

2. High Positive Pressure - If the system pressure becomes positive due to a huge increase in the Btu value of the contaminate, blow-off covers in the Multi-tube dust collector, and the heat exchanger will activate to release the pressure and ensure the safety of the people working in the area of the plant.

Small positive pressure occurrences in the PTU, are contained by the PTU seals, unique to SPI plants, until the plant automated controls, or the operator, has adjusted ID fan to bring the plant back into a negative pressure operation.

3. Emergency Shutdown - The plant has an emergency shutdown button in clear view of the operator that, when activated, shuts down all components of the LTTD plant including the electrical power feed to each component.
4. Feed System Bypass Chute: The feed system conveyor that carries feed soil to the Primary Treatment Unit, has a bypass chute that is hydraulically controlled from the Control House. The diversion chute is used in situations where the feed material should be stopped immediately. Such an example would be a loss in burner control in the PTU.
5. PTU Tee Flights: The PTU drum uses flighting or lifters to veil the soil as it moves through the drum. The flights near the burner end of the drum are designed to separate the flame from the soils. This avoids creating additional contaminants that would be produced if cold material were allowed to contact the flame and cause partial quenching
6. Alarm Lights - The Envirosoil Limited LTTD system is equipped with an Alarm Lights section located on the Plant Motor Control console. This section is dedicated to identifying a component failure that interferes with the continued operations of the plant. These enunciators will light and blink to identify when a problem exists with a plant component. An audible alarm will also sound.

4.4.4 Environmental Safeguards

Environmental safeguards for Low Temperature Thermal Desorption will fall into 1 of 3 general categories: soil analysis, stack monitoring, and site monitoring.

Soil Analysis

The soil is tested for its contaminant constituents before and after treatment. The soil is pre-screened to determine the contaminants associated with the soil. The pre-screening is most often done by consultants, and is done on-site for the owner or at Envirosoil. Soil entering Envirosoil's facility with no advance chemical analyses, does so under an emergency agreement that gives Envirosoil the right to test the soil and reject it if it does not meet the entrance requirements. All soils entering the facility are individually identified and reported to the Nova Scotia Department of the Environment through submission of quarterly monitoring reports.



The soil is tested after treatment to confirm the success of the LTTD treatment. No soils are removed from the contaminated soil holding areas until this confirmation is received.

Stack Monitoring

Envirosoil's LTTD plant includes continuous stack monitoring as standard equipment. A digital readout is located in the operator's control house and provides a continuous readout of oxygen and combustible levels of the stack gases. The oxygen and combustible content of the stack gases is a direct indication of the LTTD plant's performance.

Site Monitoring

Additional environmental safeguards can be designed into the facility and these will be different at each site that the LTTD plant operates. Envirosoil's Rocky Lake facility is located within the boundaries of a 2500 acre quarry site. The soil treatment and storage area is isolated from the remaining quarry site by a clay liner that completely encompasses the site. A collection pond, with a 100 year storm design volume collects all surface runoff. A water treatment facility located on the clay lined site pumps and treats all pond water, before it is discharged off-site.

There are monitoring wells located around the perimeter of the Envirosoil site. The groundwater is sampled and tested by an independent professional consultant on a monthly basis. Water discharged from the site in surface ditches, as well as the down gradient ponds located outside the quarry, are also routinely tested. The data and results of the monitoring program are reported to the Nova Scotia Department of the Environment, by an independent professional consulting firm, on a quarterly basis.



5. LTTD PLANT DEMONSTRATION TEST OPERATING CONDITIONS

Prior to the start of each test, the operating temperatures of the LTTD Plant were increased to the intended test temperatures, while the unit was processing existing "non-spiked" hydrocarbon impacted soil. Once the operating conditions had stabilized, the feed soil was changed from the "non-spiked" soil to the test soil. Stack emission testing began approximately one half hour after introduction of the feed soil, allowing the LTTD unit to reach steady state. Additional soil was treated prior to the start of Test #1, due to increased time required for stack testing equipment set up.

5.1 Material Feed

The soil feed rate was held relatively constant at 25 tonnes per hour for Tests #1 and Test #2, and reduced to approximately 22.5 tonnes per hour for Test #3 due to limited feedstock material. Lime was mixed with the gas stream through an injection hopper installed precedent to the baghouse. Lime was added at the rate of approximately 280 lbs/hr. (130 kg/hr). The lime feed began before the soil feed was switched to the spiked test soil, and continued through the entire LTTD test period.

5.2 Operating Conditions

A summary of the operating temperatures for the LTTD plant during the demonstration tests are shown in Table 4 below:

Table 4 Summary of LTTD Plant Operating Parameters

	Run #1	Run #2	Run #3
Soil Feed Rate (tonnes/hr.)	25	25	22.5
Average Soil Moisture (%)	9.27	9.88	9.27
PTU Temp. (°C)	510	482	455
STU Temp. (°C)	955	955	955
Baghouse Inlet Temp (°C)	215	215	215
Baghouse Δ P (cm H ₂ O)	10-16	10-15	20
Lime Feed Rate (kg/hr)	130	130	130

Stack gas temperature, velocities and flow rates are presented in Table 2 and Table 3 of the CanadEER Report (attached).

The chart records for the PTU and STU operating temperatures are provided in Appendix 2. The absolute temperature variance exceeded the intended 14°C (25°F) tolerance on several occasions, however the temperature fluctuated within the tolerance for the majority of each test.

The rotational speed of the PTU drum ranged between 13 to 14 rpm. This provided a soil residence time of approximately 8 minutes.



Following Test #1 and #2, approximately 12 bags from the baghouse (a small percentage of the overall 1285 bags) were replaced. This was done based on a manual black lighting inspection procedure; the bags showed obvious defects or signs of wear. It should also be noted that the remaining bags are likely to be at 75 to 80% of their expected life, considering the volume of soil treated to date by the LTTD unit. Scheduling for bag replacement will vary due to the variable nature of the feed material.

5.3 Heat and Material Balance

Table 5 summarizes the key parameters involved in the heat and material balance for the LTTD system. The table identifies points within the LTTD process which are shown on the Flow Diagram to identify the specific item. The flow diagram is provided in Appendix 4. The column referenced as "Mass Balance Theoretical" identifies the flow of input and output for solids and gases from each of the components. The structure of the mass balance utilized the same basis as the original plant design, but adapted to the conditions that were expected during the test demonstration. The column identified as "Actual Data from Field Test" shows the measured parameters from test runs which were conducted to simulate the demonstration test conditions. This set of data includes some items only for the purpose of identifying capacity of a particular component such as capacity of a burner or electrical drive unit. The column referenced as "Data from Stack Test" shows the stack test parameters measured during the test demonstration. In most cases, the data in the table is given in both English and metric units, for comparison purposes. Since there were some variation in the input parameters used in the mass balance versus the actual test conditions, the resulting data varies slightly. Overall, there is good correlation between the projected and actual conditions as well as the process performance.

Table 5 Envirosoil PCP/PAH Test Burn Mass Balance

Flow Chart Point	Parameter	Mass Balance Theoretical	Actual Data From Field Test	Average Data From Stack Test
1	Soil moisture content (%)	17	18	9.5
1	Soil contamination level (ppm)	12,500	20,000	
2	Soil discharge temperature °C (°F)	468 (876)	491-512 (915-954)	482 (900)
1	Feed rate (tonnes/hr)	25	21 - 28	24.2
3	PTU gas exit temperature °C (°F)	926	1038-1138	
3	PTU gas exit oxygen (%)	6.1	4.1 - 8.1	
3	NO _x Content (PPM)		100 - T23	
3	PTU exit volume (ACFM)	34,347		
4	PTU Burner Stable pressure (in.w.c.)		.08 - .38	
5	PTU Firing Rate (%)	79	12 - 36	
5	PTU Fuel flow (GPM)	4.7	3.5	
6	Fuel Pressure (psi)		6.5	
6	PTU amperage draw (%)		60	
7	Pugmill cooling water flow rate (GPM)	21.0		
8	Pugmill amperage draw (%)		35 - 40	
9	Pugmill scavenge pressure (in w.c.)		.50	
10	Pugmill discharge temperature °C (°F)	85 (185)	61-62 (142-144)	
11	STU inlet temperature °C (°F)	440 (825)		
11	Oxygen content (%)	6.1		
12	STU Firing Rate (%)	42	0 - 24.4	
12	STU Fuel Flow (GPM)	2.5	1 - 2.3	
12	Fuel Pressure (psi)		65	



Flow Chart Point	Parameter	Mass Balance Theoretical	Actual Data From Field Test	Average Data From Stack Test
		927 (1700)	945-964 (1733-1767)	955 (1750)
13	STU Exit Temperature °C (°F)	83,810		
13	STU exit volume (ACFM)	4608		
14	Pre-cooler air (ACFM)	16 (80)	18 (80)	
14	Pre-cooler air temp °C (°F)	788 1450	753-786 (1388-1447)	
15	Heat exchange inlet temperature °C (°F)	260 (600)	178 (349)	
16	Combustion air temp °C (°F) - PTU	260 (500)	281 (637)	
16	Combustion air temp °C (°F) - STU		80/86	
17	Heat exchanger fan amperage	204 (400)	213-219 (415-427)	
18	Heat exchanger exit temperature °C (°F)		12.4 - 15.4	
18	Oxygen Content (%)		6-10	
18	CO Content (PPM)		96-138	
18	Nox Content (PPM)			130 (287)
19	Dry additive feed rate kg/hr (lb/hr)	(188 - 352)		
20	Pugmill scavenge temperature °C (°F)	116 (240)	188-187 (371-368)	
21	Baghouse Inlet temperature °C (°F)	202 (395)	191-202 (376-396)	
21	Baghouse inlet volume (ACFM)	17,938		
21	Baghouse air-to-cloth ratio	4.07:1		4.42:1
22	Baghouse exit temperature °C (°F)	174 (345)	166-167 (331-332)	
22	Exhaust fan damper (%)		34-39	
22	Exhaust fan amperage draw (old motor/new)		60/70	
23	Stack temperature °C (°F)	202 (395)	188-167 (331-332)	162 (324)
23	Stack flow rate (ACFM)	47,938		52,038
23	Stack oxygen content (volume, % dry)	11.2	13.0 - 14.2	13.9
23	Stack CO content (PPM)	55	13 - 70	
23	Stack PAH content lb/hr (ug/m ³)	0.07		.001 (9.0)
23	Stack pentachlorophenol content lb/HR (ng/DSCM)			3.38 x 10 (*42.1)
23	Stack HCl ng/s (mg/DSCM)	4.74		2.76 (*34.1)
23	Stack Nox content (PPM)	173.3	72 - 123	
23	Stack velocity (ft/sec)	64.9		70.5
23	Stack particulate lb/HR (mg/DSCM)	3.9		4.1 (*52.5)
23	Stack dioxin content 2,3,7,8,T4CDD TEF lb/HR (pg/DSCM)			4.7 x 10 (59.7) x/10 - 91



6. TESTING RESULTS

6.1 Soils Testing

Soil samples were collected from the feed soil and the treated soil discharge during each of the demonstration test runs. Samples were collected every 15 minutes for the first hour and then every 30 minutes for the remaining 3 hours of in stack testing. A composite of the feed soil and a composite of the treated soil, for each test run, was submitted to MDS Laboratories for analysis of TPH/BTEX, PAH, PCP and METALS. A summary of the results are shown in Tables 6, 7 and 8.

As shown in the Tables, the soil discharge consistently met the CCME Residential/Parkland Criteria for PAHs and Pentachlorophenol. The NSDOE Level I criteria for BTEX/TPH guidelines were also met for all soils treated.



Table 6 Soil Petroleum Hydrocarbon Chemistry
 Envirosoil Demonstration Test, October 16-18, 1996

Sample ID	BTEX Parameters						Total Petroleum Hydrocarbons				Resemblance
	Concentration in mg/kg (Dry Weight Basis)						Concentration in mg/kg (Dry Weight Basis)				
	Benzene	Toluene	Ethyl-Benzene	Xylenes	Total BTEX	C6-C10	C11-C20	C21-C32	TPH		
Test #1 Feed	nd	nd	2.63	10.2	12.83	258	13100	4390	17748	Weathered fuel oil fraction.	
Test #1 Discharge	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	
Test #2 Feed	nd	nd	2.47	9.39	11.86	256	13100	4530	17886	Weathered fuel oil fraction.	
Test #2 Discharge	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	
Test #3 Feed	nd	nd	3.1	11.6	14.7	309	15800	5300	21409	Weathered fuel oil fraction.	
Test #3 Discharge	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	

LOQ	0.4	0.4	0.4	0.8		4	15	15		-
NSDOE Guidelines	0.5	-	-	-	1.0	-	-	-	100	-

Notes

nd = not detected, na = not applicable
 LOQ = Analytical "limit of quantification"
 Samples analyzed by MDS Environmental Services, Halifax, N.S.
 NSDOE Guidelines = NSDOE Level I Criteria



Table 7 Soil PAH and Pentachlorophenol Chemistry
 Envirosoil Demonstration Test, October 16 - 18, 1996

PARAMETER	UNIT	CCME CRITERIA Res/Park	Sample Identification					
			Test # 1 Feed	Test # 1 Discharge	Test # 2 Feed	Test # 2 Discharge	Test # 3 Feed	Test # 3 Discharge
Naphthalene	mg/kg	5.0	127	0.02	112	0.03	138	< 0.01
Perylene	mg/kg	-	3.75	< 0.01	3.99	< 0.01	5.07	< 0.01
1-Methylnaphthalene	mg/kg	-	206	< 0.01	189	< 0.01	239	< 0.01
2-Methylnaphthalene	mg/kg	-	482	< 0.01	435	0.01	542	< 0.01
Acenaphthylene	mg/kg	-	< 1	< 0.01	< 1	< 0.01	< 1	< 0.01
Acenaphthene	mg/kg	-	311	< 0.01	277	< 0.01	337	< 0.01
Fluorene	mg/kg	-	235	< 0.01	208	< 0.01	255	< 0.01
Phenanthrene	mg/kg	5.0	592	0.02	522	0.04	637	< 0.01
Anthracene	mg/kg	-	84.9	< 0.01	76.6	< 0.01	90.7	< 0.01
Fluoranthene	mg/kg	-	223	< 0.01	193	0.01	237	< 0.01
Pyrene	mg/kg	10.0	154	< 0.01	131	< 0.01	165	< 0.01
Benz (a) anthracene	mg/kg	1.0	33.7	< 0.01	28.9	< 0.01	35.3	< 0.01
Chrysene	mg/kg	-	39.2	< 0.01	33.7	< 0.01	43.0	< 0.01
Benzo (b) Fluoranthene	mg/kg	1.0	18.0	< 0.01	14.1	< 0.01	20.1	< 0.01
Benzo (k) Fluoranthene	mg/kg	1.0	18.0	< 0.01	14.1	< 0.01	20.1	< 0.01
Benzo (a) Pyrene	mg/kg	1.0	14.7	< 0.01	14.0	< 0.01	17.1	< 0.01
Indeno (1,2,3 - cd) Pyrene	mg/kg	1.0	3.86	< 0.01	1.66	< 0.01	3.64	< 0.01
Dibenzo (a,h) Anthracene	mg/kg	1.0	< 1	< 0.01	< 1	< 0.01	< 1	< 0.01
Benzo (g,h,i) Perylene	mg/kg	-	3.97	< 0.01	2.66	< 0.01	3.86	< 0.01
1-Chloronaphthalene	mg/kg	-	< 1	< 0.01	< 1	< 0.01	< 1	< 0.01
2-Chloronaphthalene	mg/kg	-	< 1	< 0.01	< 1	< 0.01	< 1	< 0.01
Pentachlorophenol	mg/kg	0.5	780	< 0.5	720	< 0.5	870	< 0.5

Notes:

1. CCME = Canadian Council of Ministers of the Environment Remediation Criteria for Soils.
2. - = no guideline value established
3. Samples analyzed by MDS Environmental Services Ltd., Halifax, N.S.
4. Laboratory Detection Limit of 0.5 mg/kg for Feed, and 0.05 mg/kg for discharge soil
5. Laboratory Detection Limit of 0.5 mg/kg for Pentachlorophenol
6. Samples collected October 16 - 18, 1996



Table 8 Soil Metals Chemistry
 Envirosoil Demonstration Test, October 16 - 18, 1996

PARAMETER	UNIT	MDL mg/kg	CCME Res / Park mg/kg	Soil Sample Identification					
				Test #1 Feed	Test #1 Discharge	Test #2 Feed	Test #2 Discharge	Test #3 Feed	Test #3 Discharge
Aluminum	mg/kg	10	-	12000	17000	12000	13000	11000	13000
Antimony	mg/kg	2	20	<2	<2	<2	<2	<2	<2
Arsenic	mg/kg	2	30	30	33	31	29	37	31
Barium	mg/kg	5	500	120	120	140	120	120	120
Beryllium	mg/kg	5	4	<5	<5	<5	<5	<5	<5
Boron	mg/kg	5	-	<5	15	<5	8	<5	7
Cadmium	mg/kg	0.3	.5	0.3	0.3	0.4	0.3	0.4	0.7
Chromium	mg/kg	2	250	18	23	22	19	18	17
Cobalt	mg/kg	1	50	9	9.3	9.1	8.4	9.3	8
Copper	mg/kg	2	100	58	62	59	48	62	50
Iron	mg/kg	20	-	30000	32000	33000	26000	30000	25000
Lead	mg/kg	0.1	500	330	370	380	300	300	330
Manganese	mg/kg	2	-	440	590	410	450	410	400
Molybdenum	mg/kg	2	10	2	2	2	2	2	2
Nickel	mg/kg	2	100	17	19	17	16	18	15
Selenium	mg/kg	2	3	<2	<2	<2	<2	<2	<2
Silver	mg/kg	0.5	20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Strontium	mg/kg	5	-	18	26	18	24	18	29
Thallium	mg/kg	0.1	-	0.2	0.2	0.2	0.2	0.2	0.2
Uranium	mg/kg	0.1	-	0.9	1	1	1	1	1
Vanadium	mg/kg	2	200	22	30	21	25	22	25
Zinc	mg/kg	2	500	160	160	180	130	180	140

- Notes:
1. CCME = Canadian Council of Ministers of the Environment Remediation Criteria for Soils. (Residential / Parkland Guidelines)
 2. Guideline not Established
 3. Samples analyzed by MDS Environmental Services Ltd., Halifax, N.S. by ICP-MS.
 4. Samples collected October 16-18, 1996 by JWEL.



DRE (%) Represented as Number of "Nines"

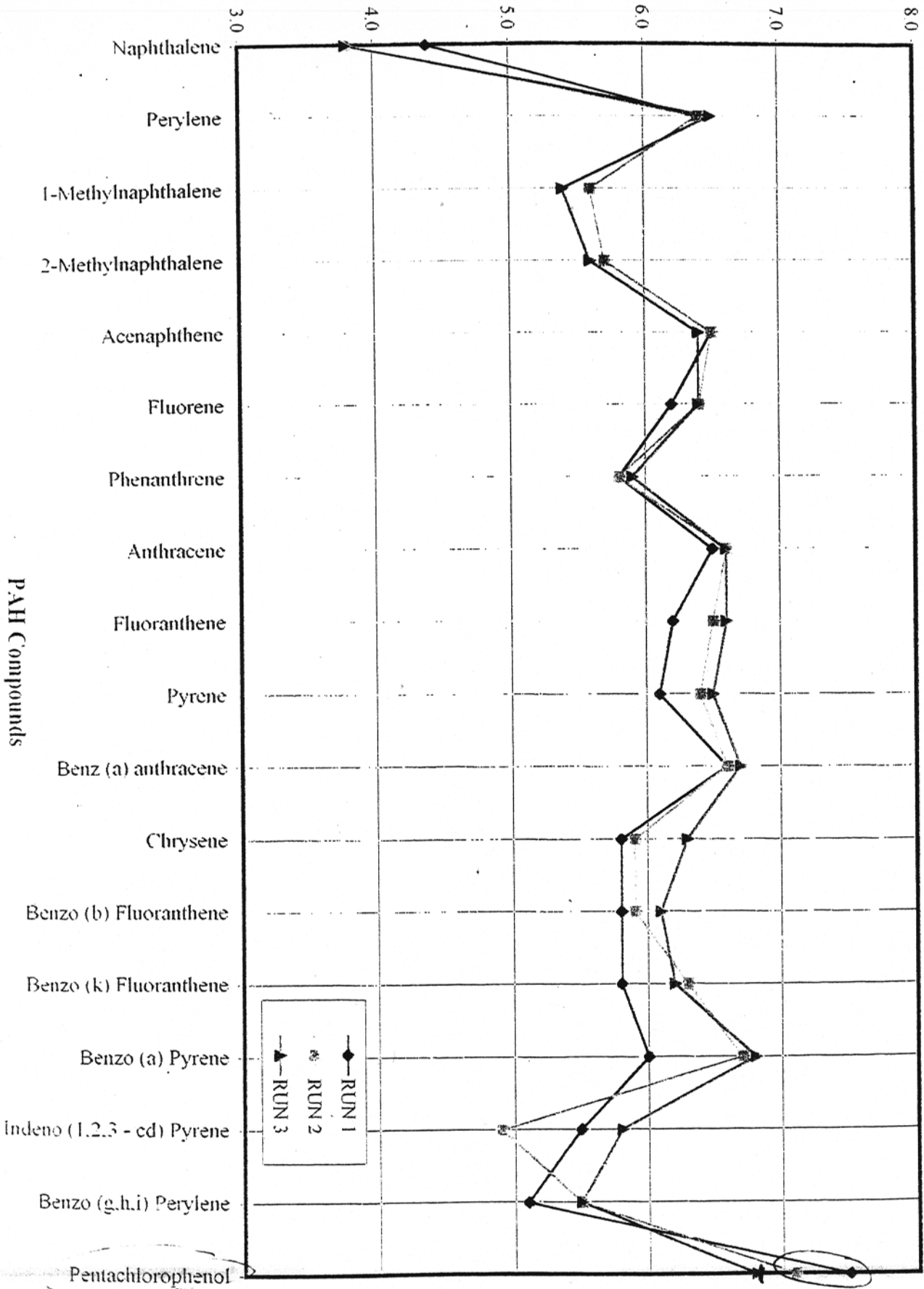


Figure 1 Destruction Removal Efficiency (DRE %) vs. PAH Compound (Pentachlorophenol Included)

6.2 Emissions Testing

The results of emission testing are detailed in a separate report by CanadeER which is submitted as an attachment to this report. The results of PAH and pentachlorophenol Destruction Removal Efficiencies (DREs) are summarized in Tables 9 through Table 11 of this report. The DREs were found to exceed the CCME Criteria of 99.99% for all PAHs with the exception of Naphthalene, which had a DRE of greater than 99.99% for Test #1 and greater than 99.98% for Tests 2 and 3. A graph is provided in Figure 1 which presents the DREs vs PAH parameter for each of the three tests. The majority of the PAH parameters (including benzo(a)pyrene) are shown to exceed a DRE of 6 "nines". The remaining parameters (excluding Naphthalene) exceed a DRE of 5 "nines".

Due to the factors identified in Section 4.0 (Plant Configuration) it is thought that the location of the dilution air intake in relation to the test soil feed pile and nearby loader traffic to and from the soil feed hopper may have compromised the quality of the test results for the volatile components (primarily Naphthalene).

This problem would be avoided in future applications by improved material handling procedures and site logistics.

DREs for pentachlorophenol were consistently greater than the "six nines" required by CCME guidelines. Average HCl emissions were 34.1 mg/Rm³ which is below the CCME guideline criterion of 75 mg/Rm³. PCDD/PCDF levels were met within the stack. }

The particulate emissions are shown in Table 2 of the CanadeER report (attached). The particulate loading decreased from 69 mg/Rm³ in Test # 1 to 38 mg/Rm³ in Test # 3, with the average value at 52.5 mg/Rm³.

Envirosoil's Operating Permit at Rocky Lake, for petroleum impacted soils has a requirements for particulate emissions to be below 90 mg/Rm³. The target particulate loading for the demonstration test was 20 mg/Rm³, which is the CCME Guideline for PAH and pentachlorophenol impacted soils.



Table 10 PAH and Pentachlorophenol Destruction Removal Efficiencies For Test # 1
Average Soil Feed Rate of 25 tonnes per hour at 9.27% Moisture
Envirosoil Demonstration Test, October 16 - 18, 1996

PARAMETER	LAB DETECTION LIMIT (Soil) mg/kg	CCME CRITERIA Res/Park (mg/kg)	Test Run # 1		PTU at 510 °C (950 °F) and STU at 955 °C (1750 °F)			
			Test #1 Feed (mg/kg)	Test #1 Discharge (mg/kg)	Parameter Feed Rate (g/s)	Stack Emissions Total (ng)	Emission mass flow (g/s)	DRE %
Naphthalene	0.01	5	127	0.02	0.800	15212	4.6056E-05	99.99424
Perylene	0.01	-	3.75	< 0.01	0.024	nd 4	1.211E-08	> 99.99995
1-Methylnaphthalene	0.01	-	206	< 0.01	1.298	1327	4.0176E-06	> 99.99969
2-Methylnaphthalene	0.01	-	482	< 0.01	3.037	2609	7.899E-06	> 99.99974
Acenaphthylene	0.01	-	< 1	< 0.01	*	256	7.7506E-07	*
Acenaphthene	0.01	-	311	< 0.01	1.959	316	9.5672E-07	> 99.99995
Fluorene	0.01	-	235	< 0.01	1.481	346	1.0475E-06	> 99.99993
Phenanthrene	0.01	5	592	0.02	3.730	1669	5.0531E-06	99.99986
Anthracene	0.01	-	84.9	< 0.01	0.535	< 80	2.4221E-07	> 99.99995
Fluoranthene	0.01	-	223	< 0.01	1.405	371	1.1232E-06	> 99.99992
Pyrene	0.01	10	154	< 0.01	0.970	284	8.5984E-07	> 99.99991
Benz (a) anthracene	0.01	1	33.7	< 0.01	0.212	< 24	7.2662E-08	> 99.99997
Chrysene	0.01	-	39.2	< 0.01	0.247	93	2.8157E-07	> 99.99989
Benzo (b) Fluoranthene	0.01	1	18.0	< 0.01	0.113	58	1.756E-07	> 99.99985
Benzo (k) Fluoranthene	0.01	1	18.0	< 0.01	0.113	51	1.5441E-07	> 99.99986
Benzo (a) Pyrene	0.01	1	14.7	< 0.01	0.093	30	9.0828E-08	> 99.99990
Indeno (1,2,3 - cd) Pyrene	0.01	1	3.86	< 0.01	0.024	38	1.1505E-07	> 99.99953
Dibenzo (a,h) Anthracene	0.01	1	< 1	< 0.01	*	< 9	2.7248E-08	*
Benzo (g,h,i) Perylene	0.01	-	3.97	< 0.01	0.025	67	2.0285E-07	> 99.99919
2-Chloronaphthalene	0.01	-	< 1	< 0.01	*	< 53	1.6046E-07	*
Pentachlorophenol	0.5	0.5	780	< 0.5	4.911	< 76	2.301E-07	> 99.99999

1. CCME = Canadian Council of Ministers of the Environment Remediation Criteria for Soils.

2. - = no guideline value established

3. Soil Samples analyzed by MDS Environmental Services Ltd., Halifax, N.S.

4. Stack sampling train analyzed by Wellington Laboratories in Ontario

5. Samples collected October 16 - 18, 1996

6. * = Parameter not detected in the feed soil



Table 11 PAH and Pentachlorophenol DESTRUCTION REMOVAL EFFICIENCIES FOR TEST #2
Average Soil Feed Rate of 25 tonnes per hour at 9.88% Moisture
Envirosoil Demonstration Test, October 16 - 18, 1996

PARAMETER	LAB DETECTION LIMIT (Soil) mg/kg	CCME CRITERIA Res/Park (mg/kg)	Test Run # 2		PTU at 482 °C (900 °F) and STU at 955 °C (1750 °F)			DRE %
			Test #2 Feed (mg/kg)	Test #2 Discharge (mg/kg)	Parameter Feed Rate (g/s)	Stack Emissions Total (ng)	Emission mass flow (g/s)	
Naphthalene	0.01	5	112	0.03	0.701	26611	8.323E-05	99.98812
Perylene	0.01	-	3.99	< 0.01	< 0.025	nd 4	1.251E-08	> 99.99995
1-Methylnaphthalene	0.01	-	189	< 0.01	< 1.183	1306	4.085E-06	> 99.99965
2-Methylnaphthalene	0.01	-	435	0.01	< 2.722	2182	6.824E-06	99.99975
Acenaphthylene	0.01	-	< 1	< 0.01	*	< 198	6.193E-07	*
Acenaphthene	0.01	-	277	< 0.01	< 1.733	< 222	6.943E-07	> 99.99996
Fluorene	0.01	-	208	< 0.01	< 1.302	232	7.256E-07	> 99.99994
Phenanthrene	0.01	5	522	0.04	3.267	1183	3.7E-06	99.99989
Anthracene	0.01	-	76.6	< 0.01	< 0.479	< 47	1.47E-07	> 99.99997
Fluoranthene	0.01	-	193	0.01	< 1.208	190	5.942E-07	99.99995
Pyrene	0.01	10	131	< 0.01	< 0.820	148	4.629E-07	> 99.99994
Benz (a) anthracene	0.01	1	28.9	< 0.01	< 0.181	21	6.568E-08	> 99.99996
Chrysene	0.01	-	33.7	< 0.01	< 0.211	76	2.377E-07	> 99.99989
Benzo (b) Fluoranthene	0.01	1	14.1	< 0.01	< 0.088	29	9.07E-08	> 99.99990
Benzo (k) Fluoranthene	0.01	1	14.1	< 0.01	< 0.088	20	6.255E-08	> 99.99993
Benzo (a) Pyrene	0.01	1	14.0	< 0.01	< 0.088	8	2.502E-08	> 99.99997
Indeno (1,2,3 - cd) Pyrene	0.01	1	1.66	< 0.01	< 0.010	42	1.314E-07	> 99.99873
Dibenzo (a,h) Anthracene	0.01	1	< 1	< 0.01	*	< 123	3.847E-07	*
Benzo (g,h,i) Perylene	0.01	-	2.66	< 0.01	< 0.017	< 27	8.444E-08	> 99.99949
2-Chloronaphthalene	0.01	-	< 1	< 0.01	*	< 49	1.533E-07	*
Pentachlorophenol	0.5	0.5	720	< 0.5	< 4.503	< 120	3.753E-07	> 99.999992

Notes:

1. CCME = Canadian Council of Ministers of the Environment Remediation Criteria for Soils
2. - = no guideline value established
3. Soil Samples analyzed by MDS Environmental Services Ltd., Halifax, N.S.
4. Stack sampling train analyzed by Wellington Laboratories in Ontario
5. Samples collected October 16 - 18, 1996.
6. * = Parameter not detected in the feed soil



Table 12 PAH and Pentachlorophenol Destruction Removal Efficiencies For Test # 3
Average Soil Feed Rate of 22.5 tonnes per hour at 9.27% Moisture
Envirosoil Demonstration Test, October 16 - 18, 1996

PARAMETER	LAB DETECTION LIMIT (Soil) mg/kg	CCME CRITERIA Res/Park (mg/kg)	Test Run # 3			PTU at 455 °C (850 °F) and STU at 955 °C (1750 °F)		
			Test 3 Feed (mg/kg)	Test # 3 Discharge (mg/kg)	Parameter Feed Rate (g/s)	Stack Emissions Total (ng)	Emission mass flow (g/s)	DRE %
Naphthalene	0.01	5	138	< 0.01	< 0.782	36371	0.00011776	> 99.98495
Perylene	0.01	-	5.07	< 0.01	< 0.029	nd	1.2951E-08	> 99.99995
1-Methylnaphthalene	0.01	-	239	< 0.01	< 1.355	2340	7.5763E-06	> 99.99944
2-Methylnaphthalene	0.01	-	542	< 0.01	< 3.073	3948	1.2783E-05	> 99.99958
Acenaphthylene	0.01	-	< 1	< 0.01	*	< 171	5.5365E-07	*
Acenaphthene	0.01	-	337	< 0.01	< 1.911	< 344	1.1138E-06	> 99.99994
Fluorene	0.01	-	255	< 0.01	< 1.446	286	9.2599E-07	> 99.99994
Phenanthrene	0.01	5	637	< 0.01	< 3.612	1334	4.3191E-06	> 99.99988
Anthracene	0.01	-	90.7	< 0.01	< 0.514	< 57	1.8455E-07	> 99.99996
Fluoranthene	0.01	-	237	< 0.01	< 1.344	166	5.3746E-07	> 99.99996
Pyrene	0.01	10	165	< 0.01	< 0.936	134	4.3386E-07	> 99.99995
Benz (a) anthracene	0.01	1	35.3	< 0.01	< 0.200	18	5.8279E-08	> 99.99997
Chrysene	0.01	-	43.0	< 0.01	< 0.244	54	1.7484E-07	> 99.99993
Benzo (b) Fluoranthene	0.01	1	20.1	< 0.01	< 0.114	31	1.0037E-07	> 99.99991
Benzo (k) Fluoranthene	0.01	1	20.1	< 0.01	< 0.114	28	9.0656E-08	> 99.99992
Benzo (a) Pyrene	0.01	1	17.1	< 0.01	< 0.097	7	2.2664E-08	> 99.99998
Indeno (1,2,3 - cd) Pyrene	0.01	1	3.64	< 0.01	< 0.021	15	4.8566E-08	> 99.99976
Dibenzo (a,h) Anthracene	0.01	1	< 1	< 0.01	*	< 33	1.0684E-07	*
Benzo (g,h,i) Perylene	0.01	-	3.86	< 0.01	< 0.022	35	1.1332E-07	> 99.99948
2-Chloronaphthalene	0.01	-	< 1	< 0.01	*	< 66	2.1369E-07	*
Pentachlorophenol	0.5	0.5	870	< 0.5	< 4.931	208	6.7345E-07	> 99.999987

Notes:

1. CCME = Canadian Council of Ministers of the Environment Remediation Criteria for Soils.
2. - = no guideline value established
3. Soil Samples analyzed by MDS Environmental Services Ltd., Halifax, N.S.
4. Stack sampling train analyzed by Wellington Laboratories in Ontario
5. Samples collected October 16 - 18, 1996
6. * = Parameter not detected in the feed soil



6.3 Ambient Monitoring

Two ambient air samplers were set up to coincide with the stack test. Samples were taken on each of the three days from an upwind and downwind location. The approximate locations of the ambient air samplers in relation to the LTTD unit are shown on Drawing 10294-1 in Appendix 1.

At the start of each day, winds were from the NW but partway through the third sample day, winds shifted to a more northerly direction so the samplers were no longer properly oriented. The samplers were activated as the Stack Testing activities began and stopped when Stack testing was completed each day. The samples taken the first two days were analyzed but samples taken the third day were determined to not be representative of potential impacts of stack emissions and thus not analyzed.

The ambient samples were analyzed for PAH and Pentachlorophenol content. Results of the analysis are shown in Appendix 3. Results show no adverse impact of operation of the LTTD.



7. DISCUSSION

The emissions test results demonstrate that the LTTD unit can successfully remediate soils with PAH and pentachlorophenol contamination. DREs for PAHs were consistently in the 99.999% and greater range, with the exception of Naphthalene. The DRE for Naphthalene is believed to be artificially elevated as explained in Section 6.2. DREs for pentachlorophenol were consistently greater than the "six nines" required by CCME guidelines.

The soil discharge met the required soil treatment criteria at each of the PTU operating temperatures, 455, 482, 510 °C, (950, 900, and 850 °F). There was no significant difference in the air emissions between individual tests, because the secondary unit was maintained at 1750 °F (955 °C) for all tests.

The tests were conducted when the majority of the bags in the baghouse were approaching the end of their effective life. A full replacement of the bags would likely have resulted in a significant reduction in particulate emissions, and some corresponding reduction in PAH emissions. It is not possible to estimate the reductions that would be achieved with better control of the particulate emissions, however it is clear from the improvements noted with the replacement of about 1% of the bags that the reduction would be significant.



8. CONCLUSION

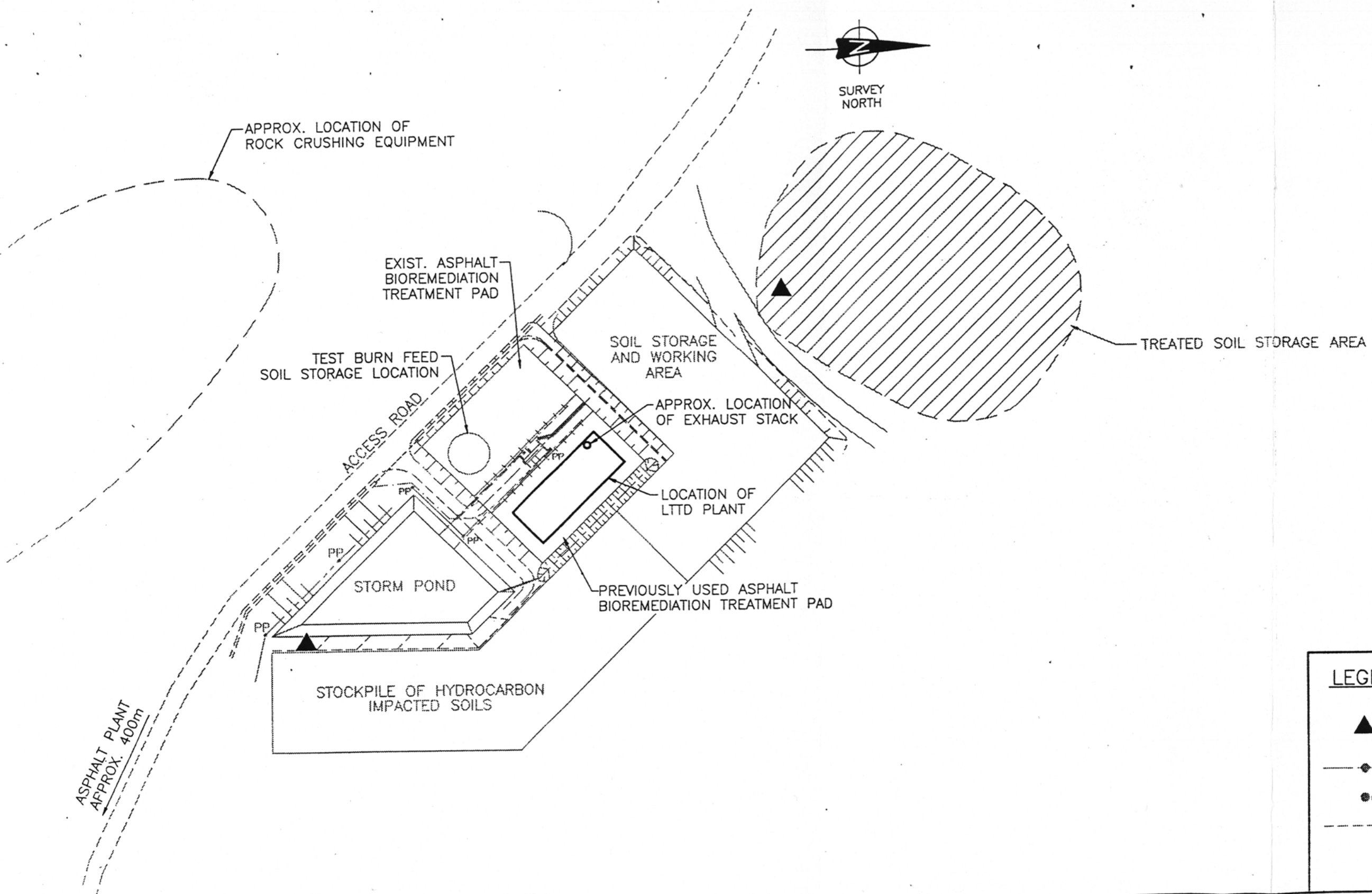
The conclusions from this study can be summarized as follows:

- The Envirosoil LTTD system is an effective and practicable technology for the remediation of soils impacted by PAH and pentachlorophenol.
- The bags in the baghouse were reaching the end of their useful lives and, as a result, particulate emissions were higher than would normally occur.
- Replacement, and more aggressive maintenance of the baghouse can significantly reduce the particulate emissions.
- Despite the particulate emissions, and discounting Naphthalene, the emissions of all other measured contaminants during operation of the system were found to be within the CCME Guidelines and other applicable limits.
- The processing of these materials did not cause any change in the normal operating mode of the plant; the operating staff are capable of working with this material with current training levels.
- The configuration of the temporary lime feed system was effective in allowing a continuous feed of lime into the process airstream.
- A primary treatment unit temperature of 455°C (850°F) is adequate to meet the CCME soil remediation criteria.



Appendix 1
Site Plan and Plant Layout





LEGEND:

- ▲ HI VOL AMBIENT AIR SAMPLER
- OVERHEAD POWER LINE
- PP POWER POLE
- - - - FRENCH DRAIN SYSTEM

Jacques Whitford
Environment Limited

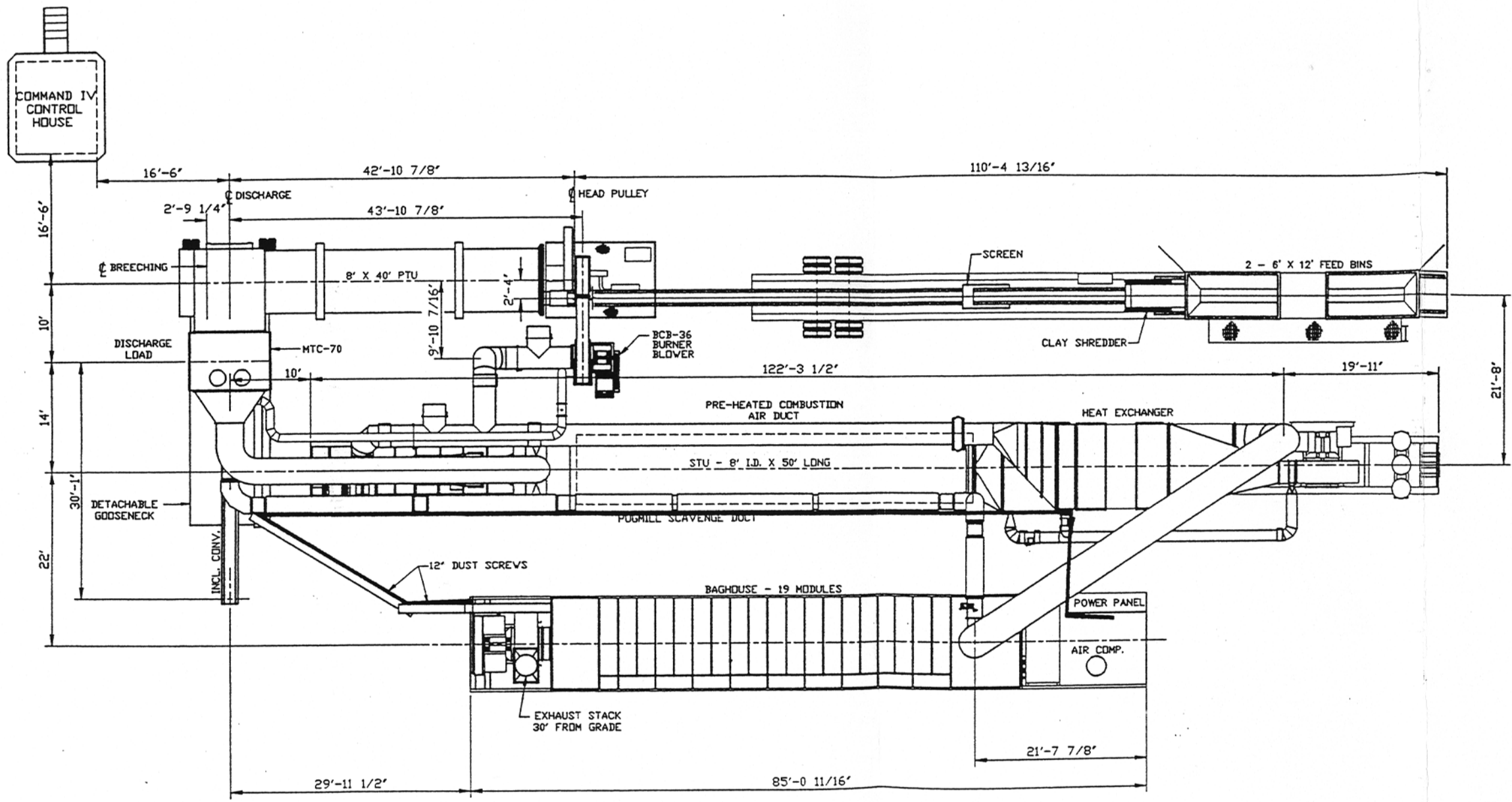
REFERENCE
DRAWING REFERENCED TO JWEL DWG. No.
8370-4R1, DATED 95/01/03.


SCALE : 1 : 2000
DATE : 97/05/05
DRAWN BY : P.J.S00
APPROVED BY :

ENVIROSOIL LIMITED
**SOIL RECYCLING FACILITY
ROCKY LAKE QUARRY**
HALIFAX COUNTY, NOVA SCOTIA

LOCATION OF LTTD
SOIL TREATMENT UNIT

DRAWING NO.
10294-1



1	DWG. CHECKED & COMPLETED			B.K.	7-20-95
NO	REVISION	APPR	BY	DATE	
 ASTEC INDUSTRIES, INC. P.O. BOX 72787 • 4101 JEROME AVENUE • CHATTANOOGA, TN 37407					
CUSTOMER: ENVROSOL					
PART NAME: PLANT LAYOUT					
MACHINE: 8' HORIZONTAL LTD					
DRW	CHKD	APPD	DATE	REV	
95-064	95-064-1	95-064-1	1	6-15-95	

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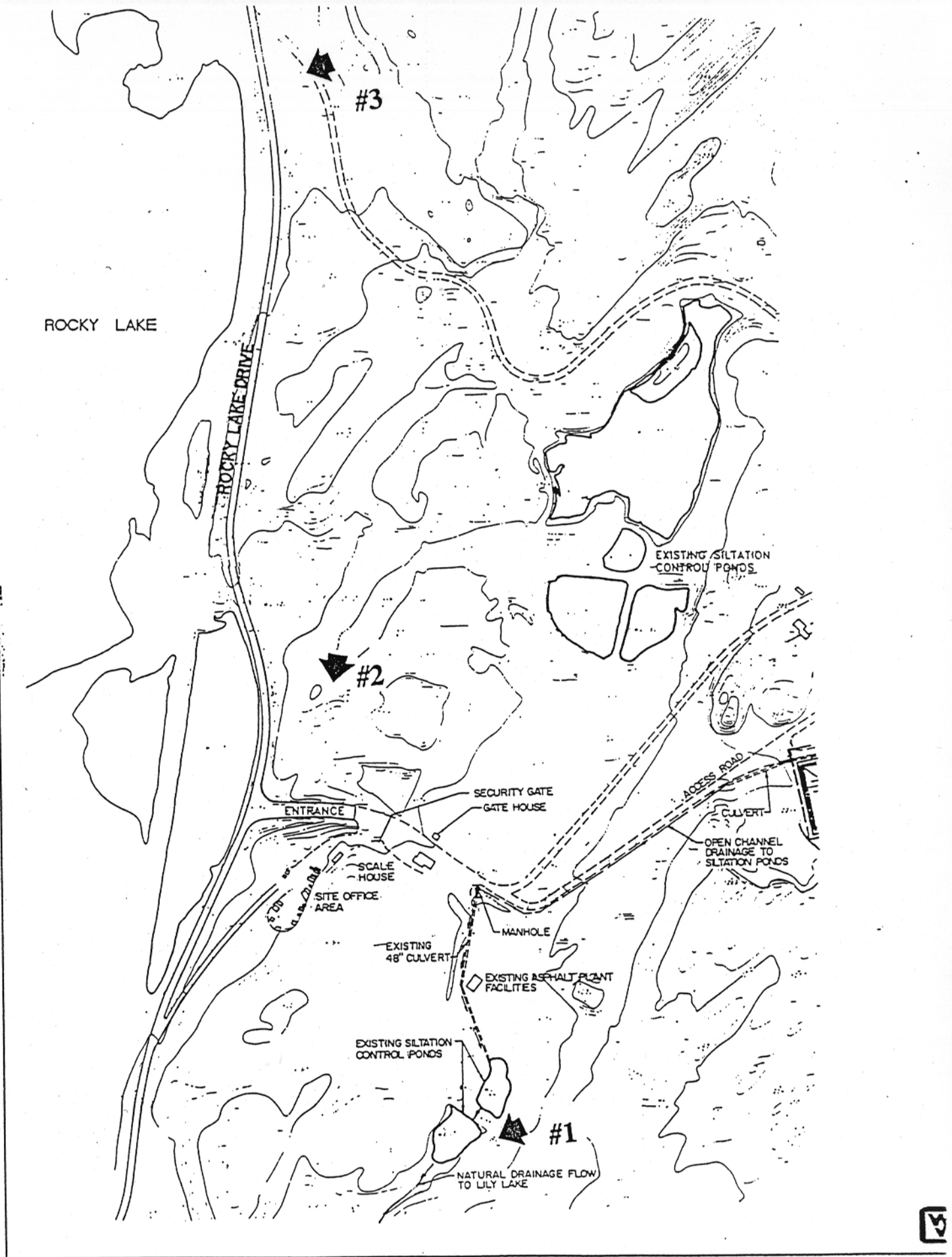
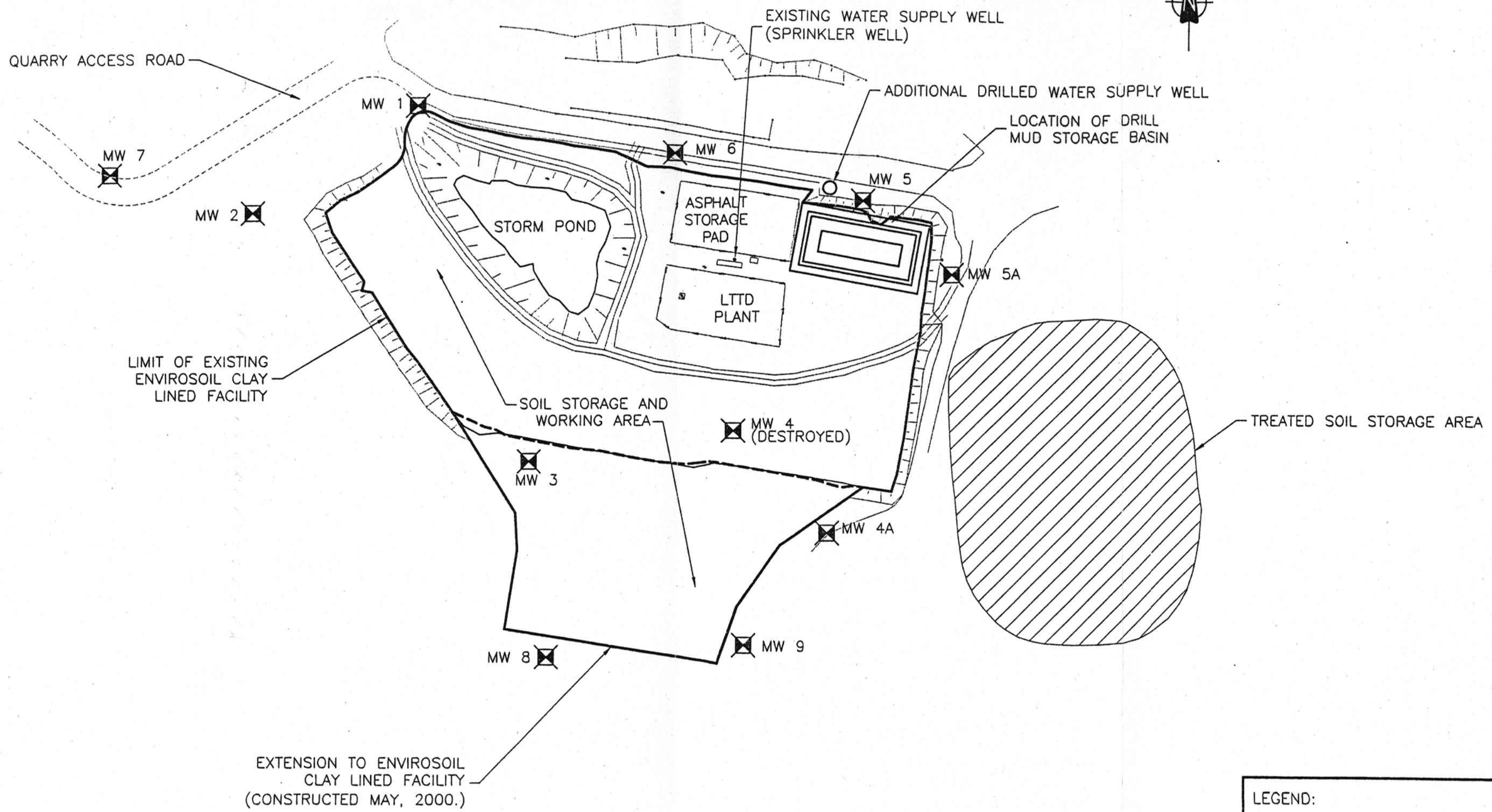



Figure 1 Sampling Locations





LEGEND:
 MONITOR WELL

8370-7-1.dwg 01/01/16



REFERENCE
 JACQUES WHITFORD DRAWING 8370-6-1,
 DATED 00/03/22.

SCALE : 1 : 2 000
 DATE : 01/01/16
 DRAWN BY : V.A.HUNTLEY
 APPROVED BY : *Dona Polk*

ENVIRONSOIL LIMITED
 SOIL RECYCLING FACILITY
 ROCKY LAKE QUARRY
 HALIFAX COUNTY, NOVA SCOTIA

SITE PLAN AND
 MONITOR WELL
 LOCATIONS

DRAWING NO.
 8370-7-1