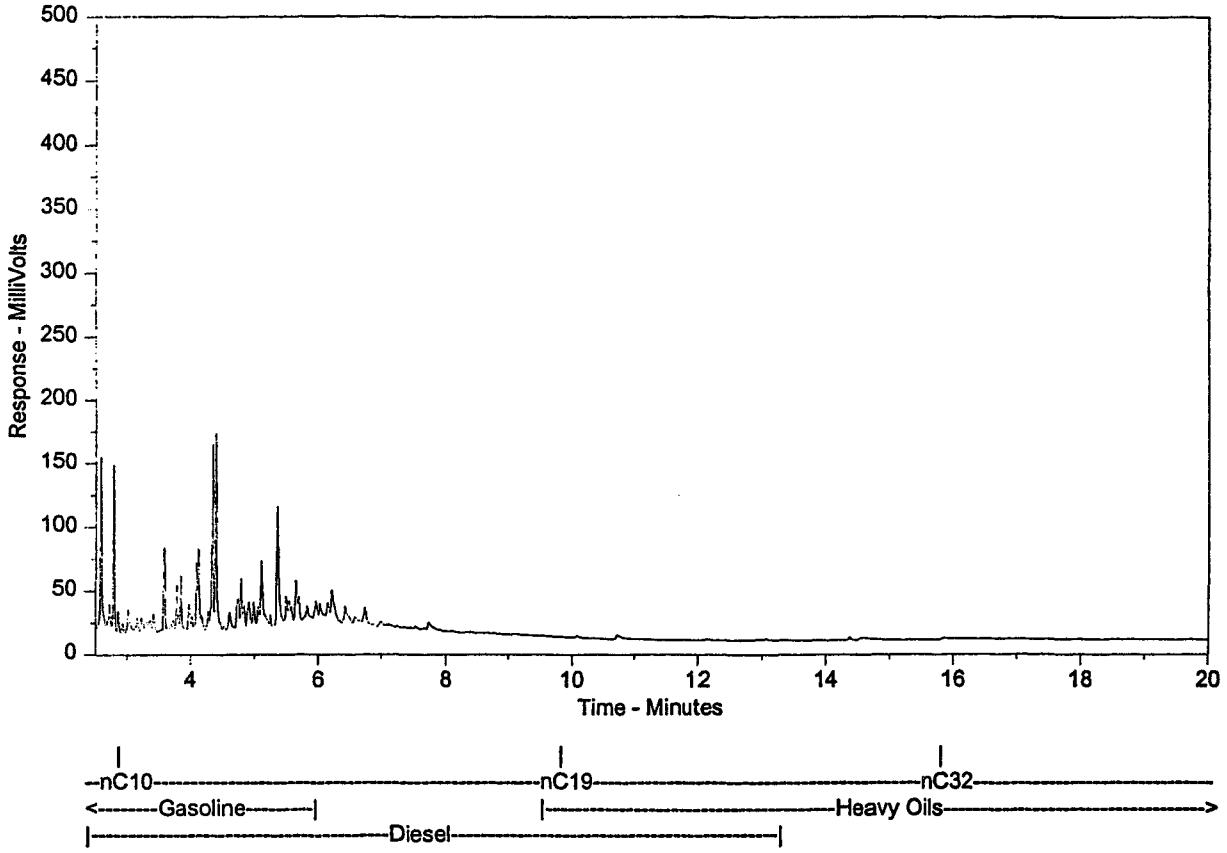
This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3500 & 9071, published by the United States Environmental Protection Agency (EPA) and "Standard Methods for the Examination of Water and Wastewater", 20th ed., Method 5520, published by the American Public Health Association. The procedure involves an extraction of a dried subsample of the sediment/soil with hexane followed by a silica gel clean-up, to remove most naturally occurring non-petrogenic organic compounds. This extract is then evaporated to dryness, and the residue weighed to determine Mineral Oil and Grease.

Recommended Holding Time:
Sample: 28 days Extract: 40 days
Reference: Puget Sound Protocols
For more detail see ASL "Collection & Sampling Guide"

End of Report

ASL Hydrocarbon Distribution Report

Client Sample ID:
ASL Sample ID: **M2565-T--1**
File Name: m:\chrom\gc12\data\gc12_12octB.0021.RAW
Run Information: Acquired on GC12, 10/13/00 3:23:23 AM



Sample Amount = 540.0 (g or mL) Dilution Factor = 1.0

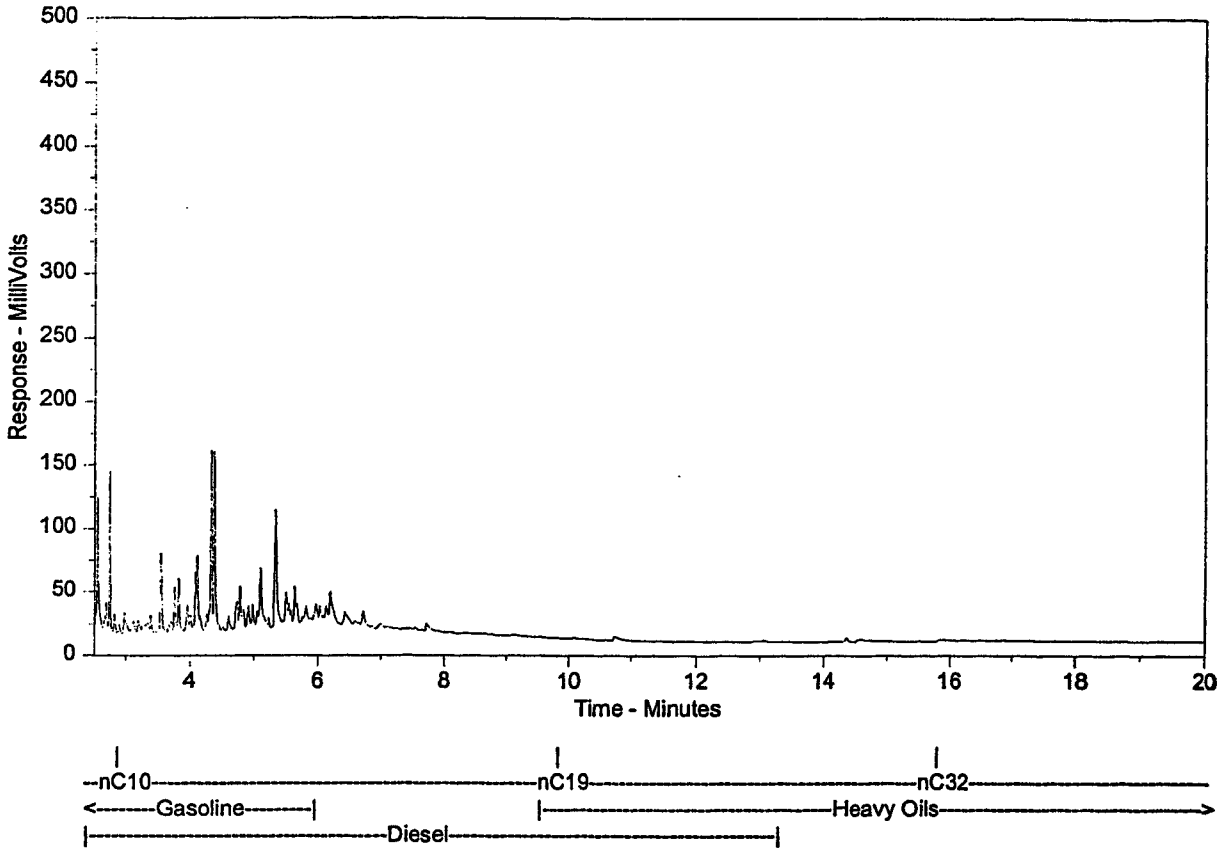
The Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and of three n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This report was produced using a temperature profile that was implemented on June 21st,1999. Under these new conditions, hydrocarbon compounds elute sooner than before, although characteristic patterns will appear similar. Please exercise caution when comparing this report to other reports produced prior to June 21st, 1999. A current library of reference products is available upon request.

ASL Hydrocarbon Distribution Report

Client Sample ID:
ASL Sample ID: **M2565-T--3**
File Name: m:\chrom\gc12\data\gc12_12octB.0022.RAW
Run Information: Acquired on GC12, 10/13/00 3:54:23 AM



Sample Amount = 540.0 (g or mL) Dilution Factor = 1.0

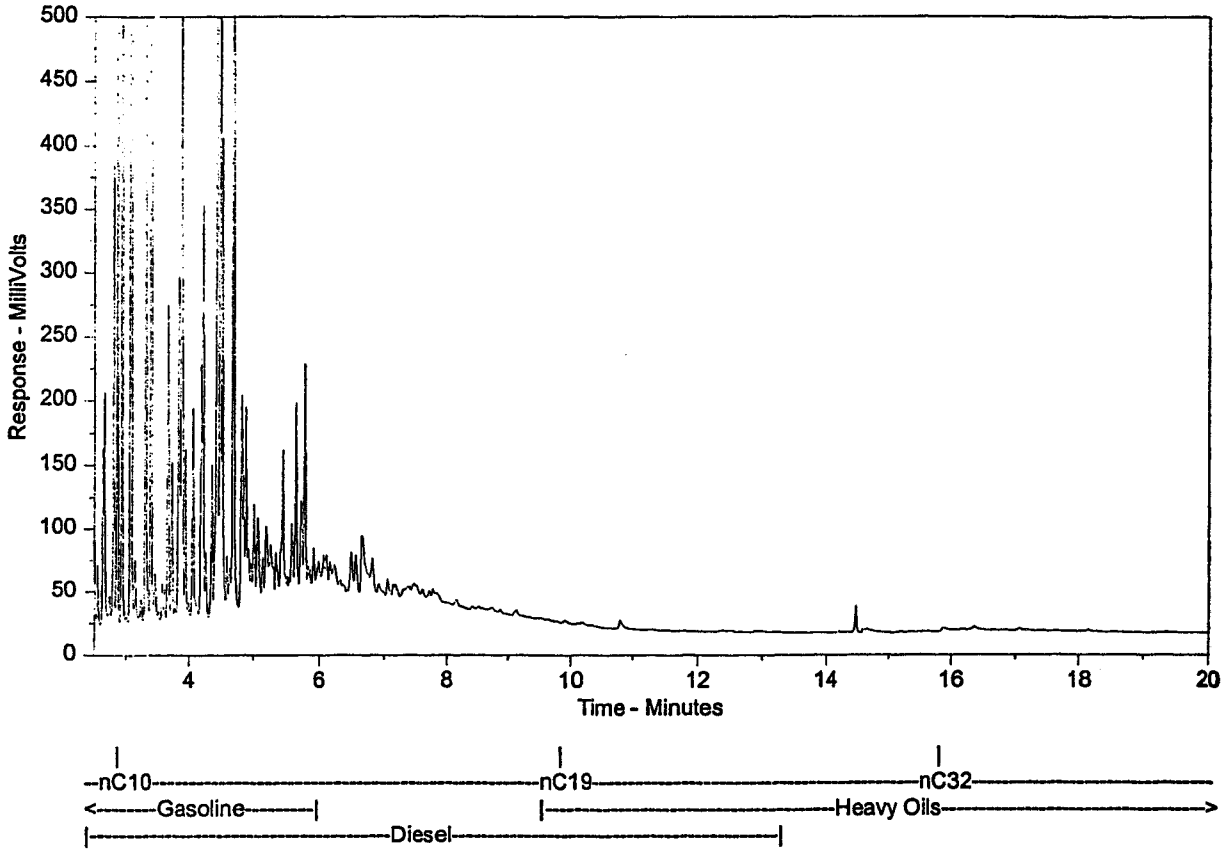
The Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and of three n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This report was produced using a temperature profile that was implemented on June 21st,1999. Under these new conditions, hydrocarbon compounds elute sooner than before, although characteristic patterns will appear similar. Please exercise caution when comparing this report to other reports produced prior to June 21st, 1999. A current library of reference products is available upon request.

ASL Hydrocarbon Distribution Report

Client Sample ID:
ASL Sample ID: **M2565-T--4**
File Name: m:\chrom\gc12\data\gc12_12octA.0023.RAW
Run Information: Acquired on GC12, 10/13/00 4:25:16 AM



Sample Amount = 540.0 (g or mL) Dilution Factor = 1.0

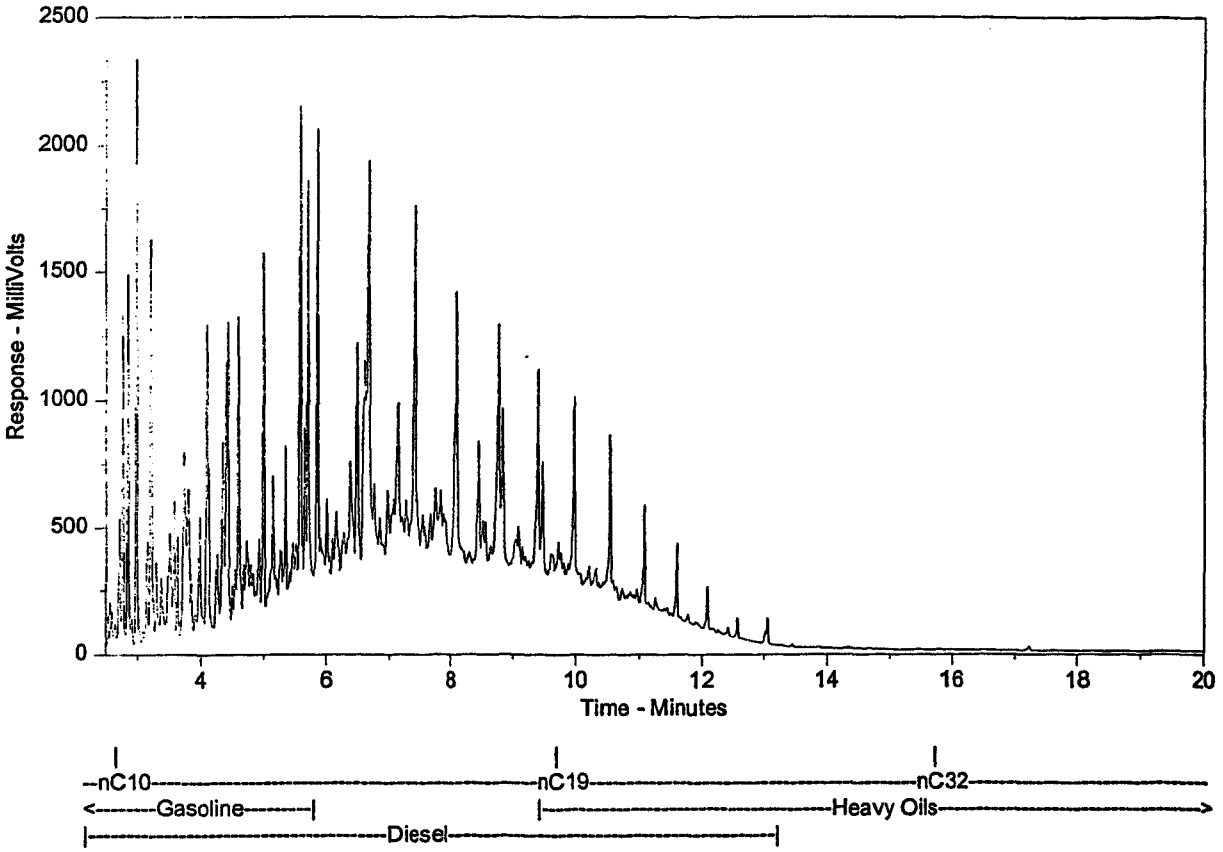
The Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and of three n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This report was produced using a temperature profile that was implemented on June 21st,1999. Under these new conditions, hydrocarbon compounds elute sooner than before, although characteristic patterns will appear similar. Please exercise caution when comparing this report to other reports produced prior to June 21st, 1999. A current library of reference products is available upon request.

ASL Hydrocarbon Distribution Report

Client Sample ID:
ASL Sample ID: **M2565-T--5**
File Name: m:\chrom\gc12\data\gc12_12octB.0023.RAW
Run Information: Acquired on GC12, 10/13/00 4:25:16 AM



Sample Amount = 540.0 (g or mL) Dilution Factor = 1.0

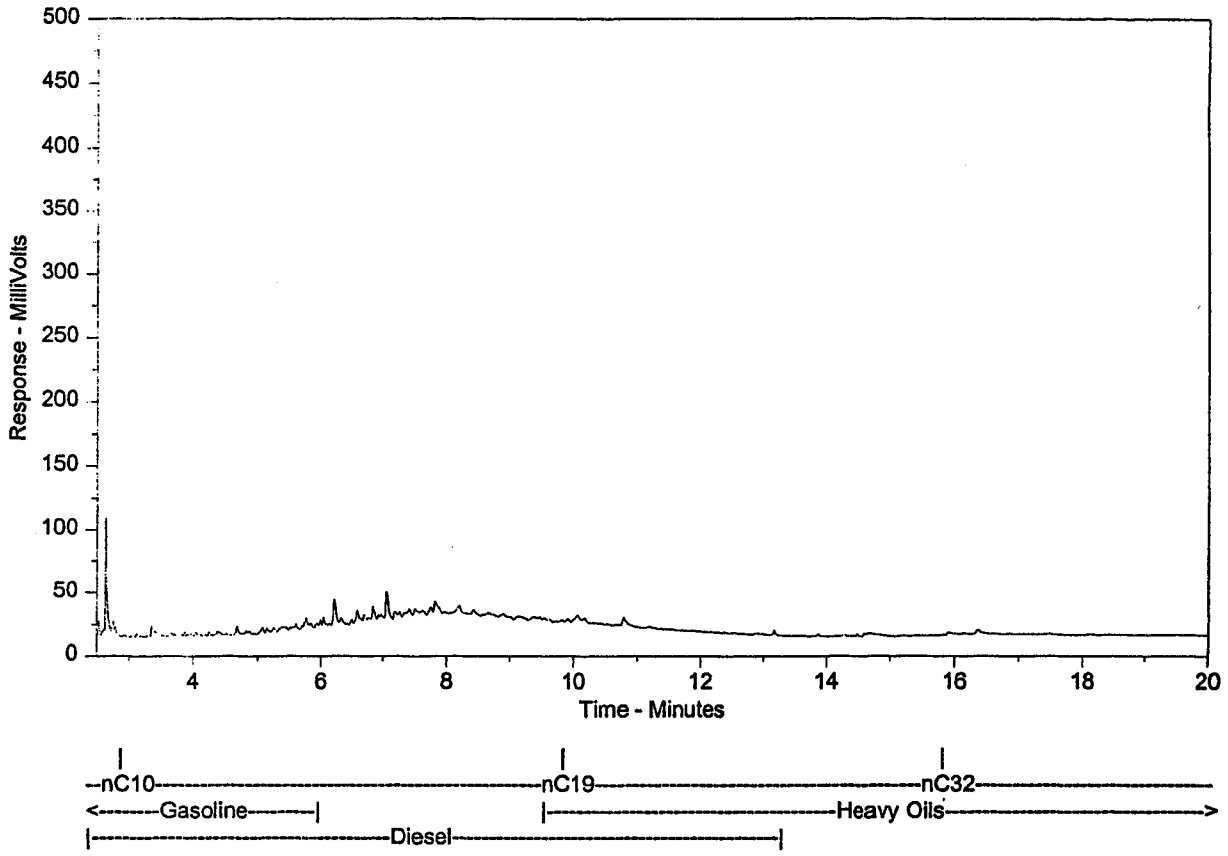
The Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and of three n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This report was produced using a temperature profile that was implemented on June 21st,1999. Under these new conditions, hydrocarbon compounds elute sooner than before, although characteristic patterns will appear similar. Please exercise caution when comparing this report to other reports produced prior to June 21st, 1999. A current library of reference products is available upon request.

ASL Hydrocarbon Distribution Report

Client Sample ID:
ASL Sample ID: **M2565-T--6**
File Name: m:\chrom\gc12\data\gc12_12octA.0024.RAW
Run Information: Acquired on GC12, 10/13/00 4:56:07 AM



Sample Amount = 540.0 (g or mL) Dilution Factor = 1.0

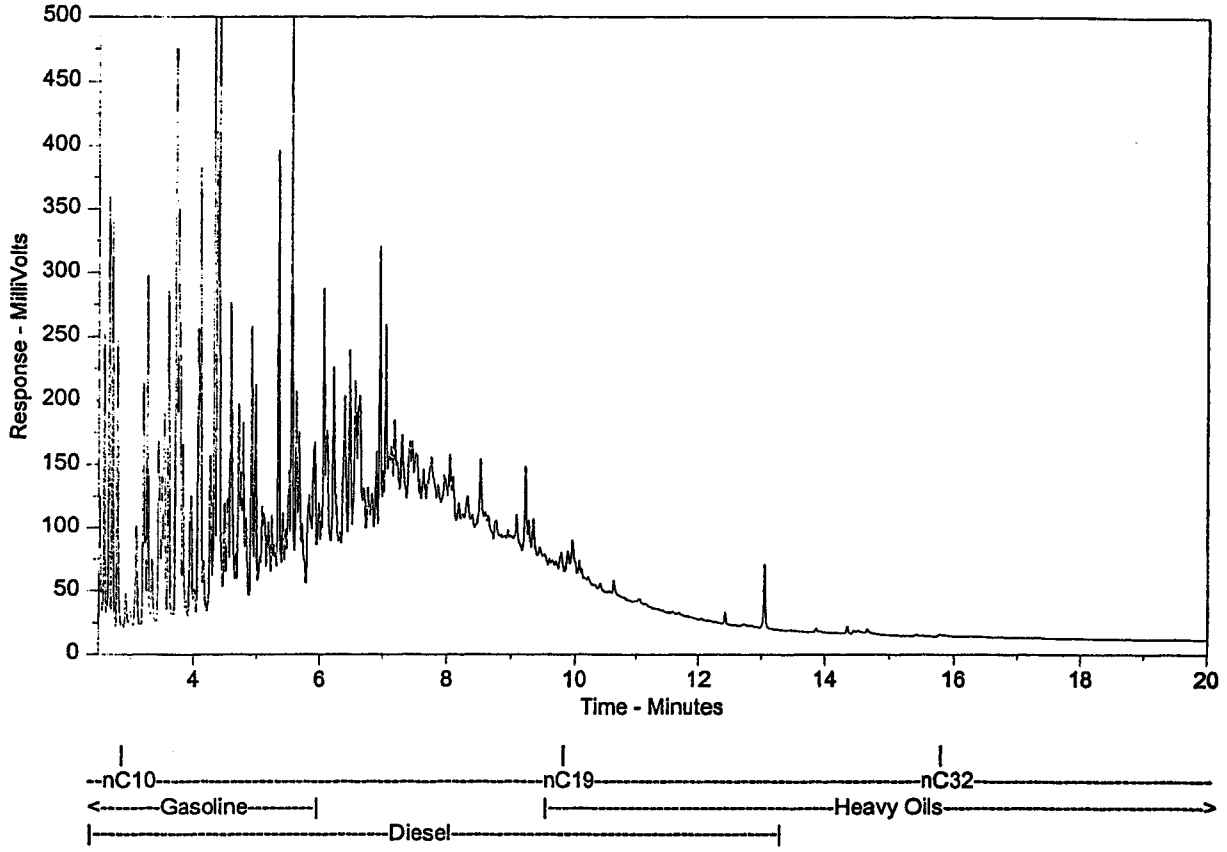
The Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and of three n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This report was produced using a temperature profile that was implemented on June 21st,1999. Under these new conditions, hydrocarbon compounds elute sooner than before, although characteristic patterns will appear similar. Please exercise caution when comparing this report to other reports produced prior to June 21st, 1999. A current library of reference products is available upon request.

ASL Hydrocarbon Distribution Report

Client Sample ID:
ASL Sample ID: **M2565-T--9**
File Name: m:\chrom\gc12\data\gc12_12octB.0025.RAW
Run Information: Acquired on GC12, 10/13/00 5:26:59 AM



Sample Amount = 540.0 (g or mL) Dilution Factor = 1.0

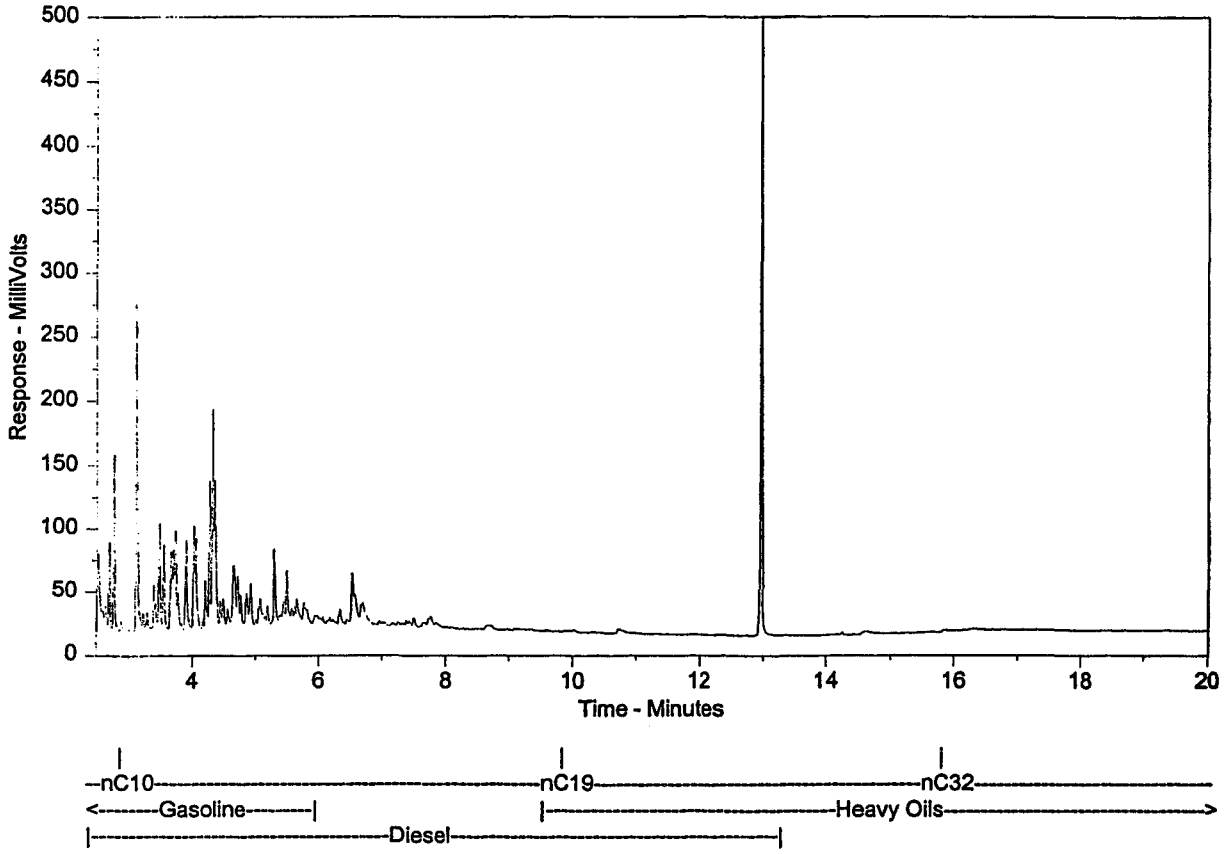
The Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and of three n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This report was produced using a temperature profile that was implemented on June 21st,1999. Under these new conditions, hydrocarbon compounds elute sooner than before, although characteristic patterns will appear similar. Please exercise caution when comparing this report to other reports produced prior to June 21st, 1999. A current library of reference products is available upon request.

ASL Hydrocarbon Distribution Report

Client Sample ID:
ASL Sample ID: **M2565-T--13**
File Name: m:\chrom\gc04\data\gc04_14octB.0016.RAW
Run Information: Acquired on GC04, 10/15/00 12:15:47 AM



Sample Amount = 535.0 (g or mL) Dilution Factor = 1.0

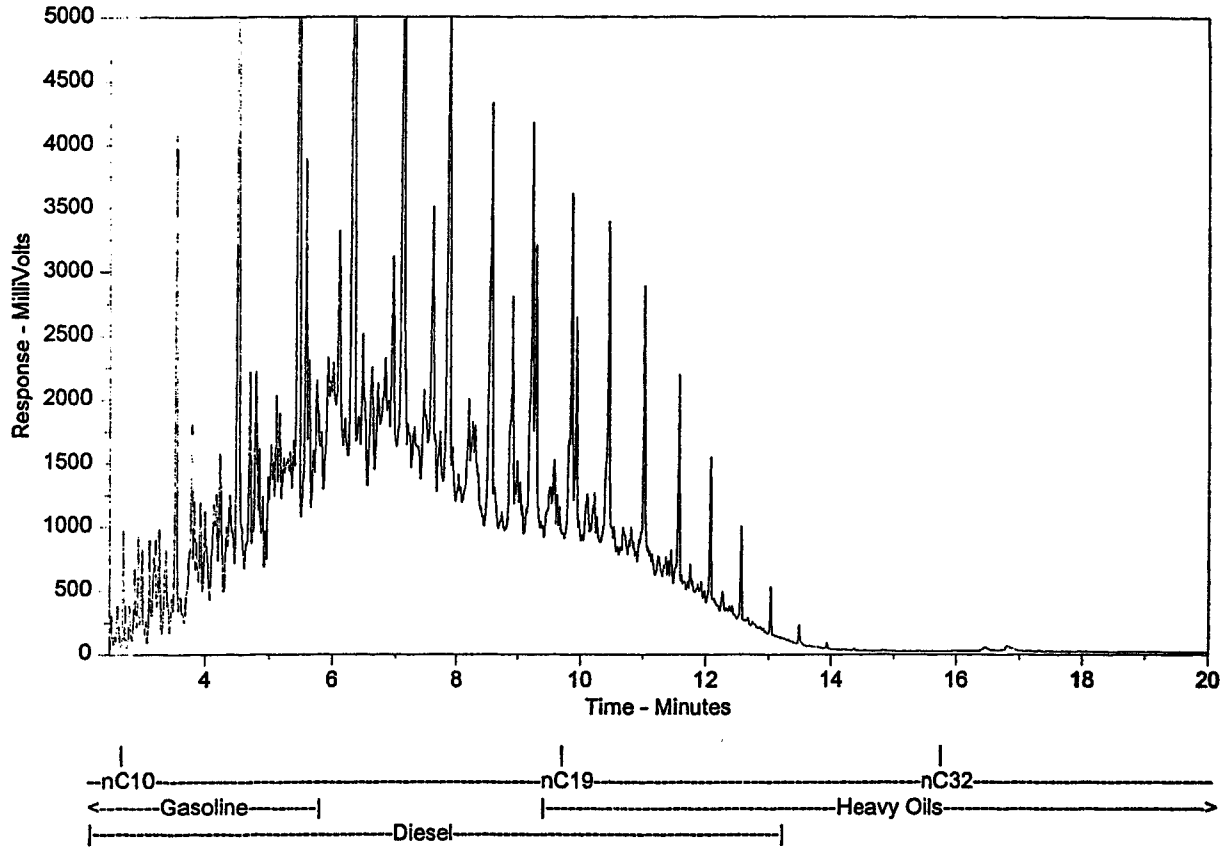
The Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and of three n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This report was produced using a temperature profile that was implemented on June 21st,1999. Under these new conditions, hydrocarbon compounds elute sooner than before, although characteristic patterns will appear similar. Please exercise caution when comparing this report to other reports produced prior to June 21st, 1999. A current library of reference products is available upon request.

ASL Hydrocarbon Distribution Report

Client Sample ID:
ASL Sample ID: **M2565-T--14**
File Name: m:\chrom\gc04\data\gc04_14octA.0017.RAW
Run Information: Acquired on GC04, 10/15/00 12:46:58 AM



Sample Amount = 535.0 (g or mL) Dilution Factor = 1.0

The Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and of three n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This report was produced using a temperature profile that was implemented on June 21st,1999. Under these new conditions, hydrocarbon compounds elute sooner than before, although characteristic patterns will appear similar. Please exercise caution when comparing this report to other reports produced prior to June 21st, 1999. A current library of reference products is available upon request.

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

1988 Triumph Street
Vancouver, BC
Canada V5L 1K5
TEL: (604) 253-4188
TOLL FREE: (800) 665-0243
FAX: (604) 253-6700
Specialists in
Environmental Chemistry

analytical service
laboratories ltd.

CLIENT: LGA ENGINEERING LTD.
ADDRESS: 1474 BUREAU PLACE
CONTACT: ANDREW PASSALIS
TELEPHONE: 604 294 0580 FAX: 7044753646
PROJECT NAME/NO.: BLANCHARD RIVER
QUOTE / P.O. NO.: C799-004-03-01
DATE SUBMITTED: 2000/10/00 ASL CONTACT: FRED CHEN

ANALYSIS REQUESTED

PAGE 1 OF 2

LAB USE ONLY	SAMPLE IDENTIFICATION	DATE / TIME COLLECTED Y	M	D		MATRIX	LEPH	HEPH	PAH	BTEX/MTBE									NOTES
	BD-1	00	09	24	AM/PM	Water	✓	✓	✓	✓									
	TH99-8				AM/PM		✓	✓	✓	✓									
	TH95-1				AM/PM		✓	✓	✓	✓									
	TH95-2				AM/PM		✓	✓	✓	✓									
	TH95-5				AM/PM		✓	✓	✓	✓									
	TH99-9				AM/PM		✓	✓	✓	✓									
	TH99-10				AM/PM		✓	✓	✓	✓									
	TH99-18				AM/PM		✓	✓	✓	✓									
	TH99-19				AM/PM		✓	✓	✓	✓									
	BLW-5				AM/PM		✓	✓											
	BLW-6				AM/PM		✓	✓	✓	✓									
	BLW-7				AM/PM		✓	✓	✓	✓									
	TH99-13				AM/PM		✓	✓	✓	✓									
	MPS				AM/PM		✓	✓	✓	✓									
					AM/PM														
					AM/PM														

FOR LAB USE ONLY

TURN AROUND REQUIRED:
- ☒ ROUTINE (7 - 10 WORKING DAYS)
- ☐ RUSH (SPECIFY DATE): _____

SPECIAL INSTRUCTIONS:

SAMPLE CONDITION UPON RECEIPT:
- ☐ FROZEN
- ☒ COLD
- ☐ AMBIENT

RELINQUISHED BY:	DATE 26/10/00	RECEIVED BY:	DATE
	TIME		TIME
RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
	TIME		TIME

REPORT COPY

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

CLIENT: [illegible] ENGINEERING

ADDRESS:

CONTACT:

TELEPHONE: 706 2840580 FAX: 204 475 3646

PROJECT NAME/NO.:

QUOTE / P.O. NO.: 1799-004-05-01

DATE SUBMITTED: [illegible] ASL CONTACT:

1988 Triumph Street
Vancouver, BC
Canada V5L 1K5
TEL: (604) 253-4188
TOLL FREE: (800) 665-0243
FAX: (604) 253-6700

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analytical service laboratories ltd.

ANALYSIS REQUESTED

LAB USE ONLY	SAMPLE IDENTIFICATION	Y	M	D	TIME	MATRIX		SPH EPH, CANADA WIDE STDS.	NOTES
	BLW-5 - Sediment	00	09	24	___ : ___ AM PM	Sediment		✓	
	BLW-6 - Sediment				___ : ___ AM PM	"		✓	
	BLW-7 - Sediment				___ : ___ AM PM	"		✓	

FOR LAB USE ONLY

TURN AROUND REQUIRED:

☑ ROUTINE (7 - 10 WORKING DAYS)

☐ RUSH (SPECIFY DATE):

SPECIAL INSTRUCTIONS:

SAMPLE CONDITION UPON RECEIPT:

☐ FROZEN

☑ COLD

☐ AMBIENT

RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	DATE / TIME
[signature]	DATE 26/09/00 TIME		DATE TIME
	DATE TIME		DATE TIME

REPORT COPY

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

CLIENT: [illegible] ENGINEERING LTD

ADDRESS: [illegible] BLEEA-U PLACE

CONTACT: [illegible] NOEN PASSALIS

TELEPHONE: [illegible] 746 6580 FAX: 10447536A6

PROJECT NAME/NO.: R. ANCHARD RIVER

QUOTE / P.O. NO.: C199-004-03-01

DATE SUBMITTED: [illegible] ASL CONTACT: FRED CHEN

1988 Triumph Street
Vancouver, BC
Canada V5L 1K5
TEL: (604) 253-4188
TOLL FREE: (800) 665-0243
FAX: (604) 253-6700
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Environmental Chemistry

analytical service laboratories ltd.

ANALYSIS REQUESTED

PAGE 1 OF 2

LAB USE ONLY	SAMPLE IDENTIFICATION	DATE / TIME COLLECTED Y	M	D	TIME	MATRIX	HARDNESS	METALS	PAH	BTEX/PHC	NOTES
	SD-1	00	09	24	AM/PM	Water	✓	✓	✓	✓	
	TH99-8				AM/PM		✓	✓	✓	✓	
	TH95-1				AM/PM		✓	✓	✓	✓	
	TH95-3				AM/PM		✓	✓	✓	✓	
	TH95-5				AM/PM		✓	✓	✓	✓	
	TH99-9				AM/PM		✓	✓	✓	✓	
	TH99-10				AM/PM		✓	✓	✓	✓	
	TH99-18				AM/PM		✓	✓	✓	✓	
	TH99-19				AM/PM		✓	✓	✓	✓	
	R.W-5				AM/PM		✓	✓			
	R.W-6				AM/PM		✓	✓	✓	✓	
	R.W-7				AM/PM		✓	✓	✓	✓	
	TH99-13				AM/PM		✓	✓	✓	✓	
	DUP 3				AM/PM		✓	✓	✓	✓	
					AM/PM						
					AM/PM						

FOR LAB USE ONLY

TURN AROUND REQUIRED:

☑ ROUTINE (7 - 10 WORKING DAYS)

☐ RUSH (SPECIFY DATE): _____

SPECIAL INSTRUCTIONS:

SAMPLE CONDITION UPON RECEIPT:

☐ FROZEN

☑ COLD

☐ AMBIENT

RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	DATE / TIME
[illegible]	DATE 26/09/00 TIME		DATE TIME
RELINQUISHED BY:	DATE TIME	RECEIVED BY:	DATE TIME

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

1988 Triumph Street
Vancouver, BC
Canada V5L 1K5
TEL: (604) 253-4188
TOLL FREE: (800) 665-0243
FAX: (604) 253-6700
Specialists in
Environmental Chemistry

analytical service
laboratories ltd.

CLIENT: [illegible] ENGINEERING

ADDRESS:

CONTACT:

TELEPHONE: [illegible] 2840586 FAX: 2044753146

PROJECT NAME/NO.:

QUOTE / P.O. NO.: 1704-004-05-01

DATE SUBMITTED: [illegible] ASL CONTACT:

PAGE ___ OF ___

ANALYSIS REQUESTED

EPH, CANADA WIDE STDS

FOR LAB USE ONLY

LAB USE ONLY	SAMPLE IDENTIFICATION	DATE / TIME COLLECTED (Y M D)	MATRIX		NOTES
1	B(W)-5 -Sediment	00 05 22 ___:___ AM PM	Sediment	✓	
2	B(W)-6 -Sediment	___:___ AM PM	"	✓	
3	B(W)-7 -Sediment	___:___ AM PM	"	✓	
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			
		___:___ AM PM			

TURN AROUND REQUIRED:

☑ ROUTINE (7 - 10 WORKING DAYS)

☐ RUSH (SPECIFY DATE):

SPECIAL INSTRUCTIONS:

SAMPLE CONDITION UPON RECEIPT:

☐ FROZEN

☒ COLD

☐ AMBIENT

RELINQUISHED BY:	DATE 26/MAY/00	RECEIVED BY:	DATE
	TIME		TIME
RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
	TIME		TIME

REPORT COPY