ENVIRONMENTAL MANAGEMENT
& CONSULTING

STAGE 1 PRELIMINARY SITE INVESTIGATION

McLean Mill

5633 Smith Road, Port Alberni, BC

Prepared For:

City of Port Alberni on behalf of D.R. Clough Consulting

Prepared By:

TerraWest Environmental Inc.

Project File: DCMM19-01

This Stage 1 PSI report may be submitted for Contaminated Sites Approved Professional review and subsequently submitted to the BC Ministry of Environment under the formal Contaminated Sites Regulation

April 18, 2019

TERRAWEST ENVIRONMENTAL INC.

Regional: 3148-F Barons Road, Nanaimo, BC V9T 4B5

Tel. 1.866.500.1553 Fax 250.389.1554 Email info@terrawest.ca

EXECUTIVE SUMMARY

TerraWest Environmental Inc. (TerraWest) was retained by The City of Port Alberni on behalf of D.R. Clough Consulting (the 'Client') to complete a Stage 1 Preliminary Site Investigation (PSI) of the property located at 5633 Smith Road, Port Alberni, BC herein referred to as the 'Subject Property' and/or the 'Site'.

At the time of this Stage 1 PSI, the Subject Property was operating as the McLean Mill National Historic Site. The Site was comprised of a historical-steam powered sawmill, open to the public with access to the property via rail and car from Port Alberni, BC. Operations on Site included seasonal historical logging and milling demonstrations, camping, event rentals, as well as a fish hatchery.

The Subject Property operated as a steam sawmill from 1927 to 1965 by the R.B. McLean Lumber Company. Operations included rail and truck transport of logs to Site, unloading into a constructed mill pond, milling of logs through steam powered operations, and shipment of finished lumber to markets via rail and truck.

Once operations ceased after 1965, the property remained vacant with no activities until 1989, when the Site was declared a National Historic Site for its association with the forest industry in British Columbia. During the early 1990s extensive restoration and conservation works began on the Site's buildings, former structures and equipment.

In 2000, the Site officially opened to the public as a tourist destination on Vancouver Island to showcase an example of early 20th century sawmill and logging operations. These operations have continued to present day with seasonal logging and milling demonstrations.

Based on the research and investigations for this Stage 1 PSI, TerraWest has identified the following areas of potential environmental concern (APECs) and previously identified areas of environmental concern (AECs). The APECs and AECs are described in the table below with reference to specific potential contaminants of concern (PCOCs) and contaminants of concern (COCs):

AEC/ APEC #	Activity Description	Possible Mechanisms of Contamination	Media- PCOCs/ COCs
AEC 1 (on-Site)	**Blacksmith Shop-29**- formerly used to produce babbitted bearing and filing saw blades from 1927- 1965. Demonstration activities occurring periodically within the building since 2000 to present (BE-pers.comm.). Envirochem 1994, identified metals contamination in soil. Soil remediation works were completed in 1995 by Envirochem. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.4, 3.2.8, 3.2.9, Tables 1, 2, 4, 5, and 12 and Figure 4 for further details.	Manufacturing of metal products	**Soil COC** - select metals **Groundwater PCOC -** select metals
AEC 2 (on-Site)	**Grease Rack/Pit & Small Parts Shed-33**- former location of vehicle maintenance between 1927-1965. Observed soil staining over ground and stored metal and oil pails outside shed during 1994 Envirochem investigations. Soil remediation works were completed in 1995 by Envirochem. Review of analytical confirmation samples from remaining soils exceeded current applied standards. See Sections 3.2.8, 3.2.9 and Table 1 and Figure 4 for further details.	Vehicle repair and maintenance	**Soil COC and PCOC -** BETXSM, VPH, PAHs, LEPH, HEPH select metals **Groundwater PCOC -** PAHs, LEPH, HEPH select metals **Vapour PCOC -** VOCs
AEC 3 (on-Site)	**The Mill-21**- associated mill equipment where extensive oil staining was visible during Envirochem investigations in 1994. COCs included metals, oil and grease and TEH. Soil remediation works were completed in 1995 by Envirochem. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.3, 3.2.8, 3.2.9. and Table 2, 4, 5, and 7 and Figures 4 & 5 for further details.	Sawmilling operations	**Soil COC -** PAHs, LEPH, HEPH, select metals **Groundwater PCOC -** PAHs, LEPH, HEPH, select metals **Vapour PCOC** - VOCs
AEC 4 (on-Site)	**Garage-32**- former service pit, oil staining over garage floor, and abandoned heating oil tank under lean-to. Envirochem 1994, completed soil investigations for metals and MO&G and a limited groundwater investigation for dissolved metals, TEH, BTEX, and Chlorinated Phenols. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.3, 3.2.8 and Tables 2, 7, 10 and Figures 4 & 5	Vehicle repair and maintenance	**Soil COCs** - PAHs, LEPH, HEPH, select metals **Groundwater PCOC -** PAHs, LEPH, HEPH, select metals **Vapour PCOC** - VOCs

AEC/ APEC #	Activity Description	Possible Mechanisms of Contamination	Media- PCOCs/ COCs
	for further details.		
AEC 5 (on-Site)	**Gas and Oil Shed-31**- three gasoline USTs are located beneath the shed. One diesel AST located behind the shed. Envirochem completed soil investigations in 1994 for metals and MO&G and groundwater investigations for BTEX, and Chlorinated Phenols. Review of analytical samples exceeded current applied standards. See Sections 3.2.2, 3.2.3, 3.2.8 and Tables 3 and 10 and Figures 4 & 5 for further details.	Petroleum storage in underground (UST) and above ground (AST) tanks-fuel transfer area.	**Soil COC and PCOC -** BETSMX, PAHs, LEPH, HEPH, select metals **Groundwater PCOC -** PAHs, LEPH, HEPH, select metals **Vapour PCOC** - VOCs
AEC 6 (on-Site)	**Former Donkey Engine and Machine Shop Area-38 & 34**- Envirochem 1994 report identified the following: a small AST containing hydraulic oil within the donkey engine. Minor soil staining observed beneath the engine. Scrap metal and two full 45- gallon drums outside machine shop. Envirochem 1994, completed soil investigations for metals and MO&G. Review of analytical samples exceeded current applied standards. See Sections 3.2.8 and Table 3 and Figure 4 for further details.	Petroleum storage in AST and surface staining from spilling or equipment loss.	**Soil COC** - PAHs, LEPH, HEPH, select metals **Groundwater PCOC -** PAHs, LEPH, HEPH, select metals **Vapour PCOC** - VOCs
AEC 7 (on-Site)	**Generator Building (Millwright) and Oil Shed-27 & 28**- location of former millwright shop and former oil shed east of mill, now location of diesel water pump for fire protection system. Envirochem 1994, completed soil investigations for metals and MO&G and groundwater investigations for metals, Chlorinated phenols, and BTEX. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.8 and Tables 4, 8, and 11 and Figure 4 for further details.	Petroleum and equipment storage and use.	**Soil COC** - PAHs, LEPH, HEPH, select metals **Groundwater PCOC -** PAHs, LEPH, HEPH, select metals **Vapour** - VOCs
AEC 8 (on-Site)	**Dip Tank/Loading Deck Area-17**- surrounding rail spur, loading deck and dip tank. Former location of wood treatment product, former location of oil water separator system and stored barrels with ground staining. Envirochem 1994, completed soil investigations for metals, MO&G, PAHs, chlorinated phenols and groundwater investigations for metals,	Chemical wood treatment location and petroleum storage and transfer area.	**Soil COC and PCOC** - PAHs, LEPH, HEPH, select metals, chlorinated phenols **Groundwater PCOC** - PAHs, LEPH, HEPH, select

AEC/ APEC #	Activity Description	Possible Mechanisms of Contamination	Media- PCOCs/ COCs
	and chlorinated phenols. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.3, 3.2.4, 3.2.8, 3.2.14, 4.0 and Tables 3, 6, and 7 and Figures 4 & 5 for further details.		metals, chlorinated phenols **Vapour PCOC** - VOCs
AEC 12 (on-Site)	**North of Mil Pond**- formal description of historical activity in the area was not provided in the 1994 Envirochem report. Envirochem 1994, completed soil investigations for metals and MO&G. Review of analytical samples exceeded current applied standards. See Sections 3.2.8, 3.2.9. and Table 3, for further details.	Not identified through investigations.	**Soil COC** – select metals **Groundwater PCOC -** select metals
AEC 13 (on-Site)	**Scrap Burner-24**- former location of scrap burn pile between 1927-1965. Used sporadically as a burn pile for scrap wood and sawdust between 2001-2018. Envirochem 1994, completed soil investigations for metals, MO&G and PAHs. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.8, 3.2.9. and Table 5 and Figure 4 for further details.	Mill waste burning over open ground.	**Soil COC and PCOC -** select metals , PAH/LEPH/HEPH **Groundwater PCOC-** select metals
AEC 14 (on-Site)	**The Mill Pond**- used in the operation of the mill for floating logs from 1927 to1965 and again between 2001-2018 after pond dredging occurred in the late 1990s. TerraWest 2018, completed sediment sampling for hydrocarbons, metals, polychlorinated phenols, dioxins and furans and surface water investigations for hydrocarbons, and metals. Review of analytical resulted indicated select exceedances when compared to applied standards. See Section 3.2.3 and 3.2.17 and Figures 5 for further details.	Historical sawmill operations.	**Sediment COC** - Select PAHs, select metals, PDCC/F
APEC 15 (on-Site)	**Transformers-26**- three historical transformers located south of the mill building, used between 1949-1965. Section 3.2.3 notes that the transformers have been tested and results indicate PCB levels were below 50 ppm, current soil standards are between 1.5 and 35 ppm. Analysis of results were not provided in the report.	Transfer and or leakage of transformers during former operations	**Soil PCOC** - PCBs, PAHs, LEPH, HEPH

AEC/ APEC #	Activity Description	Possible Mechanisms of Contamination	Media- PCOCs/ COCs
	Anecdotal information indicated that transformers may have been taken off-Site, emptied and returned to the Subject Property (TP-pers.comm.).		
AEC 16 (on-Site)	**Site office (Arnold McLean House)-7**- formerly residential and office building, subject of environmental investigation and soil remediation, by HBT AGRA, due to an accidental release of stove oil from an AST at the rear of the building, See Section 3.2.7.	Petroleum storage leak to ground.	**Soil COC** - PAHs, LEPH, HEPH **Groundwater PCOC** - PAHs, LEPH, HEPH **Vapour PCOC** - VOCs
APEC 17 (on-Site)	**Buried Fuel Rail Car**- located west of logging deck. Identified within previous letter on environmental concerns within the Subject Property, see Section 3.2.14. Anecdotal information identified its potential use as a former septic tank.	Historical petroleum storage, industrial septic system.	**Soil PCOC** - PAHs, LEPH, HEPH **Groundwater PCOC** - PAHs, LEPH, HEPH **Vapour PCOC** - VOCs
APEC 18 (on-Site)	**Boiler Discharge Location-** Steam boilers used in the operation of the mill between 1927-1965 and again between 2001and 2018. It is not known if the former or current functioning boiler is connected to appropriate discharge facilities (BE, TP, JA-pers.comm.). Blowdown discharge has the potential for metals to be discharged with water.	Blowdown discharge containing select metals	**Soil PCOC** - select metals **Groundwater PCOC-** select metals
APEC 19 (on-Site)	**Fuel Tanker Car-18-** Bunker C fuel storage and transfer area from approximately 2001to 2018 (BE-pers.comm.). Surface staining observed over ground beneath rail car during Site inspection.	Petroleum storage and transfer area	**Soil** - PAHs, LEPH, HEPH **Groundwater** - PAHs, LEPH, HEPH **Vapour** - VOC

BTEXSM – benzene, toluene, ethylbenzene, styrene, methyl t-butyl ether
LEPH – light extractable petroleum hydrocarbons
PDCC/F- polychlorinated dioxins and furans
EPH – Extractable petroleum hydrocarbons
HEPH – heavy extractable petroleum hydrocarbons
VOCs – volatile petroleum compounds
PAHs – polycyclic aromatic hydrocarbons
PCBs- Polychlorinated biphenyls

soil vapour parameters: benzene, ethylbenzene, toluene, m&p-xylenes, o-xylenes, total xylenes, n-hexane, n-decane, VPH (C6-C13), naphthalene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, 1,3-butadiene, isopropylbenzene, 1,2-dibroenvthane, 1,2-dichloroethane, methyl tert-butyl ether, methylcyclohexane

1994 and 1995 reports reference analyses and criteria for Mineral Oil and Grease (MO&G) and Total Extractable Hydrocarbons (TEH). There are no current standards for these parameters and are captured within, although not directly comparable to, the current LEPH, HEPH and PAHs. Therefore samples with levels of MO&G or TEH in excess of Level B criteria were considered COCs for LEPH/HEPH and PAHs.

TerraWest recommends a Stage 2 PSI to investigate and delineate the soil, vapour, and groundwater in the APECs and AECs listed above and to compare concentrations of PCOCs and COCs, if present, to the applicable standards.

As per WorkSafeBC, Occupational Health and Safety, and/or municipal or district guidelines, a Hazardous Material Assessment may be required prior to any renovations, modifications, or demolition activities to on-Site buildings or other structures.

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

TerraWest Environmental Inc. (TerraWest) was retained by the City of Port Alberni on behalf of D.R. Clough Consulting (the 'Client') to complete a Stage 1 Preliminary Site Investigation (PSI) of the property located at 5633 Smith Road, Port Alberni, BC, herein referred to as the 'Subject Property' and/or the 'Site'.

At the time of this Stage1 PSI, the Subject Property was operating as the McLean Mill National Historic Site. The Site was comprised of a historical steam powered sawmill open to the public as a museum, with access to the property via rail and car from Port Alberni BC. Operations on Site included seasonal historical logging demonstrations and milling operations, camping, event rentals, as well as an operational fish hatchery.

This Stage 1 PSI presents an independent third-party assessment of the environmental conditions of the Subject Property and provides conclusions that may be relied upon by the Client for their private business purposes.

Pursuant to Section 63 of the Contaminated Sites Regulation, this Stage 1 PSI has been completed in accordance with the following:

- Contaminated Sites Regulation (CSR) Part 5 and Part 14
- British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) Technical Guidance 10: Checklist for Reviewing a Preliminary Site Investigation;
- Society of Contaminated Sites Approved Professionals of British Columbia Guidelines for Contaminated Sites Approved Professional Services on Eligible Sites – Guidance for CSAPS Conducting Review of Stage 1 Preliminary Site Investigation Reports;

1.1 PROJECT TERMS OF REFERENCE

TerraWest understands that this Stage 1 PSI was commissioned to assist the Client in assessing the potential for environmental liabilities, if present, with respect to the Subject Property. This Stage 1 PSI will identify areas of potential environmental concern (APECs), if present, as well as potential contaminants of concern (PCOCs) that may be associated with the Subject Property or neighbouring properties, currently or historically. The Stage 1 PSI Report includes the following components:

- Review of historical information within pertinent Site records;
- Personal interviews with individuals with current and/or historical knowledge regarding the Site;
- Site inspection including the interior of buildings, where applicable; and

- Clear conclusions regarding the potential risk of environmental site liabilities, APECs, PCOCs, and recommendations.

A standard Stage 1 PSI specifically excludes the use of intrusive sampling and/or analytical testing and does not constitute an audit of environmental management.

Where a Stage 1 PSI identifies APECs, a Stage 2 PSI or Detailed Site Investigation may be recommended to investigate the soil, vapour, sediment, surface water, and/or groundwater in the APECs to compare concentrations of PCOCs, if present, to the applicable standards.

1.2 PROFESSIONAL STATEMENT

TerraWest certifies that the Site assessor and the senior reviewer for this report have demonstrated experience in the assessment and/or remediation of potential or actual contamination present due to activities carried out at the Site and confirms that this report has been prepared in accordance with all requirements under the Environmental Management Act and its regulations. This report was completed by Kate Gilbert and reviewed by Suzanne Durnin and Erich Bell, together these individuals have 32 years of combined experience in environmental site assessments and investigations.

1.3 LIMITATIONS, MODIFICATIONS & RELIANCE

The Subject Property is comprised of the lot as outlined in Section 1.4. Environmental background information and descriptions provided by this Stage 1 PSI report are limited to the identified lot only. This report complies with the production of a standard Stage 1 PSI and meets the requirements outlined in the Client Confirmation Form dated January 3, 2019.

TerraWest understands that the Stage 1 PSI report may be submitted for Contaminated Sites Approved Professional review and subsequently submitted to the BC ENV under the formal *Contaminated Sites Regulation* process in support of a future Certificate of Compliance, and both parties may rely on the findings and conclusions in this report for that purpose.

1.4 SITE LOCATION & ZONING

The Subject Property location and zoning is described as the following:

Site Location & Zoning	
Civic Address	5633 Smith Road, Port Alberni, BC
Legal Description	Lot A, Loop Farms and District Lot 106, Alberni District, Plan VIP57991 Except that Part in Plan VIP65071 PID: 018-572-871
Current Zoning[1]	P2 – Park and Public Use District

The general location of the Subject Property is shown on Figure 1, the Site Plan can be referenced in Figure 2, and Figure 3 for facilities and locations within the Site for reference A copy of the applicable municipal zoning plan is presented in Appendix A.

2.0 INTERVIEWS

Available persons familiar with the Subject Property were interviewed for anecdotal insights into past Site history, including land uses and activities, to identify the potential for negative environmental impacts. Interviewees are listed in alphabetical order by first name within this section. Where referenced in this report, evidence provided by the interviewees is cited as personal communications with their initials (i.e. BE-pers.comm.).

Bob East, member with the Western Vancouver Island Industrial Heritage Society (IHS). Forty years in the logging industry and knowledge of Site equipment and activities from 2007 to present.

> Mr. East confirmed current and historical Site building usage and equipment information. Past historical uses of the current buildings and structures on Site were also referenced from interviews with Mr. East.

Dave Clough, Biologist with D.R. Clough Consulting; associated with the Site's restoration and hatchery development from the early 1990s to present.

> Mr. Clough provided information regarding the Subject Property's history in relation to it's redevelopment, the development of the hatchery located in the southeast portion of the Site, and historical works surrounding Kitsucksis Creek. Mr. Clough alsoprovided historical, environmental reports relating to Site investigations,remediation, and upgrades to Kitsucksis Creek.

[1] Regional District of Alberni-Clayoquot Consolidated Zoning By-law (2018). Zoning Bylaw No. 1971. Available from https://www.acrd.bc.ca/cms/wpattachments/wpID174atID2700.pdf, and https://www.acrd.bc.ca/dms/documents/Maps/Alberni-Valley/d10.pdf

Ellie Hadley, Office manager for the McLean Mill Society. Knowledge of the Site and activities since being hired in spring 2018.

> Ms. Hadley accompanied TerraWest employee during a portion of the Site investigations and provided facility information.

Erich McCormick, Former Director of Parks & Recreation, City Clerk and City Manager with the City of Port Alberni. Specific knowledge of the Site and activities between 1990 to 1998.

> Mr. McCormick provided information relating to the former drinking water source and usage on Site and historical drinking water investigations conducted within the Subject Property.

Jamie Morton, Former manager with the Alberni Valley Museum with 20-25 years of knowledge of Site activities starting with its development as a National Historic Site.

> Mr. Morton provided historical context on the former Site operations from the logging activities, shipment of logs to Site, steam powered milling, and log shipment off Site. Mr. Morton also provided information regarding the current buildings construction and use as observed during the Site inspection and the former buildings and structures within the Subject Property.

John and Sharron Adams, property owner for 26 years of 5205 Batty Road, Port Alberni neighbouring property located downstream from the Site along Kitsucksis Creek.

> The Adams provided information relating to their and neighbouring properties historical and current water use of Kitsucksis Creek, their current and historical property use, and historical knowledge of the McLean Mill. Mr. Adams also provided context for concerns raised within a letter sent to ENV in 2016.

Ken Watson, Former City of Port Alberni Engineer and City Manager with knowledge of Site restoration and operations since early 1990s.

> Mr. Watson provided current context of Site operations and recent upgrade works initiated within the on-Site dam as of 2018. In addition to current operations, Mr. Watson provided historical information relating to previous known areas of environmental concern (AECs).

Kirsten Smith, Former curator of the McLean Mill in 2001, with historical knowledge gleaned from Site restoration reports and interviews.

> Ms. Smith provided historical documents, maps and reports relating to the restoration activities. Ms. Smith also confirm redevelopment details relating to former building locations and their use in former Site operations.

Lucas Banton, Fire Chief of the Cherry Creek Volunteer Fire Department. Mr. Banton's, experience spans the past 15 years servicing the area from the Cherry Creek Fire detachment.

> Mr. Banton provided information on the Cherry Creek fire department's role with regard to the mill Site and answered questions about fires occurring within the Site and or environmental related spills or fuel/chemical storage tank removed from the Subject Property.

Mike Irg, Manager of Planning and Development with the Alberni Clayoquot Regional District.

> Mr. Irg confirmed Site zoning and answered questions on the Site infrastructure and was the main contact for further request for information with regard to building permits, development permits, and community plan information.

Neil Malbon, Former General Manager of the McLean Mill National Historic Site from 2003 to 2016, employed by IHS.

> Mr. Malbon provided historical facility information and uses as well as operational information of the mill.

Scott Kenny, Alberni Valley Enhancement Association (AVEA), former Parks Operations Manager with City of Port Alberni. Involved with the Site's activities since 1995.

> Mr. Kenny provided confirmation of restoration activities that have occurred within the Site over time, including works related to Kitsucksis Creek and the mill pond. Mr. Kenny also provided historical reports detailing works conducted within the Site.

Tim Pley, Chief Administrative Officer with Port Alberni, former Deputy Fire Chief for Port Alberni. Knowledge and involvement with the Site in his role as the Deputy Fire Chief began in 2000.

> Mr. Pley provided context for current operations of the Mill and Site post 2000. Mr. Pley confirmed environmental related questions about the Subject Property and provided documentation relating to investigations and facility upgrades.

Tom McGuckie, Former on-Site caretaker at the McLean Mill Site from 1998 to 2016.

> Mr. McGuckie verified Site information and locations and use of the specific facilities within the Site.

3.0 RECORDS REVIEW

A detailed and technical review of the records pertaining to the Subject Property was conducted by TerraWest to set a context for the potential environmental liabilities and APECs in respect to the Subject Property.

3.1 LAND TITLES & OTHER RECORDS

Available records were reviewed for pertinent information regarding current and historical environmental conditions at the Site, and are summarized below:

Land Titles	
Current Title Holder	City of Port Alberni
Historical Title Holders	Individuals, commercial forestry operations and community owned dating back to 1925.
Land Title Holders of Potential Environmental Significance	Registered owners for the Subject Property are listed as the R.B. McLean Lumber Co. Limited from 1948 to 1988 and MacMillan Bloedel Limited, who held the title until 1994. Ownership from two titles was transferred to the City of Port Alberni in 1994.
Right-of-Ways	Right-of-ways were not noted on the current and historical land titles.
Additional Information from Legal Plan	Legal notations: The certificate of title may be affected by the agricultural land commission act, see agricultural land reserve plan no. 1, deposited April 26, 1974.
General Property Records	
Regional District of Alberni-Clayoquot	The District was contacted on February 4th, 2019 with a request to confirm Site zoning, building permits, and inspection reports that may be on file. Documents from the District included building permits and plans for the conversion to the museum/historical site, since 1997 (MI-pers.comm.).
Cherry Creek Volunteer Fire Department	•No records of fires or activities of environmental concern occurring within the Site as noted within the past 15 years (LB-pers.comm.). •Open “bee hive” or “scrap burner” located north of mill had controlled fires, periodically, once operation began after 2000. One small brush fire was noted directly north of the burner area (TP-pers.comm.).
Fire Insurance Plan and Civic Directories	Historical fire insurance plans available through the Port Alberni Archives did not cover the location of the Subject Property, nor was there any maps known to have been completed for the Site. Civic directories with reverse

	property search capabilities were not available for the Subject Property (KS-pers.comm.).
Groundwater, Surface Water & Sensitive Ecosystems	
Inferred Groundwater Flow Direction Based on Nearest Surface Water Body, Topography, and/or Observed Site Conditions[2]	North-northeast based on the location of Kitsucksis Creek and observed wetland area north of the Subject Property. Groundwater investigations completed by Envirochem in 1994 suggested a groundwater flow direction towards Kitsucksis Creek in the east portion of the Site (Appendix E. for report).
Type, Distance, and Direction to Nearest Surface Water Body[3]	Kitsucksis Creek running north to south, with a diversion creek around the mill pond. Both water bodies were located within the northeast portion of the Site.
Surface Water Bodies within 1 km	Plested Creek, 1.3 km southwest of the Site Un-named marsh, 1.7 km northwest of the Site, feeds into Kitsucksis Creek, up-stream of Subject Property.
Surface Water Intakes within 500 m[4]	Water licences associated within the Site: **C109960** Industrial Log Pond - City of Port Alberni **C110613** Industrial (log pond) & Industrial (steam production and work camp) - City of Port Alberni **C112325** Industrial (fire protection)- City of Port Alberni **C114282** Conservation- Fisheries and Oceans Canada No drinking water intakes were identified.
Hydrogeology Reports	No specific reports found pertaining to groundwater vulnerability within the Site.
Aquifer Information[5]	Aquifer 697 extends along the east side of the Alberni Valley, though the current aquifer map does not encompass the Subject property. A perched water table was suspected within the Site based on historical groundwater investigations and an on-Site field inspection completed on January 17, 2019. Aquifer 697 description: ▪Approximately 42 km^2 ▪Confined bedrock aquifer ▪Pleistocene and Holocene deposits, till, clay, sand, gravel and boulders ▪Moderate vulnerability- geometric mean depth to static water level of 3.9 m ▪Low to moderate productivity ▪This deep aquifer is identified as likely flowing east to

[2] BC Ministry of Environment (2016). BC Water Resources Atlas. Available from http://maps.gov.bc.ca/ess/sv/wrbc/
[3] BC Ministry of Environment (2018). BC Water Resources Atlas. Available from http://maps.gov.bc.ca/ess/sv/wrbc/
[4] Northwest Hydraulic Consultants Ltd. 2014. McLean Mill Dam- Operations, Maintenance and Surveillance Manual Draft for Review.
[5] Government of British Columbia (2018). iMapBC Aquifer Layer. Available from https://maps.gov.bc.ca/ess/hm/imap4m/

		west towards Somass River and Alberni Inlet.
Flood Potential[6]		This Site is not recognised to be within a flood plain.
Domestic Water Wells	**Within a 500 m radius**[7]	One non-domestic well (test well) located within the Subject Property.
	Distance to Nearest	Lat: 49.309048 Long: -124.827711 (Located on Subject Property)
	Drilling Details	Well Tag: 94833 •Total drill depth and finished depth of 540 feet (165 m). •Depth to Bedrock, 100 feet (30 m). •Stony till with cobbles to 100 feet (30 m) then transition to shale and sandstone, fracture at 240 feet (73 m) with 4 USGPM (15 l/m). Shale from 300 feet (91 m) to 535 feet (163 m) with light igneous rock observed. •Static water noted at 30 feet (9 m) with an estimated 20 GPM (75 l/m). •Further interpretation of the well record and aquifer is detailed in section 3.2.18
Monitoring Wells[8]	**Total Number of Wells Within 500 m**	No wells or monitoring stations identified within the search.
	Nearest Known Location	3.6 km southwest- Federal Provincial Water Quality Monitoring station: 241 Somass River at Papermill Dam.
Nearest Sensitive or Endangered Ecosystem[9]		A small portion of the northeast corner of the Site was identified through critical habitat modelling as *Brachyramphus marmoratus* (Marbled Murrelet) critical habitat, edited in 2014. Lat: 49.3116 Long: -124.8239, ID: 2112. This same critical habitat feature was identified directly west of the Subject Property, see critical habitat map in Appendix C for locations.
Subsurface & Climate		
Surficial Geology[10]		Quaternary cover: Alluvium, glaciofluvial gravels and sand, till.
Climate[11]	**Station**	Alberni Robertson Creek, 12 km northwest of the Subject

[6] Government of British Columbia (2018). iMapBC Flood Plain Mapping Layer. Available from https://maps.gov.bc.ca/ess/hm/imap4m/
[7] BC Ministry of Environment (2018). BC Water Resources Atlas. https://maps.gov.bc.ca/ess/hm/imap4m/
[8] Government of British Columbia (2018). iMapBC Environmental Monitoring Stations Layers. Available from https://maps.gov.bc.ca/ess/hm/imap4m/
[9] Government of British Columbia (2018). iMapBC; Habitat Wizard Endangered Species and Ecosystems and Sensitive Ecosystem Layers. Accessed from: https://maps.gov.bc.ca/ess/hm/imap4m/ and http://maps.gov.bc.ca/ess/hm/habwiz/
[10] BC Ministry of Energy, Mine, and Petroleum Resources (2005). BC Geological Survey Geoscience Map 2005-3.
[11] Environment Canada (2018). Canadian Climate Normals. Available from http://climate.weather.gc.ca/climate_normals/index_e.html

		Property
	Annual Precipitation	2153.6 mm with 2074.2 mm rainfall and 79.4 cm snowfall
	Seasonal Variations	Daily mean temperatures between 2˚C in January and 18.5˚C in August
	Infiltration Rate Estimate	190.8 days with precipitation greater than 0.2 mm.
Other Environmental Searches		
Environmental Violations Database[12]		A summary and description search for the McLean Mill and current property owner's name revealed no records.
Authorization Management System – Authorizations & Discharges[13]		A search using the operator's name, owners name and Site address revealed no records.
Archaeological Site Inventory		Correspondence with the Archaeological Branch of the Ministry of Forests, Lands and Natural Resource Operations was initiated to determine if previously-recorded archaeological sites exist on the Subject Property. A response indicated that DhSe-20, the McLean Lumber Mill, is recorded on the property. According to provincial record there are no known archaeological sites recorded on the Subject Property; however, if an archaeological site is encountered during subsurface activities, work must be halted and the Archaeological Branch must be contacted.

A summary of land title ownership, titles, and surveyed plans are provided in Appendix B, district provided documents in Appendix C, BC Water Resource Atlas maps in Appendix D, and Archaeology Search in Appendix E. A topographic map is presented as Figure 2.

3.2 Previous Reports and Letters

The summary of the Subject Property's historical activities, its former physical orientation and previous environmental investigations have been collected from previous reports and letters, summarized within this section. Complete reports and analytical findings that TerraWest considered reliable have been compared to the current applicable standards and/or approved guidelines as noted below. Any other analytical findings presented in previous reports, letters, or memos mentioned below were considered anecdotal. Previous reports referenced in this section are presented in Appendix F.

[12] BC Ministry of Environment (2018). Environmental Violations Database. Accessed from: https://a100.gov.bc.ca/pub/ocers/searchApproved.do?submitType=menu
[13] Ministry of Environment (2018). Authorization Database Search. Accessed from: https://j200.gov.bc.ca/pub/ams/Default.aspx?PossePresentation=DocumentSearch

3.2.1 *The Physical History of the R.B. McLean Lumber Company, National Historic Site. 1992. C.J. Taylor (Taylor)*

- The report, prepared by Taylor, was to assist in planning and conservation of the R.B. McLean Lumber Company (Subject Property) as a National Historic Site.
- Construction of the mill reportedly began in 1927 with operations continuing until 1965 when the mill closed.
- Taylor describes three distinct phases of development of the mill over the period of its operations. These are summarized below for context and reference noted activities.

1927 -34

First Configuration: The steam operated sawmill was built by the McLean family beside Kitsucksis Creek (current location within the Subject Property). A dam was constructed along the creek to create a pond for the booming of logs adjacent to the mill. A half mile of railway spur was also built from the mill to connect with the Esquimalt and Nanaimo Railway. The mill consisted of three floors: saws and machinery were situated on the main floor; the ground floor contained the steam engine; and, the drive shaft occupied the top floor. The boiler was located on the south side of the mill and hopper buildings on the north side for the collection of sawdust and scrap wood. Additional buildings were established on-Site during this time for staff accommodations, a blacksmith's shop, a storage building (barn), and a steam powered generator located in a building between the mill and the mill pond. Taylor suggested that the small parts shed, "locie" shed, and another fuel building existed east of the pond.

Operations: Raw logs and the movement of lumber on Site was completed by a gasoline powered locomotive "Budda" (locie). Mill equipment was powered by steam produced by a sawdust and wood fired boiler.

1934-48

Second Configuration: A new steam powered planer was installed in the same location as the original, but had a separate power source, an old steam powered tractor was situated below the planer. The tractor also powered the cyclone extractor, which blew wood shavings from the planer, through a pipe, over the mill to fuel the main boiler located on the southeast side of the mill. A new turbine generator replaced the existing steam generator to provide electricity to lights for the mill and houses on Site. In addition to this generator, a larger water turbine and D.C. generator was purchased in 1941 and a 250-watt gasoline electric light plant was purchased in 1947. The location of these generators was not noted in the report, although Figure 15 depicts a generator building located east of the mill. By

1949, the mill was connected to hydroelectric service from the British Columbia Power Commission.

Operations: The mill began exporting lumber oversees from the 1930s into the 1940s. Operations included the use of trucks and rail for hauling logs to Site. The creation of a second log dump occurred at the east of the pond for the trucks. Development of the east portion of the Site likely occurred for new logging equipment. The purchase of a motorized loading vehicle "Ross Carrier" allowed for movement of lumber within the Site, which resulted in the expansion of the lumber yard during this time.

1950-65

Third Configuration: To increase efficiency of the mill, several electric generators were installed at the mill. This conversion to electric power included the installation of twin utility poles and an enclosure surrounding the transformers erected south of the boiler house.

Operations: The railway spur south of the mill was relocated to the west of the lumber yard, running in a north-south configuration, logs were no longer brought to the pond by the rail. In addition to this spur, a new "locie" shed, dip tank, and loading platform were built within the western section of the Site. In December of 1965, it was announced that the mill was shutting down. Apart from the sale of the head rig and carriage to another mill, the operations were abandoned as they were.

1983

The mill property was acquired by MacMillan Bloedel in 1983. Shortly thereafter the Alberni Valley Museum became involved in preserving the historic buildings.

1990

The report states that the Alberni Valley Museum (City of Port Alberni) acquired ownership of the mill Site in 1990 and began preservation efforts.

3.2.2 *Investigation of Potential Site Contamination at McLean Mill, Port Alberni, B.C. May 1992. Brian Weller, CPS Ottawa, and Liz Baker PWC, Calgary.*

- The description of the sawmill within the report indicated that large quantities of lubricants would have been used within the mill facility over its lifetime. It was inferred that the lubricants would likely have impacted the ground beneath the facility or would be found in sediments of the mill pond. The mill pond was empty at the time of the investigation.

- Two small garbage dumps were found within the property, though the locations were not indicated in the report.
- Within the logging maintenance area two 500 gallon(gal) underground storage tanks (USTs), one 1,000 gal UST, and one 500 gal above ground storage tank (AST) were present. It was indicated that some tanks were known to contain gasoline; gas pumps were noted adjacent to the oil shed.
- Evidence of staining was observed within the oil pit in the maintenance building/main garage and in the area of the gas pumps and diesel fuel tank.
- A wood treatment facility was noted on Site. All that remained was the dip tank and two wood storage yards.
- The report discussion indicated that contamination may exist due to spillage of wood treatment chemicals, hydrocarbons leaking from mill machinery, hydrocarbons leaking from storage tanks or spilled during former refueling practices. These contaminants were considered a risk to the visiting public, site workers and the on-Site salmon bearing stream.
- Recommendations of this report suggested obtaining a legal opinion on liability associated with Canada Parks Service involvement and that further investigation should be conducted.

3.2.3 *General Comments from a site inspection conducted by Barry Campbell EARP/Cultural Resource Warden in July 1992. With draft memo attached.*

- This report details comments for the classification of the McLean Mill, compiled from site visits by David Lowe, a project Manager with the McLean Historical Site and Brian Weller of Canada Parks Service, and interviews from experts in government and private enterprise. The letter indicates attached documentation, though this information was not provided with the document, obtained through ENV's formal file retrieval application.
- **Dip Tank** (Dip Tank -Loading Deck-17)- the report draws attention to the dip tank and lumber drying/storage area where it describes the dip tanks use and stated it was assumed to be used later in the mill's operation; likely during the 1960s and ceased operation in 1965. Specific knowledge as to the operation of this area and the type of treatment used was not found at the time.
- Research in the report indicated that wood treatment chemicals stored within the dip tank and used on Site may have been primarily disodium octoborite with minor quantities of pentachlorophenol (PCP). Other interviews within the forestry

industry indicated that penta- and tetra- chlorophenols were used for anti-stains during that time or PQ-8, a copper preservative may have been used on-Site.

- **Mill** (Mill- 21)- Inspections of the mill identified hydrocarbon staining on the soil surface below the mill, and on the timber foundation posts or boards lying on the ground.
- **Transformers** (Transformers-26)- The report indicated that the transformers on Site were tested for PCB's and that results indicated PCB levels below 50 ppm. The Ministry of Environment recommended that oils be removed and disposed of; approximately 42 gal per transformer. It was suggested that a group sponsoring the restoration wished to re-use the transformers. The removal of oils was not mentioned, though recommendations were made to place transformers in a covered trough to protect them from the weather and contain any potential spillage.
- **Mill Pond** (Mill Pond-37)- The Mill pond on Site was describes as a grassy depression in which Kitsucksis creek runs through. Recommendations applied to the mill pond include investigations of pond sediments for possible "toxic leachates" or other chemicals from historical mill operations.
- **Fuel Building** (Gas & Oil Shed-31)- The fuel building and area was identified as having four tanks. Two 500-1,000 gal underground tanks were identified beneath the building. One of the USTs contained 1.5" of gasoline and the other UST contained gravel dirt and sludge. A third buried tank behind the building contained 1.5 inches of gasoline. Dave Lowe, was informed that the USTs were leaking when the mill was in operation, so they were not used further. The fourth tank was above ground, the volume and content was unconfirmed.
- **Wood Deck** (Grease Racks-33)- Equipment maintenance was noted to have occurred within the wood deck area where hydrocarbon staining was observed between the ramps.
- **Main Garage** – The inspection of this building noted battery storage, an oil pit and pails or grease stored on gravel flooring. Based on the oil change pit it is inferred that the building was consistent with the Maintenance Building described in the previously referenced report (See Section 3.2.2).

3.2.4 *MacMillan Bloedel Limited Memo-R.B. McLean Mill Site, Preliminary Site Assessment. 1993. John Pillsbury to D. Blake, Alberni Pacific Division.*

- This memo describes results from lab analysis from soil samples collected on Site.

- Results indicated that PCP anti-sapstain contamination was found in soil below the drain bung in the old dip-tank, and some in the storage lumber area (indicated as the present location of the satellite dish).
- In addition, oil and grease were present below the mill steam engine and fuel building, under the garage grease racks, and behind the fuel shed beneath a raised fuel tank. Metals contamination was present in soil within the blacksmith shop.
- Analysis of samples collected from the mill pond indicated the exceedance of residential standards applied for select metal parameters: arsenic, chromium, cobalt, copper, mercury, nickel, and zinc.

3.2.5 *A Management Plan for the McLean Mill National Historic Site, Port Alberni, British Columbia. 1993. Commonwealth Historic Resource Management Limited.*

- The management plan completed by Commonwealth Historic Resource Management Limited and Associates detail the intended Site's development as a National Historic Site through a three-party agreement by the City of Port Alberni, the British Columbia Heritage Trust, and Parks Canada.
- The location, conditions and proposed enhancements of historical buildings and structures within the Site are summarized in several plan figures within the report. This documentation has been used for reference in Section 3.5 and 4.0 of this Stage 1 PSI.

3.2.6 *McLean Mill National Historic Site, Draft Document - Condition Assessment, Feasibility Study and Conservation Plan for the Mill Complex. 1994. Public Works and Government Services Canada.*

- The focus of the study in this report is limited to the main mill building located on Site with a detailed assessment of conditions, assessment of the proposed plan, and a multi-year plan for investigations and further works.
- Observations of the mill site indicated that large quantities of water were running through the building's lower level, and that at several locations water was known to flow out of the ground or disappear into the ground. Excavated water channels were observed through the building and out the other side.

3.2.7 *Oil Spill Clean Up- National Historic Mill Site, Port Alberni, B.C. 1994. HBT AGRA Limited Engineering & Environmental Services (AGRA).*

- AGRA was retained by the City of Port Alberni for environmental services for the remediation of a heating oil spill at the McLean Mill in October of 1993. This report details the accidental release of between 225 and 315 litres of stove oil from a damaged copper fuel line, connected to a fuel tank, adjacent to one of the houses on Site, but is not specific as to which building.
- Impacted area was identified as the crawl space under the house where the oils were absorbed by silty loam overburden material.
- The scope of AGRA services was: to direct workers in construction of a containment cell for excavated soils, collect confirmatory samples within the excavation and stockpiled soils, analyze samples for mineral oil and grease (MO&G) to assess the level of contamination, and prepare a report on works and findings.
- A total of 3.1 m^3 of soils were excavated from below the crawl space and stockpiled on and covered by polyethylene sheeting. The report does not indicate where the stockpile was located but recommended that soil should be remediated to reduce the hydrocarbon contaminants to less than *Criteria for Managing Contaminated Sites* (CMCS) in B.C. Level B recreational/residential land use.
- Confirmation samples collected on three separate occasions from the walls and the floor indicated that MO&G concentrations were less than CMCS Level B with the exception of the floor sample which still exceeded criteria. Further excavation of soil was conducted within the floor of the excavation under the footings, though confirmation samples were not obtained due to water pooling within the excavation.
- Total depth of excavation was estimated at 1.5 m to 1.8 m deep with 0.6 to 0.9 m of pooled groundwater. Further soil removal was not recommended due to the likelihood of severely impacting the structural integrity of the building.
- AGRA estimated that the total oil recaptured was approximately 58.5% to 82.2% of the oil spilled. Based on their estimation and limitations of further soil removal below the building, AGRA recommended that a groundwater survey be conducted. A groundwater well, down-gradient from the spill site was suggested for the monitoring of any existing oils and their potential migration.

There was no indication that the groundwater survey was completed.

3.2.8 *McLean Mill National Historic Site, Port Alberni, B.C. Contamination Assessment. 1994. Envirochem Special Projects Inc. (Envirochem)*

- Envirochem was engaged by the City of Port Alberni to complete a Phase II Environmental Site Assessment (ESA) for the McLean Mill (Subject Property) to identify potential environmental liabilities associated with its continued operation as a public tourist attraction.
- The report detailed several areas of the Site as having the potential for environmental concerns. These locations were identified as: the mill building and green chain, mill pond, small parts shed, machine shop, gin pole/donkey engine, garage, oil and gas shed, blacksmith shop, dip tank, former site office (historical release of stove oil).
- Investigations within the Site included sampling of soils and groundwater within areas of potential environmental concern. Two surface water samples were collected from Kitsucksis Creek and one from a swamp. Assessment of contamination at the Site was based on industrial and commercial land use criteria as specified by the *Canadian Council of Ministers of the Environment* (CCME) *Interim Canadian Environmental Quality Criteria for Contaminated Site* (CCME, 1991) and the CMCS were referenced.
- Select soil samples collected were tested in the field for pentachlorophenol (PCP) using an immunoassay field test kit. Envirochem stated that only soil samples with the highest range of PCP concentrations (above industrial criteria) were submitted for analytical testing. Additional samples were analyzed for hydrocarbons, metals and chlorinated phenols.

TerraWest has reviewed the APECs identified within the Envirochem report and the results of investigations conducted. Analytical results of these investigations have been compared, where applicable, to current standards for the Site, see appended Tables 1-11 for compared results. Samples found to exceed current standard, or 1994 guidelines where no current standard exist, were identified as an Area of Environmental Concern (AEC). Media or parameters that were not, or not thoroughly investigated in the previous reports are listed as APECs. Samples analyzed for VOC parameters presented results below the analytical detection limit and were therefore not re-tabulated. Samples analyzed for mineral oil & grease (MO&G) were not re-tabulated as there are no current, directly comparable standards.

Sample locations are presented in Figure 4 - Previous Environmental Investigations Soil and Sediment Quality, and Figure 5 - Previous Environmental Investigations Groundwater & Surface Water Quality:

APEC #	Activity Description	Soil Analysis Completed	Groundwater Analysis Completed	APEC or AEC when compared to current Standards?
APEC 1	**Blacksmith shop**- formerly used to produce babbitted bearing and filing saw blades.	Surface soil- Metals, MO&G, PAHs	No analysis	**AEC- metals in soil.** **APEC- Metals in gw.**
APEC 2	**Grease Rack/Pit & Small Parts Shed**- former location of vehicle maintenance, observed soil staining over ground and stored metals, 5-gal. oil pails outside shed.	Surface soil- Metals, MO&G, TEH	No analysis	**AEC- Metals, MO&G, and TEH in soil.** **APEC – PAHs, LEPH, and HEPH in soil, gw, vapour, metals in gw.**
APEC 3	**The Mill**- associated equipment where extensive oil staining was visible over ground.	Surface soil- Metals, MO&G, TEH, PAHs	Dissolved metals, TEH	**AEC- Metals, PAHs, MO&G, and TEH in Soil.** **APEC- PHCs in gw and vapour, metals in gw (down-gradient gw location).**
APEC 4	**Garage**- former service pit, oil staining over garage floor, and abandoned heating oil tank behind garage.	Surface soil- Metals, MO&G	Dissolved metals, TEH, BTEX, Chlorinated Phenols	**AEC- Metals, MO&G in soil.** **APEC -PAHs, LEPH, and HEPH in soil, gw, and vapour.**
APEC 5	**Gas and Oil Shed**- three gasoline USTs are located beneath the shed. One diesel AST located behind the shed.	Surface soil- MO&G, TEH, BTEX, Chlorinated Phenols, metals	BTEX, Chlorinated Phenols	**AEC- MO&G, Metals in soil.** **APEC- PAHs, LEPH, and HEPH in soil, gw and vapour. Metals in gw.**
APEC 6	**Gin Pole/Donkey Engine and Machine Shop Area**- contains a small above ground storage tank containing hydraulic oil within the donkey engine. Minor soil staining observed beneath the engine. Scrap metal and two full 45- gallon drums outside shop.	Surface soil- MO&G, metals	No analysis	**AEC- MO&G, metals in soil.** **APEC- PAH, LEPH, and HEPH metals in soil, vapour and gw.**
APEC 7	**Generator Building and Oil Shed (located southeast of mill)**- location of millwright & generator and former oil	Soil- MO&G, metals	Metals, chlorinated phenols, BTEX.	**AEC- Metals, MO&G in soil. Metals in gw.** **APEC- PAHs, LEPH, and HEPH in soil,**

APEC #	Activity Description	Soil Analysis Completed	Groundwater Analysis Completed	APEC or AEC when compared to current Standards?
	shed.			**vapour and gw.**
APEC 8	**Dip Tank & Loading Deck Area**- surrounding rail spur, loading deck and dip tank.	Soil- MO&G, PAHs, Tetra-chlorophenol, Penta-chlorophenol, metals	Metals, Tetra-chlorophenol Penta-chlorophenol	**AEC – Metals in soil.** **APEC- Penta-chlorophenols in soil, metals and chlorinated phenols in gw down-gradient.**
APEC 9	**Treated Wood Storage Area**- Located southeast of loading deck and east of rail spur.	Surface soil- MO&G, BTEX, Chlorinated Phenols	No analysis	**No AECs or APECs**
APEC 10	**Locomotive Shed**- location of storage shed for former locomotive.	Surface soil- MO&G	No analysis	**No AECs or APECs**
APEC 11	**Greenchain**- located south of mill, electric motors allowed the movement of lumber out on a conveyor.	Surface soil- MO&G	No analysis	**No AECs or APECs**
APEC 12	**North of Mil Pond**- formal description of activity was not provided in the report.	Surface soil- MO&G, metals	No analysis	**AEC- Metals in soil.** **APEC- Metals in gw.**
APEC 13	**Scrap Burner**- former location of "bee hive" scrape burn pile.	Surface soil- MO&G, PAHs, metals	No analysis	**AEC- Metals in soil.** **APECs- metals in gw.**
APEC 14	**The Mill Pond**- once used in the operation of the mill for floating logs. Report indicated that the pond was filled in and overgrown and would likely be dredged.	No analysis	No analysis	**APEC – PHCs, metals, chlorinated phenols in sediment, and surface water.**
APEC 15	**Transformers**- located south of mill.	Section 3.2.3 notes that transformers on Site have been tested and results indicate PCB levels were below 50 ppm. Analysis of results were not provided within the report.		**APEC – PCBs within soil.**
APEC 16	**Site office (Arnold McLean House)**- formerly residential, subject of	Soil- MO&G, TEH	No analysis	**AEC – MO&G in soil**

APEC #	Activity Description	Soil Analysis Completed	Groundwater Analysis Completed	APEC or AEC when compared to current Standards?
	environmental investigation and remediation, by HBT AGRA, due to accidental release of stove oil from an AST at the rear of the building, See Section 3.2.7.			**APEC – PAHs, LEPH, HEPH, EPH in soil, soil vapour and GW.**

VOCs – volatile petroleum compounds; EPH – Extractable petroleum hydrocarbons; PAHs – polycyclic aromatic hydrocarbons
LEPH – light extractable petroleum hydrocarbons; HEPH – heavy extractable petroleum hydrocarbons; PCBs- Polychlorinated biphenyls
PDCC/F- polychlorinated dioxins and furans; BTEXSM – benzene, toluene, ethylbenzene, styrene, methyl t-butyl ether

The reported analytical results from the Envirochem's Phase II ESA have been compared to the *Contaminated Sites Regulation* (CSR) under the *Environmental Management Act* consolidated as current to January 22, 2019, and the *British Columbia Approved Water Quality Guidelines (AWQG) March 2018 Summary Report*. The applicable CSR standards for the Site have been identified through land and water use determinations as detailed within Appendix G. Assessment Standards.

Due to modernised analysis of petroleum hydrocarbons and updated standards, gross petroleum hydrocarbon screening parameters for MO&G and total extractable hydrocarbons (TEH) were not compared to current standards. It is noted that the reported concentrations exceeding 1994 applicable Level B standards are still considered high and identified as AECs. There are no current CSR standards for TEH and MO&G and they are captured within, although not directly comparable to, the current LEPH, HEPH and PAHs. Therefore samples with levels of MO&G or TEH in excess of Level B criteria are considered COCs for LEPH/HEPH and PAHs, moving forward. Vapour was not previously analyzed and remains a media of concern where volatile contaminants are noted.

- Envirochem concluded that based on their findings, soil remediation was recommended within three areas of the Site: metal contaminated soils within the vicinity of the blacksmith shop (AEC 1- Blacksmith shop), petroleum hydrocarbon contaminated soils beneath the grease rack adjacent to small parts storage shed (AEC 2- Grease Rack/Pit & Small Parts Shed), and in the vicinity of the secondary steam engine (AEC 3- Mill).

- Other petroleum contamination identified within the Site were stated as not a significant risk to human health and that since the Site will continue as an operational mill, minor oil staining will likely continue to occur, therefore it was suggested these minor contaminated areas could be left in place.

3.2.9 *McLean Mill National Historic Site, Port Alberni, B.C. Soil Remediation Summary. 1995. Envirochem Special Projects Inc. (Envirochem)*

- Envirochem completed a summary report on the remediation conducted within the McLean Mill property for the City of Port Alberni. Soil remediation was recommended for three areas within the Site, identified within the Envirochem reports as: AEC 1- Metals contamination within the vicinity of the blacksmith shop; AEC 2 – soils beneath the grease rack adjacent to the small parts storage shed; and AEC 3 – petroleum hydrocarbon contaminated soils in the vicinity of the secondary steam engine at the mill. The report stated that remediation was recommended for areas where heavy-end petroleum hydrocarbons and metals were observed.
- Remediation activities within each AEC are summarized below:

AEC 1- Blacksmith shop: Metal contaminated surface soils were excavated down to 30 cm from the northwest exterior surrounding the blacksmith shop. An estimated 10 m^3 of soil was removed from the area. Three final confirmation samples, collected from the floor of the excavation, show that results were found to be less than the *CMCS - BC industrial remediation criteria* (Level C). The excavated area was then backfilled with clean imported granular soils.

AEC 2- Grease Pit: Soils impacted with MO&G were excavated from below the grease rack area in two stages. In total approximately 5 m^3 of petroleum hydrocarbon contaminated soil was excavated and stockpiled. Three final confirmatory soil samples were collected on March 25, 1994. Analytical results indicated that MO&G concentrations were less than the BC Environmental Level C criteria.

AEC 3- Mill Area: Petroleum hydrocarbon contaminated soil was found in the vicinity of the mill area adjacent to the secondary steam engine, initially at depths up to 0.3 m. With further excavation, contamination was identified to depths of 1 m in select areas and was also observed within select thin layers beneath the mill. Manual excavation was used to remove contaminated soils up to 0.8 m depth and the remaining contamination was left in place due to concerns regarding structural integrity of the mill pilings. Confirmatory samples collected after the excavation indicated that the average residual soil concentrations of MO&G were 5%. The excavation was reportedly backfilled with clean, relatively low permeable material.

Hydrocarbon contaminated soils excavated from the grease pit and mill area were placed into a bioremediation treatment cell (biocell) on Site, though the specific location of biocell and ultimate use and quality of soils was not noted.

The analytical results from the confirmatory soil samples have been compared to current applicable standards for the Site by TerraWest, see Table 12 for compared results. Gross petroleum hydrocarbon screening parameters for MO&G and TEH results were not compared to current standards, though it is noted that the reported concentrations exceeding the applied Level B standards are still considered high and identified as AECs.

The excavated soils, reportedly placed in an on-Site biocell, could present an area of environmental concern, however the location, possible treatment and final quality and disposal location of these soils was not confirmed.

Below is a summary of the AECs partially remediated by Envirochem and conclusions, when compared to current standards, as summarized by TerraWest:

APEC #	Activity Description	Remediation		Does AEC/APEC remain post remediation?
		Soil Analysis Completed	Groundwater Analysis Completed	
AEC 1	**Blacksmith shop**- formerly used to produce babbitted bearing and filing saw blades	Confirmation soil - Metals	No analysis	**AEC- metals in soil.** **APEC- metals in gw.**
AEC 2	**Grease Rack/Pit & Small Parts Shed**- former location of vehicle maintenance, observed soil staining over ground and stored metals, 5-gal. oil pails outside shed.	Confirmation soil- MO&G, TEH	No analysis	**AEC- Metals, MO&G, and TEH in soil.** **APEC – PAHs, LEPH, HEPH in soil, gw, vapour, metals in gw.**
AEC 3	**The Mill**- associated equipment where extensive oil staining was visible over ground.	Confirmation soil- MO&G, TEH	No analysis	**AEC- Metals, MO&G, and TEH in Soil.** **APEC- PAH, LEPH, HEPH in soil, gw and vapour, metals in gw (down-gradient gw location).**

3.2.10 *Metal Contaminated Soil Disposal-McLean Mill Historic Site, Port Alberni, B.C. 1995. Envirochem Special Projects. (Envirochem)*

- Letter to the B.C. Ministry of Environment requesting permission to dispose of metal contaminated soil in excess of the B.C. Environment CMCS Level B criteria for barium, copper, lead, tin and zinc to the Port Alberni Landfill. Approximately 6 m^3 of soil excavated soil from around the former blacksmith shop at the McLean Mill required disposal.

No information confirming the movement of these soils was provided.

3.2.11 *Restoration of McLean Mill National Historic Site, Phase 1 1995-96, Mill Pond Reconstruction. July 1995. Canadian Heritage Professional & Technical Services Pacific and Yukon Region*

- This report completed by the Canadian Heritage is the results of a project screening process for the restoration of the sawmill mill pond as detailed within the previous Draft Management Plan for the McLean Mill National Historic Site. This screening report presents the results of an additional environmental assessment.
- The report identified that the former dam along Kitsucksis Creek failed in 1991. The rebuilding of the dam structure was proposed as part of the Management Plan created for the McLean Mill to re-establish the mill pond.
- The report states that the mill pond excavation would involve the removal of accumulated detritus to a depth of 0.5-1.5 m, which would be loaded directly into trucks for removal from the Site. It notes that if stockpiling was necessary, that materials should be stockpiled in a location that prevents siltation into Kitsucksis Creek.
- The report presents a summary of mitigation measures proposed for the restoration of the mill pond, construction of the new dam, and the spillway fish ladder construction to reduce the impact of works on Kitsucksis Creek.

3.2.12 *McLean Mill Dam Retrofit Overview, Final Report. 2009. Northwest Hydraulic Consultants Ltd. (NHC)*

- This report completed by NHC for the Alberni Valley Enhancement Association, provides a proposed scope of work to address issues and deficiencies regarding the on-Site dam to improve its operation and safety.
- Two project options were proposed to modify the existing structure to include new flow control works or the alternative option to isolate the mill pond and construct a new river channel.

3.2.13 *McLean Mill Dam- Bypass Channel Construction Report (Draft). 2015. Northwest Hydraulic Consultants Ltd. (NHC)*

- The summary report completed by NHC details the construction of the McLean Mill Dam bypass channel in 2014. The project works completed the following tasks:

  -Site preparation included the relocation of a spar tree;

-Construction of a fish counting fence, bridge, bypass channel, saddle and diversion berm and diver; and, the installation of a diversion intake and pipe

- Excavated material from within the bypass channel and the sediment pond was hauled to a spoil area located south and southeast of the garage/storage shed east of the existing dam.

The report detailed remaining modifications to the bypass channel and a list of work that was not undertaken.

3.2.14 *Contaminants on the property designated the McLean Mill National Historic Site. 2017 (states March 26, 2016). Letter from J. Adams to Ministry of Environment, Environmental Protection Division*

- Letter to the B.C. Ministry of Environment – Environmental Protection Division by J. Adams was in regard to environmental related concerns involving activities occurring or previously occurred within the Subject Property. Mr. Adam's property is located down gradient of the Site along Kitsucksis Creek. Photos taken around the time of the letter being penned are appended.
- Photographs within the letter are described as the following and have been confirmed with J. Adams by TerraWest as to their subject and location:

Photo 1- Stored barrels situated on stained ground. Location identified as the former loading deck area east of the dip tank.

Photo 2- The rail car tanker located adjacent to the loading deck, northwest side of Site. Abandoned heating oil tanks and drums observed in the background.

Photo 3, 4 & 5- Rail tanker car located in the northwest portion of the Site.

Photo 6- Treated rail tie storage within the former treated storage area.

Photo 7- Former dip tank adjacent to rail lines in northwest portion of Site.

Photo 8- Partially buried rail tanker located west of log deck on the front side of the former care taker trailer (JA, TM, NM-pers.comm.).

Photo 9 & 10- Fill pipe observed adjacent to mill pond.

Photo 11- Surface soil staining below mill equipment.

3.2.15 *Compliance Notice Letter, McLean Mill National Historic Site, 5633 Smith Road, Port Alberni, B.C. 2017. Ministry of Environment, Environmental Protection Division. Letter to City of Port Alberni*

- This letter details findings by the Ministry of Environment, Environmental Protection Division Staff who conducted an inspection of the McLean Mill facility on March 29, 2017. This inspection was completed following a complaint see Section 3.2.14.
- Results of the inspection identified the following:

  -Barrels viewed were filled with rail plates or were empty, none were noted to be leaking.

  -Salvaged metal was noted throughout the Site and were identified as being stored for re-use by the Alberni Pacific Railway (APR).

  -No evidence of recent fish kill in the pond.

  -A railcar, historically used as a septic tank, was empty, but open to the elements allowing rainwater to enter which may drain to ground.

  -No evidence of hydrocarbon impacts below a fuel supply rail car.

  -Site reps indicated that rail ties are not burned on Site, but are stacked and stored for re-use by APR.

Photographs appended to the inspection report identified tanks adjacent to the rail fuel car "heating oil tanks" that were used as an oil/water separating system.

From the reported letter in Section 3.2.14, confirmation interview with letter author, and review of the compliance notice letter information, TerraWest has identified, or reconfirmed previously identified, APECs within the Subject Property:

APEC #	Activity Description	Soil Analysis Completed	Groundwater Analysis Completed	APEC or AEC?
APEC 8	**Loading Deck & Dip Tank Area**- Oil water separator system and stored barrels with staining beneath over ground within former loading deck area.	MO&G, chlorophenols metals analysed in 1994	metals, chlorophenol analysed in 1994	**APEC- PAH, LEPH, HEPH, chlorinated phenols in soil, groundwater and vapour.**
APEC 17	**Buried fuel rail car located west of log deck**- potential use as former septic tank.	No analysis	No analysis	**APEC- PAH, LEPH, HEPH in soil, and vapour.**

3.2.16 *Environmental Review and Opinion-McLean Mill National Historic Site, Port Alberni, B.C. 2017. Envirochem Services Inc. (Envirochem)*

This letter, composed by Envirochem, addresses the concerns raised by a member of the public (J. Adams) to the ENV about potential environmental impacts effecting his property. The concerns raised, and a response are detailed below:

1) & 3) The former dip tank was still in place and accessible to the public.

Envirochem identified that the investigation results for PCPs were compared to an interim criterion established in 1991 under the Federal Canadian Council of Ministers of the Environment (CCME) and that the current parkland standard that applies (7.6 mg/kg) is well above the reported concentrations seen in historical soil sampling. The impacts of PCP in groundwater was not evaluated in the former investigations.

2) Former oil tanks are still within the ground.

It was identified that the underground storage tanks below the area of the oil and gas shed were reported as essentially empty and left in place as to not impact the shed structure. Soil samples collected within the area during a previous investigation did not suggest soil quality impacts from fueling activities.

3) See #1

4) Questions on how former lumber demolished on Site was disposed of and if it was burned.

Envirochem was unaware of any specific details in regard to material disposal during the time of the restoration works.

5) & 6) Concerns about the final location of where soil ended up after the biocell grease rack remediation and if soil were supposed to go to a special waste dump.

The report indicated that Envirochem had no knowledge of what happened to the former bioremediation cell.

6) See #5)

7) Inquiry into whether an arsenic tank was removed.

Envirochem was unclear as to what the "arsenic tank" is referring to.

TerraWest recognizes the changes in standards from Industrial to Urban Park, the lack of pH data required to confirm some standards, the absence of groundwater assessments, and the passage of time between the assessment of the integrity of USTs in 1994 and this current review. No APECs or AECs were added or removed based on this information.

3.2.17 *Sediment and Water Sampling Results-McLean Mill. 2018. TerraWest Environmental Inc. (TerraWest)*

- TerraWest was engaged by D.R. Clough Consulting to complete sediment and surface water sampling within the mill pond located at the McLean Mill Historical Site.
- Three surface water samples and three sediment samples were collected from designated sampling locations within the mill pond. Surface water samples were analyzed for benzene, toluene, ethylbenzene, total xylenes, styrene methyl-t-butyl ether (BTEXSM), light extractable petroleum hydrocarbons (LEPH), heavy extractable petroleum hydrocarbons (HEPH), volatile petroleum hydrocarbons (VPH), polycyclic aromatic hydrocarbons (PAH) and metals. Sediment samples were analyzed for BTEXSM, EPH, VPH, LEPH/HEPH, PAHs, metals, polychlorinated phenols, and dioxins and furans.
- The standards applied for comparison were the BC Ministry of Environment and Climate Change, *Contaminated Sites Regulation (CSR)* Schedule 3.2 Generic Numerical Water Standards for freshwater aquatic life, irrigation, livestock, and drinking water use and Schedule 3.4 Generic Numerical Sediment Criteria for freshwater sensitive sediment.
- Results indicated concentrations of select PAH parameters, select metals, and total equivalency of polychlorinated dioxins and furans was found to exceed the sensitive sediment standards.
- Report recommendations indicated that further delineation works be conducted in addition to an assessment of the wider mill property's history and uses to help identify a potential source.

Upon the review of the Sediment and Water Sampling Results report, TerraWest has identified the following APECs within the Subject Property. Cobalt in surface water was initially identified as an exceedance, however additional information detailed in Section 3.2.18 removed the potential for "groundwater use for drinking water" standard and therefore cobalt is no longer a contaminant of concern.

APEC #	Activity Description	Sediment Analysis Completed	Surface Water Analysis Completed	APEC or AEC when compared to current Standards?
AEC14	**The Mill Pond**- used in the operation of the mill for floating logs - from 1927-1965 and again from 2001-2018 once dredging of the pond had occurred.	BTEXSM, EPH, VPH, LEPH/HEPH, PAHs, metals, polychlorinated phenols, dioxins and furans	BTEXSM, EPH, VPH, LEPH/HEPH, PAHs, and metals	**AEC – PAHs, metals, TEQ D&F in sediment**

3.2.18 *Groundwater Well Drilling, Fife Drilling, 1997*

As part of this historical review, TerraWest was informed about a drilling program conducted to assess the Site aquifer (EM-pers.comm.). In 1997, one borehole was advanced to 540 ft below grade to assess the potential to use the groundwater for a drinking water source. A review of the water well, installed by Fife Drilling, indicated soil stratigraphy of till between 10 to 100 ft, where bedrock was encountered. The well was continued through shale to 500 ft below grade where a water bearing rock formation was encountered. The estimated yield was 20 USGPM. Groundwater samples collected from this well were submitted for potability with results indicating Total Dissolved Solids of 1380 mg/L and sodium at 463 mg/L. These results preclude the future potential for the water to be used as Drinking Water. Therefore, the Drinking Water standards, presented in the CSR are considered to no longer apply.

The remainder of this page is intentionally left blank.

3.2.19 *Previous Report and Letters Summary of Existing APECs and AECs*

The following table presents a summary of all APECs and AECs identified within the previous reports. These APECs and AECs are presented on Figures 4, 5 and 6. Samples found to exceed current standards, or 1994 guidelines where no current CSR standard exists, were identified as an Area of Environmental Concern (AEC). Media or parameters that were not, or not thoroughly, investigated in the previous reports are listed as APECs. PAHs, LEPH and HEPH were not standard parameters of concern in 1994 and are therefore identified here as PCOC.

APEC #	Activity Description	Information Source	Soil Analysis Completed	Groundwater Analysis Completed	APEC or AEC when compared to current Standards?
AEC 1	**Blacksmith shop**- formerly used to produce babbitted bearing and filing saw blades.	1994 and 1995 Envirochem Investigation and Remediation reports (Section 3.2.8 and 3.2.9)	Surface soil- Metals, MO&G, PAHs	No analysis	**AEC- metals in soil.** **APEC- Metals in gw.**
AEC 2	**Grease Rack/Pit & Small Parts Shed**- former location of vehicle maintenance, observed soil staining over ground and stored metals, 5-gal. oil pails outside shed.	1994 and 1995 Envirochem Investigation and Remediation reports (Section 3.2.8 and 3.2.9)	Surface soil- Metals, MO&G, TEH	No analysis	**AEC- Metals, MO&G, and TEH in soil.** **APEC – PAHs, LEPH, HEPH, in soil, gw, vapour, metals in gw.**
AEC 3	**The Mill**- associated equipment where extensive oil staining was visible over ground.	1994 and 1995 Envirochem Investigation and Remediation reports (Section 3.2.8 and 3.2.9)	Surface soil- Metals, MO&G, TEH, PAHs	Dissolved metals, TEH	**AEC- Metals, PAHs, MO&G, and TEH in Soil.** **APEC- PAHs, LEPH, and HEPH, in gw and vapour, metals in gw (down-gradient gw location).**
AEC 4	**Garage**- former service pit, oil staining over garage floor, and abandoned heating oil tank behind garage.	1994 Envirochem Investigation and reports (Section 3.2.8)	Surface soil- Metals, MO&G	Dissolved metals, TEH, BTEX, Chlorinated Phenols	**AEC- MO&G, metals in soil.** **APEC -PAHs, LEPH, HEPH in soil, gw, and vapour.**
AEC 5	**Oil and Gas Shed**- three gasoline USTs are located beneath the shed. One diesel AST located behind the	1994 Envirochem Investigation and reports (Section 3.2.8)	Surface soil- MO&G, TEH, BTEX,	BTEX, Chlorinated Phenols	**AEC- MO&G, metals in soil.** **APEC- PAHs, LEPH, and**

APEC #	Activity Description	Information Source	Soil Analysis Completed	Groundwater Analysis Completed	APEC or AEC when compared to current Standards?
	shed.		Chlorinated Phenols, metals		**HEPH in soil, gw and vapour. Metals in gw.**
AEC 6	**Gin Pole/Donkey Engine and Machine Shop Area**- contains a small above ground storage tank containing hydraulic oil within the donkey engine. Minor soil staining observed beneath the engine. Scrap metal and two full 45- gallon drums outside shop.	1994 Envirochem Investigation and reports (Section 3.2.8)	Surface soil- MO&G, metals	No analysis	**AEC- MO&G, metals in soil.** **APEC- PAH, LEPH, and HEPH, metals in soil, vapour and gw.**
APEC 7	**Generator Building and Oil Shed (located southeast of mill)**- location of millwright & generator and former oil shed.	1994 Envirochem Investigation and reports (Section 3.2.8)	Soil- MO&G, metals	Metals, chlorinated phenols, BTEX.	**AEC- Metals, MO&G in soil. Metals in gw.** **APEC- PAHs, LEPH, HEPH in soil, vapour and gw.**
APEC 8	**Dip Tank & Loading Deck Area**- surrounding rail spur, loading deck and dip tank. Oil water separator system and stored barrels with staining beneath over ground within former loading deck area.	1993 MacMillian Bloedel Preliminary Assessment (Section 3.2.2) 1994 Envirochem Investigation and reports (Section 3.2.8)	Soil- MO&G, PAHs, Tetra-chlorophenol, Penta-chlorophenol, metals	Metals, Tetra-chlorophenol, Penta-chlorophenol	**AEC- Metals in soil** **APEC- metals and chlorinated phenols in gw down-gradient. Chlorinated phenols, Petroleum hydrocarbons in soil, and vapour.**
APEC 9	**Treated Wood Storage Area**- Located southeast of loading deck and east of rail spur.	1994 Envirochem Investigation and reports (Section 3.2.8)	Surface soil- MO&G, BTEX, Chlorinated Phenols	No analysis	**No AECs or APECs**
APEC 10	**Locomotive Shed**- location of storage shed for former locomotive.	1994 Envirochem Investigation and reports (Section 3.2.8)	Surface soil- MO&G	No analysis	**No AECs or APECs**
APEC 11	**Green chain**- located south of mill, electric motors allowed the movement of lumber out on a conveyor.	1994 Envirochem Investigation and reports (Section 3.2.8)	Surface soil- MO&G	No analysis	**No AECs or APECs**
APEC 12	**North of Mil Pond**- formal	1994 Envirochem	Surface soil-	No analysis	**AEC- Metals in soil.**

APEC #	Activity Description	Information Source	Soil Analysis Completed	Groundwater Analysis Completed	APEC or AEC when compared to current Standards?
	description of activity was not provided in the report.	Investigation and reports (Section 3.2.8)	MO&G, metals		**APEC- Metals in gw.**
APEC 13	**Scrap Burner**- former location of “bee hive” scrape burn pile.	1994 Envirochem Investigation and reports (Section 3.2.8)	Surface soil- MO&G, PAHs, metals	No analysis	**AEC- Metals in soil.** **APECs- metals in gw.**
AEC 14	**The Mill Pond**- used in the operation of the mill for floating logs -from 1927-1965 and again from 2001-2018 once dredging of the pond had occurred.	2018 TerraWest sediment and surface water sampling (Section 3.2.18)	Sediment- BTEXSM, EPH, VPH, LEPH/HEPH, PAHs, metals, polychlorinated phenols, dioxins and furans	Surface water- BTEXSM, EPH, VPH, LEPH/HEPH, PAHs, and metals	**AEC – PAHs, metals, TEQ D&F in sediment**
APEC 15	**Transformers**- located south of mill.	Section 3.2.3 notes that transformers on Site have been tested and results indicate PCB levels were below 50 ppm. Analysis of results were not provided within the report.			**APEC – PCBs within soil.**
APEC 16	**Site office (Arnold McLean House)**- formerly residential, subject of environmental investigation and remediation	1994 HBT Agra, Oil Spill Clean-up report (Section 3.2.7)	Soil- MO&G, TEH	No analysis	**AEC – MO&G in soil** **APEC – PAHs, LEPH, HEPH, EPH in soil, soil vapour and GW.**
APEC 17	**Buried fuel rail car located west of log deck**- potential use as former septic tank.	2017 Correspondence between J. Adams and BC ENV (Section 3.2.14)	No analysis	No analysis	**APEC- Petroleum hydrocarbons in soil, and vapour.**

These APECs and AECs will be carried through the remainder of the report and are presented on associated drawings.

3.3 Ministry of Environment Site Registry

A search of the BC ENV Electronic Site Registry (the 'Site Registry') was conducted using BC Online by TerraWest for evidence of regulatory activity, notices, environmental orders, offences or permits filed under the *Environmental Management Act* against the current land titles, or other properties within a 500 m proximal radius. The search results are current as of the date presented on the top left corner of the document.

The Site Registry search resulted in one result specifically pertaining to the Subject Property; with no other results for surrounding properties within a 0.5 km search radius. The details of the Registry report are presented below:

BC ENV Electronic Site Registry	
Site ID	1715
Civic Address	5633 Smith Road, Port Alberni, BC (The Site)
Date Registered	October 9, 1997
Date Updated	No updates noted
Notification of Off-Site Migration	None listed
Identified Schedule 2 Activities	**Suspected Land Use noted:** **I4** – Treated wood storage at the site of treatment **I7** – Wood treatment (anti sapstain or preservation) **B1** – Battery (lead acid or other) manufacturing or wholesale bulk storage **F7** – Petroleum production, produced water storage aboveground/underground tank **G2** – Vehicle repair/salvage/wrecking
Additional Comments	The detailed report and documents obtained from the BC ENV indicated the following activities or events occurred on this property: **1993** – Site investigation report submitted, Investigation of Potential Site Contamination at McLean Mill, Port Alberni (See Section 3.248 for report summary). **1994** – Soil Remediation Submitted for a fuel oil spill on-Site, (See Section 3.2.7 for report summary). **1994** – Site Investigation report submitted by Envirochem Special Projects Inc. and City of Port Alberni, metals contamination surrounding blacksmith shop (See Section 3.2.8 and 3.2.9 for report summary). **1995** – Case Management Item, soil suitable for disposal at Port

	Alberni Regional Landfill. (Soils from blacksmith shop). (See Section 3.2.10 for report summary).

A copy of the search results generated by the Site Registry and detailed report are presented in Appendix H.

3.4 FEDERAL CONTAMINATED SITES INVENTORY

A search of the Federal Contaminated Sites Inventory was conducted by TerraWest for evidence of known contaminated sites under custodianship of departments, agencies, and consolidated Crown corporations, and/or contaminated sites in which the Government of Canada has accepted full or partial financial responsibility.

The Federal Contaminated Sites Inventory search results did not return any results specifically pertaining to the Site; however, the search did return one record for the Sprout Falls fishway (Site ID: 00021098) approximately 4 km southwest of the Site. Based on latitude and longitude and brief description provided, this site does not appear to be related to the Subject Property or near and was therefore not researched further.

3.5 AERIAL PHOTOGRAPHS & HISTORICAL LAND USE

The historical land use for the Site was determined through an historical records review as discussed in the Sections above. Additional historical information was obtained from aerial photographs from 1951, 1957, 1964, 1968, 1972, 1975, 1979, 1986, and 1992 from the University of British Columbia, 2005, 2012, 2015, 2017 and 2018 from Google Earth. The information gleaned from available aerial photographs for the Subject Property and adjacent or neighbouring properties is summarized below:

Time Period	Description of Subject Property and Adjacent or Neighbouring Properties
1951 to 1964	**Subject Property:** The Subject Property appears to be developed during this time and is possibly in use, as observed by ground disturbance seen within aerial photographs. Details provided below are limited due to the poor quality of the aerial photographs. There appears to be a long rectangular building (likely the mill building) located in the north-central portion of the Site. Several cleared areas are observed to the west, and southwest of the mill building with three additional areas that extend northwest off-Site. A main road appears to enter the Site from the southeast corner of the property where it terminates within a large rectangular yard. A spur road is visible to the south of the main road and it enters the Site in the south-central portion. There appears to be a circular structure located to the north of the long rectangular building. Other buildings

Time Period	Description of Subject Property and Adjacent or Neighbouring Properties
	appear to be located south, southeast of the mill building, but cannot be distinguished. **Neighbouring Properties:** The adjacent property to the east shares its boundaries with the Subject Property on its north, northeast, east, and southeast sides and is mainly forested. This property appears to contain a large rectangular building connected by a road from the Subject Property within the 1957 aerial photograph. A portion of the land beyond this building appears to be cleared of trees for possible agricultural use. Further northeast, within this adjacent property, appears to be a small building along a spur road. The neighbouring property to the southwest appears to have some clearing off the main road (Smith Road) that enters the Subject Property. The majority of the area appears treed. The remaining adjacent properties appear to be forested.
1968 to 1992	**Subject Property:** In the 1968 photo, the Subject Property appears to have less activity occurring, as observed by bright cleared areas within main roads entering the Site and former yards appear to be slightly darker and revegetated. The long rectangular building appears to have an additional structure extending out from its west side which appears to be removed by the 1992 aerial photograph. A large wetted area was visible adjacent, to the northeast side of the mill building in the 1968 aerial photograph. Smaller buildings appear to be present northwest of this wetted area. This wetted area slowly appears to become overgrown with vegetation and appears be no longer present by the 1986 aerial photograph. **Neighbouring Properties:** No major changes are evident on the surrounding adjacent properties during this time compared to the last period. The neighbouring properties to the southeast and northeast appear to have areas cleared of trees for possible agricultural activity.

2005 to 2018	**Subject Property:** The long rectangular mill building, located in the north-central portion of the Site, appears to have been renovated with new construction visible and the addition of a structure extending out from the mill's west side similar to the structure previously seen prior to 1992 aerial photographs. The previously seen wetted area, to the east of the mill, appears re-established. A small rectangular building is now visible within the southeast portion of the Site with a second structure visible directly south of this new building. **Neighbouring Properties:** The adjacent property to the east appears to no longer contain a portion of cleared land west of the large building. Smith road now clearly connects with Debeaux Road running south from the Subject Property. There appears to be some clearing of trees and the establishment of a building in the south adjacent property within the 2017 aerial photograph. No major changes are evident on the other surrounding adjacent properties during this time compared to the last period.
Comments	From the aerial photograph evidence, APECs could not be clearly identified within the Subject Property or neighbouring properties at this time.

An inquiry was made to the University of British Columbia GIC department for the availability of additional aerial photographs of the Subject Property from the late 1990s. The response from the department indicated that no additional aerial photographs, with the exception of 1990, were available. Excerpts of select aerial photographs are presented in Appendix I.

4.0 SITE INSPECTION

TerraWest conducted a Site inspection to confirm land uses and activities to identify the potential for negative environmental impacts. The data collected from the Site inspection is presented below:

General	
Date Conducted	January 17, 2017
TerraWest Personnel	Kate Gilbert
Limitations	Interior inspection of buildings on Site were limited to the following buildings, reference # (see Figure.3) 1- Visitors centre hall, 3- Office-Admission, 4- Washrooms, 21- Mill. Interior building descriptions, historical and current use

		information were provided through interviews (BE, JM, KS, JA, TP, TM, SK-pers.comm.).
Property Description		
Property Use	**Current**	The Site is currently designated a National Historic Site and operates as a historical steam powered sawmill, open to the public with access to the Site via rail and car. Operations on Site include seasonal historical logging and milling operations demonstrations as well as a fish hatchery.
	Historical	The Subject Property operated as a steam sawmill between 1927-1965 by the R.B. McLean Lumber Company. Operations included rail and truck transport of logs to Site, unloading into a man-made mill pond, milling of logs through steam powered operations, and shipment of lumber to markets via rail and truck. Once operations ceased after 1965, the Site remained vacant with no activities until 1989 when the Site was declared a National Historic Site for its association with the forest industry in BC. During the early 1990s extensive restoration and conservation works were conducted on the Site's buildings, former structures, and equipment. In 2000 the Site officially opened to the public as a tourist destination to showcase early 20th-century sawmill and logging operations. These operations have continued to present day with seasonal logging and milling demonstrations. See Section 3.2.1 for additional details relating to the former Site infrastructure and operations.
Roads, Parking Facilities, & Right-of-Ways		Two parking facilities were located in the southeast corner of the Site, accessed from Smith Road. A maintenance road connected to Smith Road, in the southwest corner of the Site, which allowed for access into the milling area and further northeast into the logging area. There was one railway line that entered the Site in the south, where it crossed Smith Road and terminated at the west-northwest Site boundary. This rail line was observed to contain creosote rail ties along its entire reach within the Subject Property.
Percentage Occupied by Buildings and Paved Areas	**Current**	10% buildings with the remaining gravel, grasses areas and forested land.
	Historical	9% buildings with the majority of the area either unpaved or forested as seen in aerial photographs.
Fill Materials		Large cobbles observed piled adjacent to Machine Shop-34, located in the north portion of the Site adjacent

		to Kitsucksis Creek bypass.
Topography		The Site has an observed decrease in grade towards the north-northeast section of Site.
Ground Cover		Open vegetated yards, parking lots and roads within the Site were gravelled.
Surface Water Features		Kitsucksis Creek, entered the Site from the north boundary and flows southeast through a constructed diversion creek with diverted flows entering a constructed mill pond.
Indications of Contamination in Water Features		None observed
Buildings Description		
Buildings	**Current-Historical**	Site buildings were originally constructed, beginning in 1926. Construction was wood post and beam over bare ground. Recent buildings developed in the late 1990s are constructed over concrete slabs. See Appendix E. for reports detailing building construction details[14].
Heating & Cooling Systems	**Current**	Building identification numbers presented. See Figure 3 Site Plan-Facilities for building numbers, locations and descriptions. 2, 3, 4, 9, 35- Electric heat 1, 25- Propane heat 7- Oil heat (possibly no longer in use) Remaining buildings did not have heat at the time of the Site inspection.
	Historical	Former buildings on Site would have used wood or sawdust burners for heating (JM, KS-pers.comm.). Former care taker trailer, located where Caretaker RV-16 was located in the early 1990s, was heated by oil heat (NM, TM-pers.comm.).
Current Mechanical Equipment		• Steam powered milling equipment located within the Mill-21and Green Chain-23. • Historical wood/sawdust powered boiler located within Boiler House-25. • Propane powered boiler installed in early 2000s within the building adjacent to the Boiler House-25 (considered one for report). • Fire protection pump powered by a diesel engine located within the Oil Shed-Pump House- 28.
Electrical Transformers or Capacitors		Three historical transformers (building 26) were observed on Site, no longer in operation. Anecdotal information

[14] Public Works and Government Services. 1994. McLean Mill National Historic Site, Draft Document.

		identified that BC-Hydro removed transformer oils and replaced transformers (TP-pers.comm.). Three electrical transformers were observed on a hydro pole within the east portion of the Site.
Waste & Emission Generation		
Manufacturing Processes & Raw Materials	**Current**	Seasonal manufacture of milled wood either for order or for public demonstration purposes. Propane powered boiler.
	Historical	Historical creation of milled wood products involved the use of wood preservatives or wood treatment products. Historical Dip Tank- 17 would have been used to store the chemical solutions for wood treatment. Former location of the dip tank was assumed to be on the north-west side of the mill and lumber deck prior to the use of the Ross Carrier and crane as noted by (Taylor, 1992) and confirmed by (JM, KS-pers.comm.). No conclusive evidence was found to confirm a former dip tank location through investigations. Due to this lack of information and the historical restorations conducted on the log deck and surrounding area, TerraWest does not consider this area as an APEC.
Potential Schedule 2 Activities	**Current**	I9 – Sawmills H23 – Waste oil reprocessing, recycling or bulk storage F5 – Petroleum product, other than compressed gas, dispensing facilities, including service stations and card locks
	Historical	I9 – Sawmills I7 – Wood treatment -anti-sapstain or preservation (Historical) G6 – Rail car or locomotive maintenance, cleaning, salvage or related uses, including railyards G2 – Automotive, truck, bus, subway or other motor vehicle repair, salvage or wrecking F5 – Petroleum product, other than compressed gas, dispensing facilities, including service stations and card locks
Waste Generation & Disposal or Treatment	**Current**	Sawdust and wood scraps were by-products of on-Site milling operations. These items are burned within the Waste Burn Pile- 24(TP, JM-pers.comm.). Barrels full or partially full of liquid were observed on pallets directly east of the Fuel Tanker Car-18 within the Loading Deck- 17 area. Boiler operations (Boiler House-25) included the addition of water treatment agents. The chemicals used for treatment included a powdered oxygen scavenger for

		protection against oxygen corrosion and a scale build-up inhibitor (TP-pers.comm.). During operations and maintenance of a boiler, blowdowns occur periodically where discharge of water, boiler chemicals and mineral deposits occur. The current discharge location for the boiler at the Site is unconfirmed, the potential location is identified as APEC 18.
	Historical	Heating oil AST's and barrels full of oil were formerly located within the Loading Deck-17 area indicated in a letter to ENV.[15] Former use of heating oil tanks was identified as a modified oil water separator (JM, BE-pers.comm.). As a result of these activities, and information obtained from previous reports, the Loading Deck - 17 is considered an APEC.
Fuel Storage Tanks	**Current**	Rail Tanker Car- located in the west portion of the Site (Fuel Tanker Car- 18). Tanker car was brought to Site to fuel locomotive steam engines (BE-pers.comm.) At the time of the Site visit, the tanker car was located on rail lines over gravel. The fuel transfer area had secondary containment from the car to the second rail line. Diesel tank AST, volume unknown, located in the Oil Shed/Pump House- 28, used to store diesel for the water pump used in fire protection works. Tank was located over concrete slab and footings (JM, SK, TP-pers.comm.). Heating oil AST, approximately 500 L, was located southwest side of the A. McLean House- 7. Three propane cylinders approximately 3000 L each, located on north side of service road in the southwest portion of the Site. Fuel pumps and three underground fuel storage tanks (USTs) of various sizes were currently located beneath the Gas and Oil Shed - 31 used formerly in historical sawmill operations (1927-1965). One above ground fuel tank, approximately 800 L were located on northwest side of the Gas and Oil Shed- 31, formerly used during historical sawmill operations.
		Partially buried rail tanker car, volume unknown, was located west of the log deck within a slightly treed area, as of 2016 (JA-pers.comm.). Reportedly used as a septic tank, possibly connected to the former caretaker trailer-16 (TM, NM, BE-pers.comm.).
Storage Containers		Barrels containing unknown liquids and others containing rail yard materials were observed within the

[15] J.Adams. 2016. Contaminants on the property designated the McLean Mill National Historic Site. Letter to Ministry of Environment, Environmental Protection Division

		former treated wood storage area and adjacent to the Loading Deck- 17 area. Cleaning products found within Visitors Centre-Hall-1: • Suman T20 Low Temperature Sanitizer in 18 L pail • Diverforce, machine dish detergent in 18 L pail • Liquid Rinse Additive by Sysco in 9 L jug
Comments		The locations of current and former fuel tanks, as well as areas utilized as storage areas for drums are identified APECs and AECs as previously detailed. Newly identified APECs are presented below.
Odours		None observed
Staining	**Surface**	Dark surface staining was noted below the Fuel Tanker Car-18, on the surrounding gravelled area. Staining noted along the wood deck beside the Green Chain-23, closest to the Lumber Deck-22. Dark staining observed over ground below milling equipment within the Mill-21. Staining and mould growth observed over ground below the cooking oil collection bin in the Waste Collection Area-5.
	Walls & Ceilings	None observed
Visible Signs or Sources of Pollutants on the Surface of the Soil		None observed
Stressed Vegetation		None observed
Drains & Sumps		None specifically noted
Air Emissions		Steam from boiler is emitted during milling operations.
Services & Utilities		
Water		Cherry Creek Improvement District. Subject Property is provided with potable water from the Cherry Creek Water system which originates from the Cold Creek watershed.
Sewer or Septic System		Two domestic septic fields and/or septic tanks were observed on Site. One east of Cookhouse-11 and the second east of Workers House-6. Third domestic septic was field reportedly located west of Office-Admissions-3 building within a treed area (EH-pers.comm.)
Storm Sewer		One observed on the south side of the Gift Shop (former Café building-2). Discharge location was not identified.

Electricity	BC Hydro
Natural Gas	No connection to Site
Solid Waste Disposal	Third party waste collection company. Cooking oil collection bin was observed to be open to the elements and was full of water. Mold and obvious staining from contents over spilling were observed below the collection bin.
Other	
Identified Hazardous Materials & Special Attention Items	None specifically identified; however, asbestos or other hazardous materials may potentially be present in the building.

Photographs of the Site and surrounding area taken during the Site investigation are presented in Appendix J and Figure 3 Site Plan – McLean Mill Facilities provides description of locations identified within the section above.

APECs identified during field inspection are summarized in the table below, if not already identified within Section 3.2.19.

APEC #	Activity Description	Soil Analysis Completed	Groundwater Analysis Completed	APEC or AEC when compared to current Standards?
APEC18	**Potential Boiler Discharge Location**- Boilers used in the operation of the mill for generating steam power -from 1927-1965 and again from 2001-2018.	No analysis	No analysis	**APEC – Metals within soil and groundwater**
APEC 19	**Fuel Tanker Car-18**- Bunker C fuel storage and transfer area from approximately 2001-2018. Surface staining observed over ground beneath rail car.	No analysis	No analysis	**Soil - PAHs, LEPH, HEPH** **Groundwater- PAHs, LEPH, HEPH** **Vapour- volatile hydrocarbons**
-	**Rail Ties-**Used in the railway corridor that provides train access to the Site.	The leaching of PAHs, select metals and phenolic compounds from creosote impregnated railroad ties to surrounding soils.		In the event that the railway corridor is removed, soils within the rail bed should be assessed.

4.1 Neighbouring Properties & Land Use

Adjacent and neighbouring properties within a 300 m radius were reviewed by TerraWest from public right-of-ways, Site boundaries, or online research for indications of current and/or historical land use activities that could potentially represent off-site sources of contamination. A summary of neighbouring property land uses is presented below:

<table>
<tr><th>Direction From Site</th><th>Address</th><th>Current Land Use</th><th>Historical Land Use and Properties of Potential Environmental Significance</th></tr>
<tr><td>North</td><td>No civic address</td><td>Managed forest area</td><td>Historical timber lands.</td></tr>
<tr><td>Northeast</td><td rowspan="3">No civic address</td><td rowspan="3">Managed forest area</td><td>Historical timber lands.</td></tr>
<tr><td>East</td><td>Lease forest lands where a barn was used for storage of mill equipment, IHS equipment and historical mill artifacts (JM-pers.comm.). Barn and former field to the northeast formerly used by residents of the mill during the former operations (JM-pers.comm.).</td></tr>
<tr><td>Southeast</td><td>Historical timber lands.
Further southeast (neighbouring) is 5205 Batty Road, location of farm and agricultural fields located down stream of Site along Kitsucksis Creek (JA-pers.comm.). Agricultural fields clearly visible in aerial photographs from 1968.</td></tr>
<tr><td rowspan="2">South</td><td>7051 Debeaux Road</td><td>Rural residential</td><td>Historical timber lands until the 2017 aerial photograph when a residential building was noted. Confirmed during the Site inspection.</td></tr>
<tr><td>5625 Debeaux Road</td><td>Managed forest area</td><td>Historical timber lands.</td></tr>
<tr><td>Southwest</td><td>No civic address</td><td>Railway spur connecting into the Site</td><td>Use consisted of timber land and railway spur running from the McLean Mill Site through this property, zoned M4- industrial open storage district[16].</td></tr>
</table>

[16] Regional District of Alberni-Clayoquot Consolidated Zoning By-law (2018). Zoning Bylaw No. 1971. Available from https://www.acrd.bc.ca/cms/wpattachments/wpID174atID2700.pdf, and https://www.acrd.bc.ca/dms/documents/Maps/Alberni-Valley/d10.pdf

Direction From Site	Address	Current Land Use	Historical Land Use and Properties of Potential Environmental Significance
West	No civic address	A portion of the Site is a railway boneyard associated with the Site's railway activities (BE-pers.comm.).	Historical use of the Site appear to be former wood storage yards for the McLean Mill up, until 1965.
Northwest	No civic address	Managed forest area	Historical timer lands and marsh area.

Neighbouring properties were not identified as APECs at this time.

5.0 CONCLUSIONS

Based on the research and investigations for this Stage 1 PSI, TerraWest has identified the following APECs and AECs. The APECs and AECs are described in the table below with reference to specific PCOCs and COCs within the following table:

AEC/ APEC #	Activity Description	Possible Mechanisms of Contamination	Media- PCOCs/ COCs
AEC 1 (on-Site)	**Blacksmith Shop-29**- formerly used to produce babbitted bearing and filing saw blades from 1927- 1965. Demonstration activities occurring periodically within the building since 2000 to present (BE-pers.comm.). Envirochem 1994, identified metals contamination in soil. Soil remediation works were completed in 1995 by Envirochem. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.4, 3.2.8, 3.2.9, Tables 1, 2, 4, 5, and 12 and Figure 4 for further details.	Manufacturing of metal products	**Soil COC**- select metals **Groundwater PCOC**- select metals
AEC 2 (on-Site)	**Grease Rack/Pit & Small Parts Shed-33**- former location of vehicle maintenance between 1927-1965. Observed soil staining over ground and stored metal and oil pails outside shed during 1994 Envirochem investigations. Soil remediation works were completed in 1995 by Envirochem. Review of analytical confirmation samples from remaining soils exceeded current applied standards. See Sections 3.2.8, 3.2.9 and Table 1 and Figure 4 for further details.	Vehicle repair and maintenance	**Soil COC -** PAHs, LEPH, HEPH select metals **Groundwater PCOC-** PAHs, LEPH, HEPH select metals **Vapour PCOC-** volatile hydrocarbons
AEC 3 (on-Site)	**The Mill-21**- associated mill equipment where extensive oil staining was visible during Envirochem investigations in 1994. COCs included metals, oil and grease and TEH. Soil remediation works were completed in 1995 by Envirochem. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.3, 3.2.8, 3.2.9. and Table 2, 4, 5, and 7 and Figures 4 & 5 for further details.	Sawmilling operations	**Soil COC -** PAHs, LEPH, HEPH, select metals **Groundwater PCOC-** PAHs, LEPH, HEPH, select metals **Vapour PCOC**- volatile hydrocarbons
AEC 4 (on-Site)	**Garage-32**- former service pit, oil staining over garage floor, and abandoned heating oil tank under lean-to. Envirochem 1994, completed soil investigations for metals and MO&G and a limited groundwater investigation for dissolved metals, TEH, BTEX, and Chlorinated Phenols. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.3, 3.2.8 and Tables 2, 7, 10 and Figures 4 &	Vehicle repair and maintenance	**Soil COCs** - PAHs, LEPH, HEPH, select metals **Groundwater PCOC-** PAHs, LEPH, HEPH, select metals **Vapour PCOC**- volatile hydrocarbons

AEC/ APEC #	Activity Description	Possible Mechanisms of Contamination	Media- PCOCs/ COCs
	5 for further details.		
AEC 5 (on-Site)	**Gas and Oil Shed-31**- three gasoline USTs are located beneath the shed. One diesel AST located behind the shed. Envirochem completed soil investigations in 1994 for metals and MO&G and groundwater investigations for BTEX, and Chlorinated Phenols. Review of analytical samples exceeded current applied standards. See Sections 3.2.2, 3.2.3, 3.2.8 and Tables 3 and 10 and Figures 4 & 5 for further details.	Petroleum storage in underground (UST) and above ground (AST) tanks-fuel transfer area.	**Soil COC and PCOC-** BETSMX, PAHs, LEPH, HEPH, select metals **Groundwater PCOC-** PAHs, LEPH, HEPH, select metals **Vapour PCOC**- volatile hydrocarbons
AEC 6 (on-Site)	**Former Donkey Engine and Machine Shop Area-38 & 34**- Envirochem 1994 report identified the following: a small AST containing hydraulic oil within the donkey engine. Minor soil staining observed beneath the engine. Scrap metal and two full 45- gallon drums outside machine shop. Envirochem 1994, completed soil investigations for metals and MO&G. Review of analytical samples exceeded current applied standards. See Sections 3.2.8 and Table 3 and Figure 4 for further details.	Petroleum storage in AST and surface staining from spilling or equipment loss.	**Soil COC** - PAHs, LEPH, HEPH, select metals **Groundwater PCOC-** PAHs, LEPH, HEPH, select metals **Vapour PCOC**- volatile hydrocarbons
AEC 7 (on-Site)	**Generator Building (Millwright) and Oil Shed-27 & 28**- location of former millwright shop and former oil shed east of mill, now location of diesel water pump for fire protection system. Envirochem 1994, completed soil investigations for metals and MO&G and groundwater investigations for metals, Chlorinated phenols, and BTEX. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.8 and Tables 4, 8, and 11 and Figure 4 for further details.	Petroleum and equipment storage and use.	**Soil COC** - PAHs, LEPH, HEPH, select metals **Groundwater PCOC-** PAHs, LEPH, HEPH, select metals **Vapour**- volatile hydrocarbons

AEC/ APEC #	Activity Description	Possible Mechanisms of Contamination	Media- PCOCs/ COCs
AEC 8 (on-Site)	**Dip Tank/Loading Deck Area-17**- surrounding rail spur, loading deck and dip tank. Former location of wood treatment product, former location of oil water separator system and stored barrels with ground staining. Envirochem 1994, completed soil investigations for metals, MO&G, PAHs, chlorinated phenols and groundwater investigations for metals, and chlorinated phenols. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.3, 3.2.4, 3.2.8, 3.2.14, 4.0 and Tables 3, 6, and 7 and Figures 4 & 5 for further details.	Chemical wood treatment location and petroleum storage and transfer area.	**Soil COC-PCOC** - PAHs, LEPH, HEPH, select metals, chlorinated phenols **Groundwater PCOC**- PAHs, LEPH, HEPH, select metals, chlorinated phenols **Vapour PCOC**- volatile hydrocarbons
AEC 12 (on-Site)	**North of Mil Pond**- formal description of historical activity in the area was not provided in the 1994 Envirochem report. Envirochem 1994, completed soil investigations for metals and MO&G. Review of analytical samples exceeded current applied standards. See Sections 3.2.8, 3.2.9. and Table 3, for further details.	Not identified through investigations.	**Soil COC** – select metals **Groundwater PCOC-** select metals
AEC 13 (on-Site)	**Scrap Burner-24**- former location of "bee hive" scrap burn pile between 1927-1965. Used sporadically as a burn pile for scrap wood and sawdust between 2001-2018. Envirochem 1994, completed soil investigations for metals, MO&G and PAHs. Review of analytical confirmation samples exceeded current applied standards. See Sections 3.2.8, 3.2.9. and Table 5 and Figure 4 for further details.	Mill waste burning over open ground.	**Soil COC –** select metals **Groundwater PCOC-** select metals
AEC 14 (on-Site)	**The Mill Pond**- used in the operation of the mill for floating logs from 1927 to1965 and again between 2001-2018 after pond dredging occurred in the late 1990s. TerraWest 2018, completed sediment sampling for hydrocarbons, metals, polychlorinated phenols, dioxins and furans and surface water investigations for hydrocarbons, and metals. Review of analytical resulted indicated select exceedances when	Historical sawmill operations.	**Sediment COC**- Select PAHs, select metals, PDCC/F

AEC/ APEC #	Activity Description	Possible Mechanisms of Contamination	Media- PCOCs/ COCs
	compared to applied standards. See Section 3.2.3 and 3.2.17 and Figures 5 for further details.		
APEC 15 (on-Site)	**Transformers-26**- three historical transformers located south of the mill building, used between 1949-1965. Section 3.2.3 notes that the transformers have been tested and results indicate PCB levels were below 50 ppm, current soil standards are between 1.5 and 35 ppm. Analysis of results were not provided in the report. Anecdotal information indicated that transformers may have been taken off-Site, emptied and returned to the Subject Property (TP-pers.comm.).	Transfer and or leakage of transformers during former operations	**Soil PCOC** - PCBs
AEC 16 (on-Site)	**Site office (Arnold McLean House)-7**- formerly residential and office building, subject of environmental investigation and soil remediation, by HBT AGRA, due to an accidental release of stove oil from an AST at the rear of the building, See Section 3.2.7.	Petroleum storage leak to ground.	**Soil COC**- PAHs, LEPH, HEPH **Groundwater PCOC**- PAHs, LEPH, HEPH **Vapour PCOC**- volatile hydrocarbons
APEC 17 (on-Site)	**Buried Fuel Rail Car**- located west of logging deck. Identified within previous letter on environmental concerns within the Subject Property, see Section 3.2.14. Anecdotal information identified its potential use as a former septic tank.	Historical petroleum storage, industrial septic system.	**Soil PCOC** - PAHs, LEPH, HEPH **Groundwater PCOC**- PAHs, LEPH, HEPH **Vapour PCOC**- volatile hydrocarbons
APEC 18 (on-Site)	**Boiler Discharge Location-** Steam boilers used in the operation of the mill between 1927-1965 and again between 2001and 2018. It is not known if the former or current functioning boiler is connected to appropriate discharge facilities (BE, TP, JA-pers.comm.). Blowdown discharge has the potential for metals to be discharged with water.	Blowdown discharge containing select metals	**Soil PCOC**- select metals **Groundwater PCOC-** select metals
APEC 19 (on-Site)	**Fuel Tanker Car-18-** Bunker C fuel storage and transfer area from approximately 2001to 2018 (BE-pers.comm.). Surface staining	Petroleum storage and	**Soil** - PAHs, LEPH, HEPH **Groundwater**- PAHs,

AEC/ APEC #	Activity Description	Possible Mechanisms of Contamination	Media- PCOCs/ COCs
	observed over ground beneath rail car during Site inspection.	transfer area	LEPH, HEPH **Vapour**- volatile hydrocarbons

BTEXSM – benzene, toluene, ethylbenzene, styrene, methyl t-butyl ether
EPH – Extractable petroleum hydrocarbons
PAHs – polycyclic aromatic hydrocarbons
LEPH – light extractable petroleum hydrocarbons
HEPH – heavy extractable petroleum hydrocarbons
PCBs- Polychlorinated biphenyls
PDCC/F- polychlorinated dioxins and furans

Schedule 11 soil vapour parameters: benzene, ethylbenzene, toluene, m&p-xylenes, o-xylenes, total xylenes, n-hexane, n-decane, VPH (C6-C13), naphthalene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, 1,3-butadiene, isopropylbenzene, 1,2-dibromoethane, 1,2-dichloroethane, methyl tert-butyl ether, methylcyclohexane

1994 and 1995 reports reference analyses and criteria for Mineral Oil and Grease (MO&G) and Total Extractable Hydrocarbons (TEH). There are no current standards for these parameters and are captured within, although not directly comparable to, the current LEPH, HEPH and PAHs. Therefore samples with levels of MO&G or TEH in excess of Level B criteria were considered COCs for LEPH/HEPH and PAHs.

TerraWest recommends a Stage 2 PSI to investigate and delineate the soil, vapour, and groundwater in the APECs and AECs listed above and to compare concentrations of PCOCs and COCs, if present, to the applicable standards.

As per WorkSafeBC, Occupational Health and Safety, and/or municipal or district guidelines, a Hazardous Material Assessment may be required prior to any renovations, modifications, or demolition activities to on-Site buildings or other structures.

6.0 LIMITATIONS & CLOSURE

TerraWest Environmental Inc. has prepared this report for the exclusive use of its Client, the City of Port Alberni on behalf of D.R. Clough Consulting, and may be relied upon by the Client for their private business purposes. Any other third party use of this report, or reliance placed on it, or decisions taken based on it, is the responsibility of such parties. TerraWest accepts no responsibility for any damages suffered by any third party, or any claims made by any third party as a result of decisions made or actions taken, based on this report. This report does not constitute any expression of legal opinion, and the City of Port Alberni on behalf of D.R. Clough Consulting is specifically advised to seek professional legal opinions with respect to applicable regulatory statutes in this matter.

Investigations described by this report were initiated on the Subject Property at the request of the Client. TerraWest's investigations were conducted in accordance with generally accepted practices of such environmental investigations. No other warranties are made, either expressed or implied.

The findings of this report are partially based on information provided to TerraWest by the Client and other individuals or organizations. While TerraWest believes that information was provided in good faith and has attempted to verify such information where possible, TerraWest does not accept any responsibility for any inaccuracies, deficiencies or omissions contained in this report, based on the use of such information.

These report findings are partially based on TerraWest's observations of Site environmental conditions, limited to the dates and specific locations of investigation. TerraWest offers no warranty, either expressed or implied, as to the presence or potential presence of any chemical substances or contamination on the Subject Property covered by this report. This report constitutes neither an endorsement nor a condemnation of the Subject Property.

A signed paper copy of this report constitutes the official and complete deliverable document of record in this matter. The complete report includes the main report text, Attachments and Appendices, as identified in the Table of Contents. Should this report be distributed by means of digital transmission, or copied in paper hardcopy form, TerraWest accepts no liability for the completeness, accuracy or digital compatibility of the files provided.

Prepared by:

Kate Gilbert, *AScT*
Project Coordinator

Reviewed by:

Suzanne Durnin, *P.Ag.*
Project Manager

Erich Bell, *AScT, R.B.Tech*
Manager, Nanaimo Operations

FIGURES

FIGURE 1. SITE LOCATION

CLIENT: CITY OF PORT ALBERNI ON BEHALF OF D.R. CLOUGH CONSULTING

LOCATION: 5633 SMITH ROAD, PORT ALBERNI, BC

PROJECT: DCMM19-01

DATE: FEBRUARY 2019

CREATED BY: KEG

LEGEND

— — — SITE BOUNDARY

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 8 1/2"X11" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH

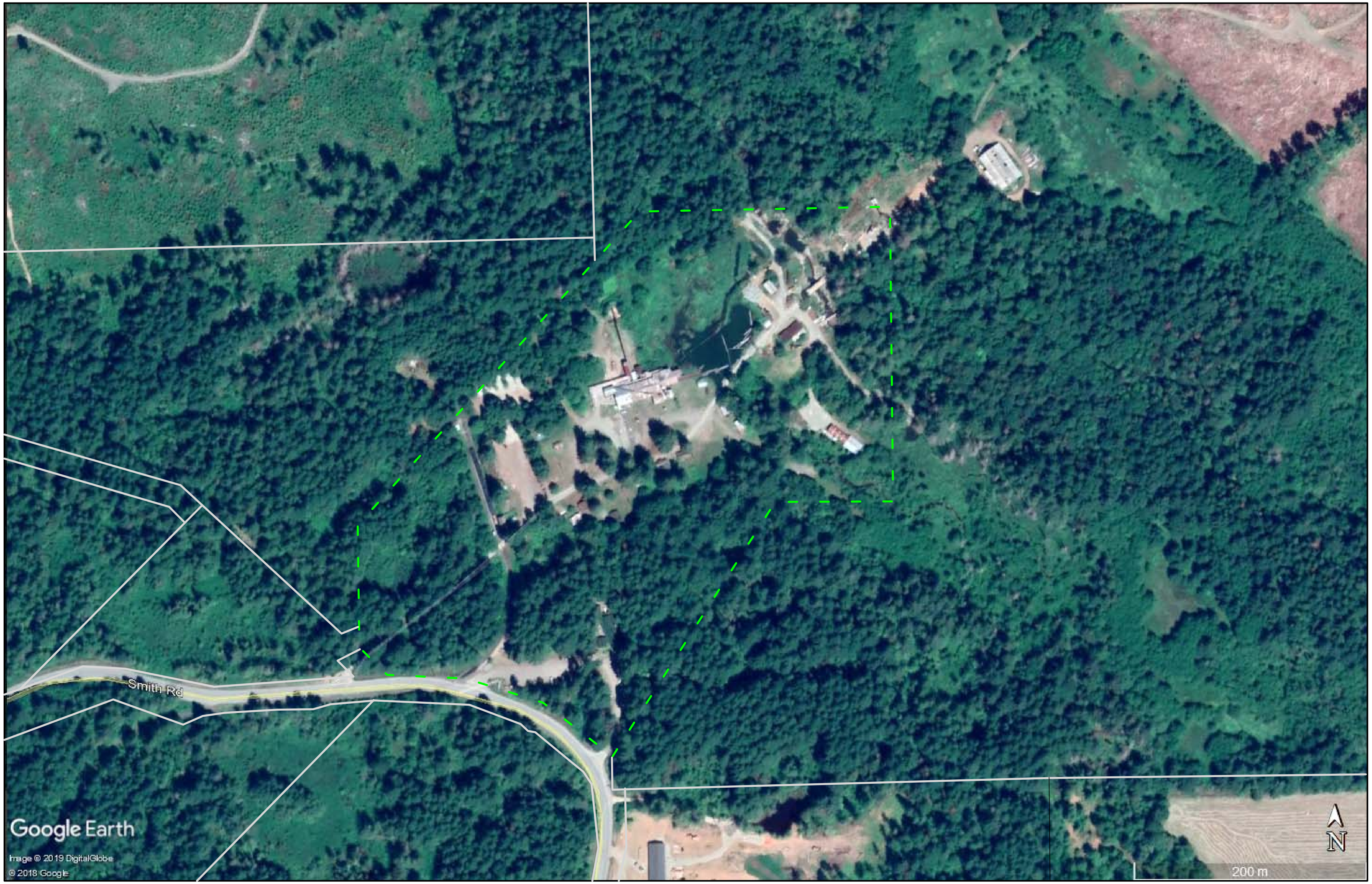


FIGURE 2. SITE PLAN - McLEAN MILL

CLIENT: CITY OF PORT ALBERNI ON BEHALF OF D.R. CLOUGH CONSULTING

LOCATION: 5633 SMITH ROAD, PORT ALBERNI, BC

PROJECT: DCMM19-01

DATE: FEBRUARY 2019

CREATED BY: KEG

LEGEND

SITE BOUNDARY

PROPERTY BOUNDARIES

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 11"x17" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH, iMAPBC INTEGRATED CADASTRAL FABRIC.

FIGURE 3. SITE PLAN - FACILITIES

CLIENT: CITY OF PORT ALBERNI ON BEHALF OF D.R. CLOUGH CONSULTING

LOCATION: 5633 SMITH ROAD, PORT ALBERNI, BC

PROJECT: DCMM19-01

DATE: FEBRUARY 2019

CREATED BY: KEG

LEGEND

SITE BOUNDARY

SURFACE WATER BOUNDARIES & FLOW DIRECTION

BUILDING LOCATIONS

INFRASTRUCTURE LOCATIONS

HISTORICAL EQUIPMENT/INFRASTRUCTURE LOCATION

BUILDING AND EQUIPMENT DESCRIPTIONS

1. VISITORS CENTER-HALL
2. CAFE-GIFT SHOP
3. OFFICE-ADMISSION
4. WASHROOMS
5. WASTE COLLECTION AREA
6. WORKERS HOUSE
7. ARNOLD McLEAN HOUSE
8. EQUIPMENT SHED
9. OFFICE
10. R.B. McLEAN HOUSE
11. COOKHOUSE
12. WOOD SHED
13. ROOT HOUSE
14. WATER TOWER
15. YARD OFFICE-TEACHERAGE
16. CARE TAKERS RV
17. DIP TANK - LOADING DECK
18. FUEL TANKER CAR
19. LOCIE SHED
20. RAIL EQUIPMENT SHED
21. MILL
22. LUMBER DECK
23. GREEN CHAIN
24. WASTE BURN PILE
25. BOILER HOUSE
26. TRANSFORMERS
27. GENERATOR BUILDING-MILLWRIGHT
28. OIL SHED/FIRE PUMP HOUSE
29. BLACKSMITH SHOP
30. BUNKHOUSE
31. GAS AND OIL SHED
32. GARAGE
33. GREASE RACK-SMALL PARTS SHED
34. MACHINE SHOP
35. SALMON HATCHERY
36. TANKER-OFF-SITE
37. MILL POND
38. FORMER DONKEY ENGINE LOCATION
39. STEAM DONKEY AND SPAR POLE

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 11"x17" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH,
iMAPBC INTEGRATED CADASTRAL FABRIC,
McLEAN MILL DAM OPERATIONS- MAINTENANCE AND SURVEILLANCE MANUAL-GENERAL LAYOUT,
VISITORS' RECEPTION CENTER-FLOOR SITE PLAN. 1997,
PAUL MERRICK ARCHITECTURE, GRAEME & MURRAY CONSULTANTS LTD.
1997. McLEAN MILL SITE SERVICING PLAN

TERRAWEST

FIGURE 4. PREVIOUS ENVIRONMENTAL INVESTIGATIONS SOIL & SEDIMENT QUALITY

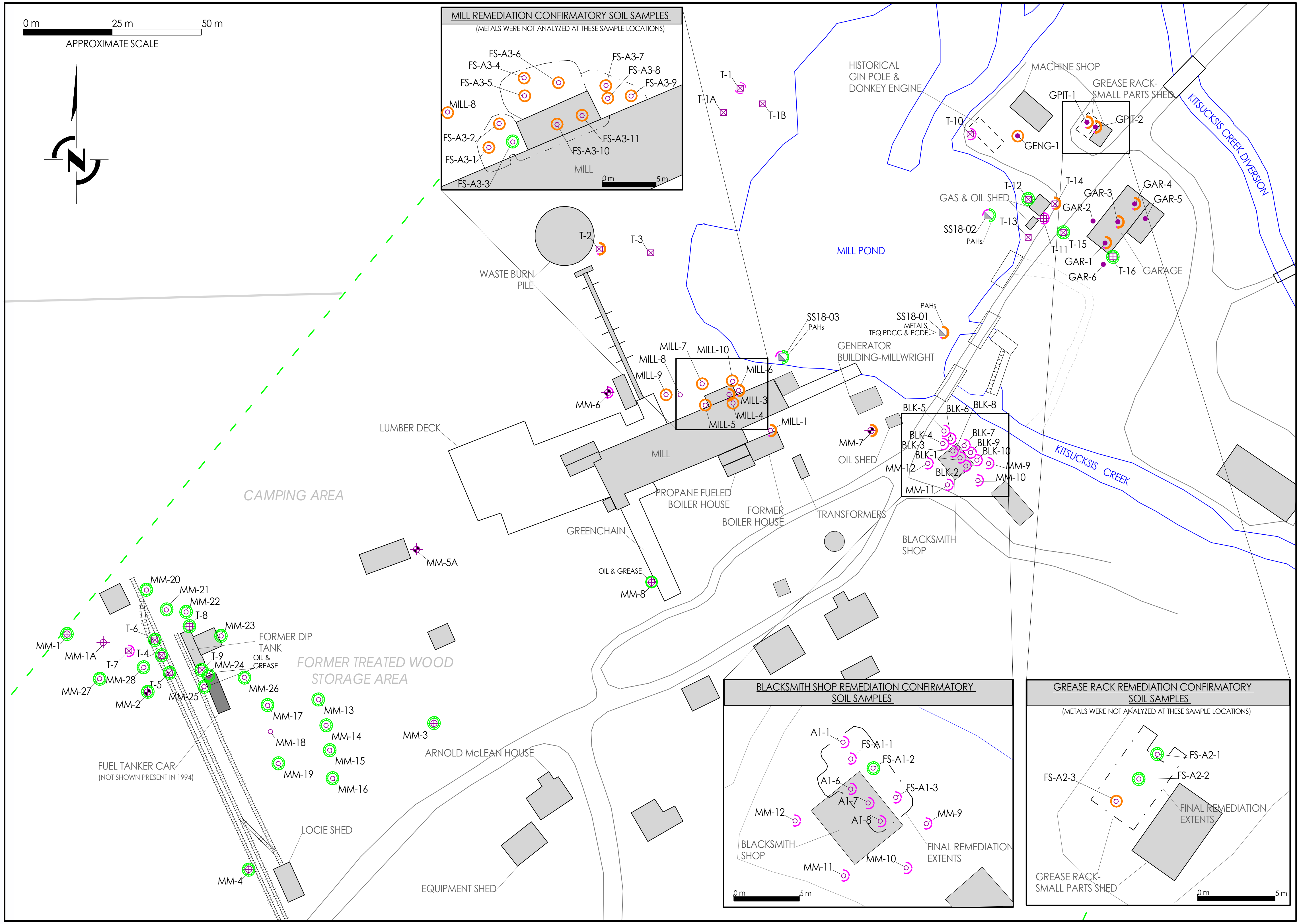
CLIENT: CITY OF PORT ALBERNI ON BEHALF OF D.R. CLOUGH CONSULTING

LOCATION: 5633 SMITH ROAD, PORT ALBERNI, BC

PROJECT: DCMM19-01

DATE: FEBRUARY 2019

CREATED BY: KEG



LEGEND

- SITE BOUNDARY
- SURFACE WATER BOUNDARIES
- BUILDING LOCATION
- INFRASTRUCTURE LOCATION
- HISTORICAL EQUIPMENT/INFRASTRUCTURE LOCATION
- SAMPLE LOCATION EXCEEDS SELECT METALS STANDARDS (2018 CSR 3.2 GENERIC NUMERICAL SOIL STANDARDS)
- SAMPLE LOCATION EXCEEDS MINERAL OIL & GREASE (1994-1995 BC MOE CRITERIA LEVEL B- 1,000 ug/g)
- SAMPLE LOCATION LESS THAN APPLICABLE STANDARDS FOR ANALYZED PARAMETERS

ENVIROCHEM 1994-1995 INVESTIGATIONS

- BOREHOLE WITH MONITORING WELL
- BOREHOLE
- TEST PIT WITH STANDPIPE
- TEST PIT
- SHALLOW SOIL BORING- SOLID STEM
- SURFACE SOIL SAMPLE- HAND AUGER

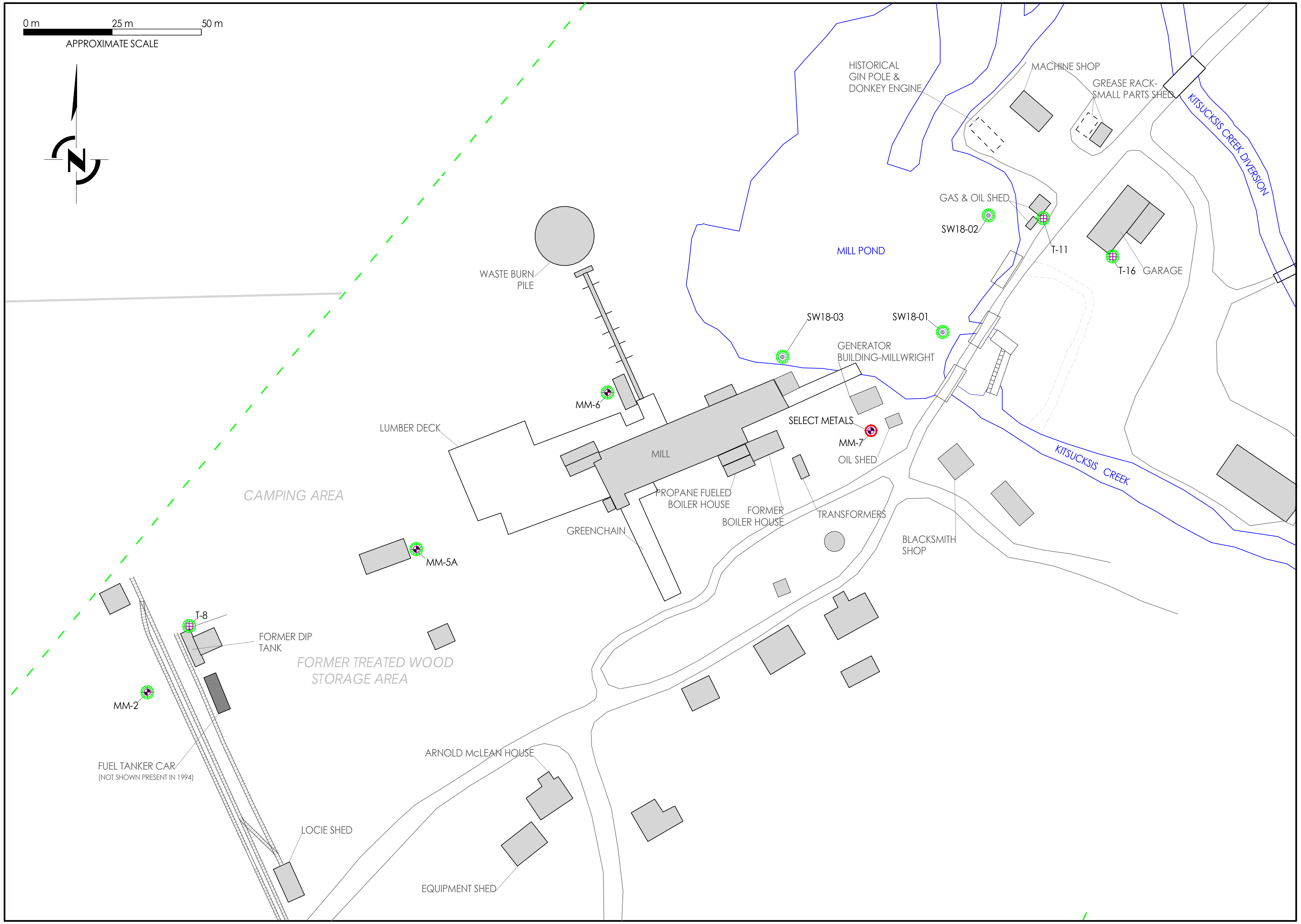
TERRAWEST 2018 INVESTIGATIONS

- SEDIMENT SAMPLE LOCATION

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 11"x17" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH,
iMAPBC INTEGRATED CADASTRAL FABRIC,
ENVIROCHEM. 1994. FIGURE 2 SITE PLAN SHOWING SAMPLE LOCATIONS,
ENVIROCHEM. 1994. FIGURE 6 SITE PLAN SHOWING AERIAL EXTENT OF HYDROCARBON CONTAMINATION,
TERRAWEST. 2018. SEDIMENT AND WATER SAMPLING RESULTS-McLEAN MILL,
McLEAN MILL DAM OPERATIONS- MAINTENANCE AND SURVEILLANCE MANUAL-GENERAL LAYOUT,
VISITORS' RECEPTION CENTER-FLOOR SITE PLAN. 1997,
PAUL MERRICK ARCHITECTURE, GRAEME & MURRAY CONSULTANTS LTD.
1997. McLEAN MILL SITE SERVICING PLAN

TERRAWEST

FIGURE 5. PREVIOUS ENVIRONMENTAL INVESTIGATIONS GROUNDWATER & SURFACE WATER QUALITY



CLIENT: CITY OF PORT ALBERNI ON BEHALF OF D.R. CLOUGH CONSULTING

LOCATION: 5633 SMITH ROAD, PORT ALBERNI, BC

PROJECT: DCMM19-01

DATE: FEBRUARY 2019

CREATED BY: KEG

LEGEND

- SITE BOUNDARY
- SURFACE WATER BOUNDARIES
- BUILDING LOCATION
- INFRASTRUCTURE LOCATION
- HISTORICAL EQUIPMENT/INFRASTRUCTURE LOCATION
- SAMPLE LOCATION GREATER THAN APPLICABLE STANDARDS FOR ANALYZED PARAMETERS
- SAMPLE LOCATION LESS THAN APPLICABLE STANDARDS FOR ANALYZED PARAMETERS

ENVIROCHEM 1994-1995 INVESTIGATIONS

- BOREHOLE WITH MONITORING WELL
- TESTPIT WITH STANDPIPE

TERRAWEST 2018 INVESTIGATIONS

- SURFACE WATER SAMPLE LOCATION

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 11"x17" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH,
iMAPBC INTEGRATED CADASTRAL FABRIC,
ENVIROCHEM. 1994. FIGURE 2 SITE PLAN SHOWING SAMPLE LOCATIONS,
ENVIROCHEM. 1994. FIGURE 6 SITE PLAN SHOWING AERIAL EXTENT OF HYDROCARBON CONTAMINATION,
TERRAWEST. 2018. SEDIMENT AND WATER SAMPLING RESULTS-McLEAN MILL,
McLEAN MILL DAM OPERATIONS- MAINTENANCE AND SURVEILLANCE MANUAL-GENERAL LAYOUT,
VISITORS' RECEPTION CENTER-FLOOR SITE PLAN. 1997,
PAUL MERRICK ARCHITECTURE, GRAEME & MURRAY CONSULTANTS LTD.
1997. McLEAN MILL SITE SERVICING PLAN

TERRAWEST

FIGURE 6. SITE PLAN - AECs AND APECs

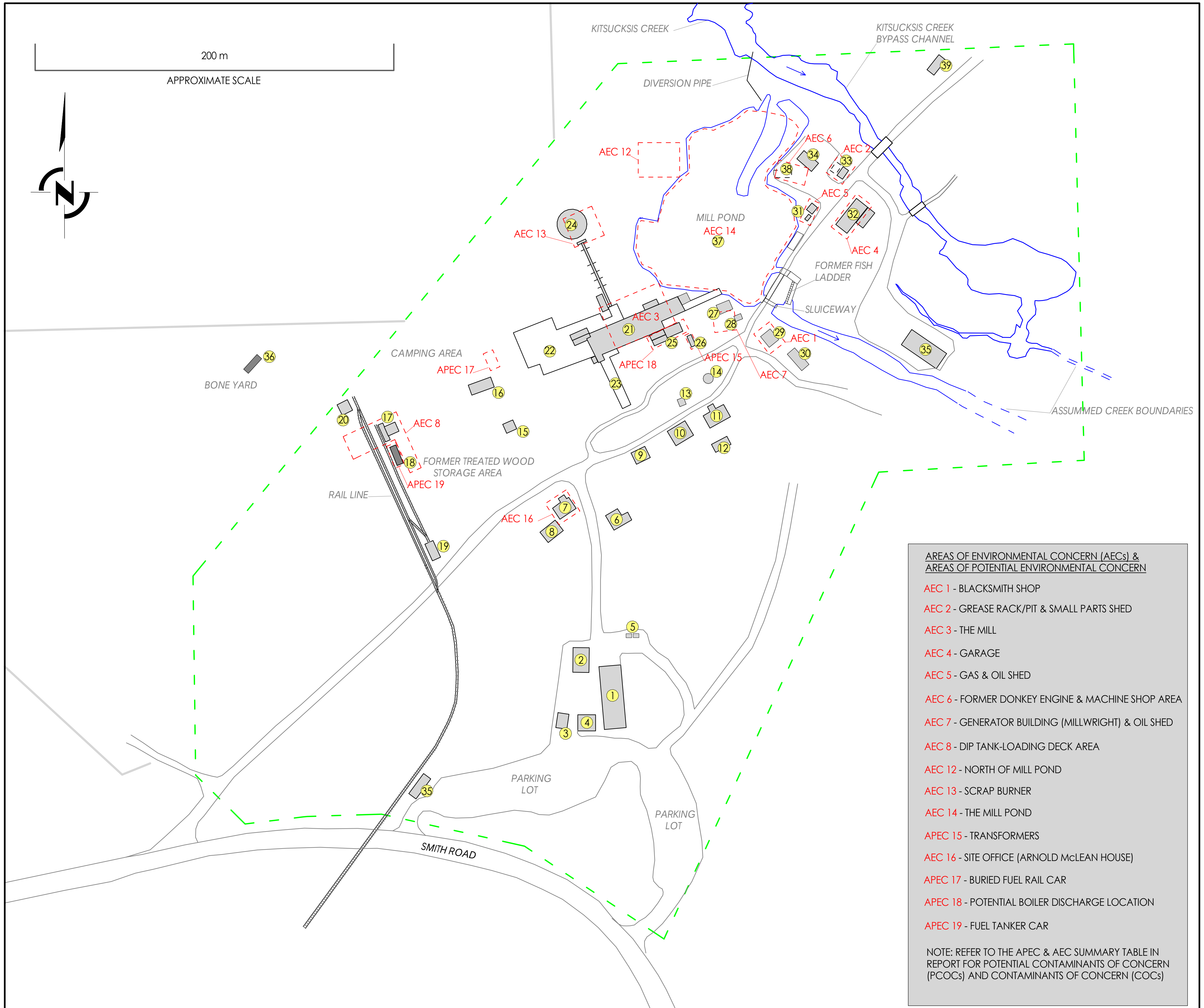
CLIENT: CITY OF PORT ALBERNI ON BEHALF OF D.R. CLOUGH CONSULTING

LOCATION: 5633 SMITH ROAD, PORT ALBERNI, BC

PROJECT: DCMM19-01

DATE: FEBRUARY 2019

CREATED BY: KEG



AREAS OF ENVIRONMENTAL CONCERN (AECs) & AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

- AEC 1 - BLACKSMITH SHOP
- AEC 2 - GREASE RACK/PIT & SMALL PARTS SHED
- AEC 3 - THE MILL
- AEC 4 - GARAGE
- AEC 5 - GAS & OIL SHED
- AEC 6 - FORMER DONKEY ENGINE & MACHINE SHOP AREA
- AEC 7 - GENERATOR BUILDING (MILLWRIGHT) & OIL SHED
- AEC 8 - DIP TANK-LOADING DECK AREA
- AEC 12 - NORTH OF MILL POND
- AEC 13 - SCRAP BURNER
- AEC 14 - THE MILL POND
- APEC 15 - TRANSFORMERS
- AEC 16 - SITE OFFICE (ARNOLD McLEAN HOUSE)
- APEC 17 - BURIED FUEL RAIL CAR
- APEC 18 - POTENTIAL BOILER DISCHARGE LOCATION
- APEC 19 - FUEL TANKER CAR

NOTE: REFER TO THE APEC & AEC SUMMARY TABLE IN REPORT FOR POTENTIAL CONTAMINANTS OF CONCERN (PCOCs) AND CONTAMINANTS OF CONCERN (COCs)

LEGEND

- SITE BOUNDARY
- SURFACE WATER BOUNDARIES & FLOW DIRECTION
- BUILDING LOCATIONS
- INFRASTRUCTURE LOCATIONS
- HISTORICAL EQUIPMENT/INFRASTRUCTURE LOCATION
- AREA OF ENVIRONMENTAL CONCERN (AEC) AREA OF POTENTIAL ENVIRONMENTAL CONCERN (APEC)

BUILDING AND EQUIPMENT DESCRIPTIONS

1 VISITORS CENTER-HALL	21 MILL
2 CAFE-GIFT SHOP	22 LUMBER DECK
3 OFFICE-ADMISSION	23 GREEN CHAIN
4 WASHROOMS	24 WASTE BURN PILE
5 WASTE COLLECTION AREA	25 BOILER HOUSE
6 WORKERS HOUSE	26 TRANSFORMERS
7 ARNOLD McLEAN HOUSE	27 GENERATOR BUILDING-MILLWRIGHT
8 EQUIPMENT SHED	28 OIL SHED/FIRE PUMP HOUSE
9 OFFICE	29 BLACKSMITH SHOP
10 R.B. McLEAN HOUSE	30 BUNKHOUSE
11 COOKHOUSE	31 GAS AND OIL SHED
12 WOOD SHED	32 GARAGE
13 ROOT HOUSE	33 GREASE RACK-SMALL PARTS SHED
14 WATER TOWER	34 MACHINE SHOP
15 YARD OFFICE-TEACHERAGE	35 SALMON HATCHERY
16 CARE TAKERS RV	36 TANKER-OFF-SITE
17 DIP TANK - LOADING DECK	37 MILL POND
18 FUEL TANKER CAR	38 FORMER DONKEY ENGINE LOCATION
19 LOCIE SHED	39 STEAM DONKEY AND SPAR POLE
20 RAIL EQUIPMENT SHED	

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 11"x17" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH,
iMAPBC INTEGRATED CADASTRAL FABRIC,
McLEAN MILL DAM OPERATIONS- MAINTENANCE AND SURVEILLANCE MANUAL-GENERAL LAYOUT,
VISITORS' RECEPTION CENTER-FLOOR SITE PLAN, 1997,
PAUL MERRICK ARCHITECTURE, GRAEME & MURRAY CONSULTANTS LTD.
1997, McLEAN MILL SITE SERVICING PLAN

TERRAWEST

TABLES

Table 1. Summary of Surface Soil Analytical Results - Metals

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC
Envirochem Special Projects, 1994.

Sample ID		GPIT-1	GPIT-1	GPIT-2	BLK-1	BLK-2	BLK-3	BLK-4	BLK-5	BLK-6	BLK-7	CSR Schedule 3.1 - Part 1 Urban Park Land Use[2]				CSR Schedule 3.1 Part 2 Urban Park Land Use[3]	CSR Schedule 3.1 Part 3 Urban Parkland Land Use[4]
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Human Health Protection	Environmental Protection				
Depth (m below surface grade)		0.00	0.1 - 0.15	0.1	0.20	0 - 0.2	0 - 0.2	0 - 0.1	0 - 0.2	0 - 0.1	0.1 - 0.2						
Sample Date		May 1994	May 1994	May 1994	March 1994	Spring 2014	May 1994	May 1994	May 1994	Spring 2014	May 1994	Intake of Contaminated Soil	Toxicity to Invertebrates and Plants	Groundwater Flow to Freshwater	Groundwater Used for Irrigation	Human Health Protection	Ecological Health
Comments		AEC 2 - Grease Rack/Pit	AEC 2 - Grease Rack/Pit	AEC 2 - Grease Rack/Pit	AEC 1- Blacksmith	AEC 1- Blacksmith	AEC 1- Blacksmith	AEC 1- Blacksmith	AEC 1- Blacksmith	AEC 1- Blacksmith	AEC 1- Blacksmith						
PARAMETERS	Units	**Analytical Results[1]**															
pH	No Units	-	-	-	-	-	-	-	-	-	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Metals																	
Arsenic	mg/kg	3.3	3.41	**11.1**	6.5	7.5	**18.2**	8	4.82	**17.5**	3.39	40	25	10	10	n.s.	n.s.
Barium	mg/kg	218	100	403	656	**705**	650	176	**896**	**1220**	137	15,000	700	3,500	n.s.	n.s.	n.s.
Cadmium	mg/kg	**1.6***	0.27	**1.47***	**1.4***	**1.4***	0.72	**1***	<0.25	0.9	0.75	40	30	1 to 50^{pH}	1 to 70^{pH}	n.s.	n.s.
Chromium	mg/kg	61.1	**107***	40	32.8	48.5	42.0	15.1	22.0	30.4	10.6	250	200	60 (CrVI)/300,000 (CrIII)	60 (CrVI)/15,000 (CrIII)	n.s.	n.s.
Cobalt	mg/kg	7.8	**28.2**	13.9	8.2	13.5	11.1	4.3	7.1	8.4	3.3	25	45	25	25	n.s.	n.s.
Copper	mg/kg	**556**	**104***	**232**	**155**	**163**	**228**	71.6	**80.2***	**198**	50.6	7,500	150	75 to 7,500^{pH}	75 to 15,000^{pH}	n.s.	n.s.
Lead	mg/kg	**8270.0**	**90.5***	**565**	**483**	**204**	**1800**	**390**	26.4	**2290**	**293**	120	550	200 to 90,000^{pH}	350 to 150,000^{pH}	n.s.	n.s.
Mercury	mg/kg	<0.07	0.066	0.1	0.1	<0.05	0.036	0.1	0.009	<0.05	0.056	25	40	n.s.	n.s.	n.s.	n.s.
Molybdenum	mg/kg	**31**	**<4**	**<4**	<1	<1	**<4**	<1	**<4**	<1	**<4**	400	80	650	3	n.s.	n.s.
Nickel	mg/kg	23.5	53.9*	34.1	30	37.6	34.7	10.7	21.4	26.1	12.1	900	150	90 to 9,500^{pH}	70 to 1,500^{pH}	n.s.	n.s.
Selenium	mg/kg	<0.1	<0.5	<0.5	0.1	<0.1	<0.5	<0.1	<0.5	<0.1	<0.5	400	1.5	1	1	n.s.	n.s.
Silver	mg/kg	<0.5	<1.5	<1.5	<0.5	<0.5	<1.5	<0.5	<1.5	<0.5	<1.5	n.s.	n.s.	n.s.	n.s.	400	20
Tin	mg/kg	<0.1	5.1	2.9	<1	17	**540**	<1	10	<1	**203**	n.s.	n.s.	n.s.	n.s.	50,000	50
Zinc	mg/kg	**764**	139	**231***	**687**	**405***	**1160**	**1290**	63.3	**908**	**1700**	25,000	450	150 to 3,000^{pH}	150 to 9,000^{pH}	n.s.	n.s.
Aluminum	ug/g	10800	**44400**	16900	17000	28500	18400	9730	19000	27700	3990	n.s.	n.s.	n.s.	n.s.	40,000	n.s.
Antimony	ug/g	3	<8	<8	**54**	**42**	**169**	**49**	<8	**260**	<8	n.s.	n.s.	n.s.	n.s.	500	20
Beryllium	ug/g	<0.1	<1.5	<1.5	<0.1	<0.1	<1.5	<0.1	<1.5	<0.1	<1.5	150	150	1 to 500^{pH}	8.5 to 35,000^{pH}	n.s.	n.s.
Bismuth	ug/g	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Boron	ug/g	-	64.9	35.8	-	-	101	-	44.9	-	33.6	n.s.	n.s.	n.s.	n.s.	15,000	n.s.
Calcium	ug/g	4520	5500	3650	60400	72700	62300	92900	70700	71000	22700	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Iron	ug/g	31100	**69900**	**38100**	**55000**	**67300**	**53500**	24300	24200	**53900**	16100	n.s.	n.s.	n.s.	n.s.	35,000	n.s.
Lithium	ug/g	4.3	-	-	8	7.1	-	2	-	4.6	-	n.s.	n.s.	n.s.	n.s.	65	n.s.
Magnesium	ug/g	4670	12700	10800	6290	10100	7020	2020	5690	10600	1680	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Manganese	ug/g	249	1620	626	**3420**	**3390**	**3000**	1060	**3250**	**5260**	756	10,000	2,000	n.s.	2,000	n.s.	n.s.
Phosphorus	ug/g	937	1920	865	4540	3720	8840	629	11200	4550	4040	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Potassium	ug/g	590	255	140	8700	10300	7170	1110	13100	8000	1680	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Silicon	ug/g	296	-	-	291	168	-	290	-	511	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Sodium	ug/g	137	147	113	**1440**	**1600**	**1090**	166	**1650**	**1020**	251	>1**	1,000	n.s.	n.s.	n.s.	n.s.
Strontium	ug/g	11	11.7	9.5	246	254	343	83	393	215	101	n.s.	n.s.	n.s.	n.s.	20,000	n.s.
Sulfur	ug/g	2940	-	-	620	420	-	690	-	490	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Thorium	ug/g	<1	-	-	<1	<1	-	<1	-	<1	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Titanium	ug/g	1000	1360	38.7	843	2310	184	620	99.2	1750	288	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Uranium	ug/g	<5	-	-	<5	<5	-	<5	-	<5	-	250	500	150	15	n.s.	n.s.
Vanadium	ug/g	49	**151**	7.3	38	76	57.7	23	42.1	40	17.9	400	150	n.s.	350	n.s.	n.s.
Zirconium	ug/g	4.7	-	-	5.2	6.2	-	0.6	-	1.1	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Notes:

1 - Data excerpted from Quanta Trace Laboratories Inc. and Can Test Ltd. analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.1 - Part 1 Numerical Soil Standards, site-specific land use and pathways as noted above

3 - BC CSR Schedule 3.1 - Part 2 Generic Numerical Soil Standard to Protect Human Health, site-specific land use as noted above

4 - BC CSR Schedule 3.1 - Part 3 Generic Numerical Soil Standards to Protect Ecological Health, site-specific land use as noted above

n.s. = No applicable standard

pH = Standard is pH dependant and is specific to each sample with the range noted above

< = Less than the laboratory method detection limit

- = Parameter not reported

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

* = Regional Background estimates applied due to no reported pH values

Cadmium	0.95 ug/g
Chromium	65 ug/g
Copper	100 ug/g
Lead	40 ug/g
Nickel	50 ug/g
Zinc	150 ug/g

Bold reported detection limits exceed the lowest applied standard.

Table 2. Summary of Surface Soil Analytical Results Continued - Metals

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC
Envirochem Special Projects, 1994.

Sample ID		BLK-9	BLK-10	GAR-1	GAR-3	GAR-4	MILL-1A	MILL-1B	MILL-1	MILL-3	CSR Schedule 3.1 - Part 1 Urban Park Land Use[2]				CSR Schedule 3.1 Part 2 Urban Park Land Use[3]	CSR Schedule 3.1 Part 3 Urban Parkland Land Use[4]
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Human Health Protection	Environmental Protection				
Depth (m below surface grade)		0 - 0.2	0 - 0.1	0.0	0.00	0.00	0 - 0.1	0 - 0.1	0.2 - 0.3	0 - 0.1						
Sample Date		Spring 2014	May 1994	Spring 2014	Spring 2014	Spring 2014	Spring 2014	May 1994	May 1994	May 1994	Intake of Contaminated Soil	Toxicity to Invertebrates and Plants	Groundwater Flow to Freshwater	Groundwater Used for Irrigation	Human Health Protection	Ecological Health
Comments		AEC 1- Blacksmith	AEC 1- Blacksmith	AEC 4- Garage	AEC 4- Garage	AEC 4- Garage	AEC 3- Mill	AEC 3- Mill	AEC 3- Mill	AEC 3- Mill						
PARAMETERS	Units	**Analytical Results[1]**														
pH	No Units	-	-	-	-	-	-	-	-	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Metals																
Arsenic	ug/g	8.3	6.77	6.3	5.5	4.8	**58**	3.89	**10.8**	**10.6**	40	25	10	10	n.s.	n.s.
Barium	ug/g	382	362	198	49.8	77.9	65.8	53.5	156	38.8	15,000	700	3,500	n.s.	n.s.	n.s.
Cadmium	ug/g	**2.6***	0.89	**1.5***	**1.3***	**1.5***	0.9	<0.25	0.42	<0.25	40	30	1 to 50^{pH}	1 to 70^{pH}	n.s.	n.s.
Chromium	ug/g	16.9	50	**66.3**	**70**	**82**	63.0	31.0	**103**	40.8	250	200	60 (CrVI)/300,000 (CrIII)	60 (CrVI)/15,000 (CrIII)	n.s.	n.s.
Cobalt	ug/g	4.9	15.6	19.3	18.2	20.2	17.9	6.4	24.1	10.7	25	45	25	25	n.s.	n.s.
Copper	ug/g	67.2	**103***	**135***	**109***	**121***	83.3	41	**134***	71.6	7,500	150	75 to 7,500^{pH}	75 to 15,000^{pH}	n.s.	n.s.
Lead	ug/g	**140**	**232**	**1010**	**112**	**860**	16	21.3	**84**	**175***	120	550	200 to 90,000^{pH}	350 to 150,000^{pH}	n.s.	n.s.
Mercury	ug/g	<0.05	0.052	0.1	0.2	0.1	0.2	0.065	0.19	0.064	25	40	n.s.	n.s.	n.s.	n.s.
Molybdenum	ug/g	<1	<4	<1	<1	<1	<1	**<4**	**<4**	**<4**	400	80	650	3	n.s.	n.s.
Nickel	ug/g	16.7	39.5	38	37.7	43.2	34.3	15.8	49.2	24.5	900	150	90 to 9,500^{pH}	70 to 1,500^{pH}	n.s.	n.s.
Selenium	ug/g	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	400	1.5	1	1	n.s.	n.s.
Silver	ug/g	<0.5	<1.5	<0.5	<0.5	<0.5	<0.5	<1.5	<1.5	<1.5	n.s.	n.s.	n.s.	n.s.	400	20
Tin	ug/g	<1	**57.5**	<1	<1	<1	<1	13.4	9.0	22.9	n.s.	n.s.	n.s.	n.s.	50,000	50
Zinc	ug/g	**1610**	**616**	121	122	**158***	**197***	**443***	**603**	**396***	25,000	450	150 to 3,000^{pH}	150 to 9,000^{pH}	n.s.	n.s.
Aluminum	ug/g	8820	21400	**43900**	**47700**	38300	**42900**	11300	37600	16600	n.s.	n.s.	n.s.	n.s.	40,000	n.s.
Antimony	ug/g	13	<8	1	2	40	4	<8	<8	<8	n.s.	n.s.	n.s.	n.s.	500	20
Beryllium	ug/g	<0.1	<1.5	<0.1	<0.1	<0.1	<0.1	<1.5	<1.5	<1.5	150	150	1 to 500^{pH}	8.5 to 35,000^{pH}	n.s.	n.s.
Bismuth	ug/g	<5	68.3	<0.1	<0.1	<0.1	<5	20.2	58.4	28.7	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Boron	ug/g	-	-	-	-	-	-	-	-	-	n.s.	n.s.	n.s.	n.s.	15,000	n.s.
Calcium	ug/g	44500	35900	13200	18400	20800	10100	5050	19600	3700	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Iron	ug/g	30900	**55000**	**79000**	**73800**	**63400**	**64500**	19500	**65600**	29300	n.s.	n.s.	n.s.	n.s.	35,000	n.s.
Lithium	ug/g	2	-	8.5	8.9	9	9	-	-	-	n.s.	n.s.	n.s.	n.s.	65	n.s.
Magnesium	ug/g	2740	8840	16100	22500	20500	10800	3700.0	13600	5350	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Manganese	ug/g	**2080**	1730	1110	986	951	946	430.0	1280	398	10,000	2,000	n.s.	2,000	n.s.	n.s.
Phosphorus	ug/g	2350	3910	575	321	415	394	1260	1980	1030	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Potassium	ug/g	3470	3830	1100	1120	1160	1060	563	1020	534	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Silicon	ug/g	514	-	229	332	584	85	-	-	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Sodium	ug/g	427	740	293	355	**1840**	185	160	252	108	>1**	1,000	n.s.	n.s.	n.s.	n.s.
Strontium	ug/g	153.0	194	19	23	35.0	23	17.8	43.3	10.4	n.s.	n.s.	n.s.	n.s.	20,000	n.s.
Sulfur	ug/g	910	-	360	340	760	170	-	-	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Thorium	ug/g	<1	-	<1	<1	<1	<1	-	-	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Titanium	ug/g	476	406	4390	4070	3730	2750	204	828	1240	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Uranium	ug/g	<5	-	<5	<5	<5	<5	-	-	-	250	500	150	15	n.s.	n.s.
Vanadium	ug/g	21	83.3	**200**	**200**	**180**	**180**	20.9	122	74.2	400	150	n.s.	350	n.s.	n.s.
Zirconium	ug/g	0.5	-	14.5	10.2	12.8	16	-	-	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Notes:

1 - Data excerpted from Can Test Ltd. analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.1 - Part 1 Numerical Soil Standards, site-specific land use and pathways as noted above

3 - BC CSR Schedule 3.1 - Part 2 Generic Numerical Soil Standard to Protect Human Health, site-specific land use as noted above

4 - BC CSR Schedule 3.1 - Part 3 Generic Numerical Soil Standards to Protect Ecological Health, site-specific land use as noted above

n.s. = No applicable standard

pH = Standard is pH dependant and is specific to each sample with the range noted above

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

** = Standard has been converted from mg/g to ug/g

* = Regional Background estimates applied due to no reported pH values

Cadmium	0.95 ug/g
Chromium	65 ug/g
Copper	100 ug/g
Lead	40 ug/g
Nickel	50 ug/g
Zinc	150 ug/g

Bold reported detection limits exceed the lowest applied standard.

Table 3. Summary of Test Pit Soil Analytical Results - Metals

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC
Envirochem Special Projects, 1994.

Sample ID		T-1	T-2	T2	T-7	T-10	T-11	T-14	T-14	CSR Schedule 3.1 - Part 1 Urban Park Land Use[2]				CSR Schedule 3.1 Part 2 Urban Park Land Use[3]	CSR Schedule 3.1 Part 3 Urban Parkland Land Use[4]
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Human Health Protection	Environmental Protection				
Depth (m below surface grade)		0.20	0 - 0.1	0.5	0 - 0.1	0 - 0.1	0 - 0.1	0 - 0.1	0.3						
Sample Date		March 1994	March 1994	March 1994	March 1994	March 1994	March 1994	March 1994	March 1994	Intake of Contaminated Soil	Toxicity to Invertebrates and Plants	Groundwater Flow to Freshwater	Groundwater Used for Irrigation	Human Health Protection	Ecological Health
Comments		AEC 12- north of mill pond	AEC 13- Scrap Burner	AEC 13- Scrap Burner	AEC 8- Loading Deck & Dip Tank	AEC 6- Gin pole/machine shop	AEC 5- Oil and gas shed	AEC 5- Oil and gas shed	AEC 5- Oil and gas shed						
PARAMETERS	Units	**Analytical Results[1]**													
pH	No Units	-	-	-	-	-	-	-	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Metals															
Arsenic	ug/g	**26**	**11**	6.4	6.7	8.1	6.8	4.8	3.3	40	25	10	10	n.s.	n.s.
Barium	ug/g	71.5	11.8	151	62	97.1	40.5	40.8	47	15,000	700	3,500	n.s.	n.s.	n.s.
Cadmium	ug/g	**1***	0.1	0.1	0.7	**1***	0.6	0.8	0.9	40	30	1 to 50^{pH}	1 to 70^{pH}	n.s.	n.s.
Chromium	ug/g	**91***	1	**183***	49.3	**228***	48.3	**73.1***	**62.0**	250	200	60 (CrVI)/300,000 (CrIII)	60 (CrVI)/15,000 (CrIII)	n.s.	n.s.
Cobalt	ug/g	**30.7**	0.5	**58**	18.9	**26.4**	9.7	**27.8**	21.3	25	45	25	25	n.s.	n.s.
Copper	ug/g	**141***	2.8	**259**	84.5	**199**	79.7	**135***	**110***	7,500	150	75 to 7,500^{pH}	75 to 15,000^{pH}	n.s.	n.s.
Lead	ug/g	8.0	4	24	11	12	**58***	9	34.0	120	550	200 to 90,000^{pH}	350 to 150,000^{pH}	n.s.	n.s.
Mercury	ug/g	0.2	<0.05	<0.05	0.2	0.3	0.4	0.2	0.1	25	40	n.s.	n.s.	n.s.	n.s.
Molybdenum	ug/g	<1	<1	<1	<1	<1	<1	<1	<1	400	80	650	3	n.s.	n.s.
Nickel	ug/g	52.3*	0.97	**119***	48.7	56.6	24.0	48.2	38	900	150	90 to 9,500^{pH}	70 to 1,500^{pH}	n.s.	n.s.
Selenium	ug/g	0.3	**1.3***	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	400	1.5	1	1	n.s.	n.s.
Silver	ug/g	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	n.s.	n.s.	n.s.	n.s.	400	20
Tin	ug/g	<1	<1	<1	<1	<1	<1	<1	<1	n.s.	n.s.	n.s.	n.s.	50,000	50
Zinc	ug/g	70.1	14.8	**165***	51.3	78.1	66.6	82.4	72.6	25,000	450	150 to 3,000^{pH}	150 to 9,000^{pH}	n.s.	n.s.
Aluminum	ug/g	**57200**	327	**93800**	**50800**	**67400**	**55100**	**72900**	**56500**	n.s.	n.s.	n.s.	n.s.	40,000	n.s.
Antimony	ug/g	1.6	3.2	0.5	0.5	1.6	2.9	0.3	0.6	n.s.	n.s.	n.s.	n.s.	500	20
Beryllium	ug/g	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	150	150	1 to 500^{pH}	8.5 to 35,000^{pH}	n.s.	n.s.
Bismuth	ug/g	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Boron	ug/g	-	-	-	-	-	-	-	-	n.s.	n.s.	n.s.	n.s.	15,000	n.s.
Calcium	ug/g	12900	1170	14000	22500	27600	18000	16200	18500	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Iron	ug/g	**94300**	530	940	**75200**	**88500**	**80300**	**109000**	**90300**	n.s.	n.s.	n.s.	n.s.	35,000	n.s.
Lithium	ug/g	11.8	0.5	<0.5	25.4	16.1	7.8	8.3	7.4	n.s.	n.s.	n.s.	n.s.	65	n.s.
Magnesium	ug/g	20100	118	22600	20300	37300	24600	23300	25200	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Manganese	ug/g	1390	69.3	1310	1360	1560	381	1750	1590	10,000	2,000	n.s.	2,000	n.s.	n.s.
Phosphorus	ug/g	274	132	820	487	313	205	703	572	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Potassium	ug/g	1400	70	2800	770	2220	640	830	740	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Silicon	ug/g	940	<5	670	537	209	162	512	351	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Sodium	ug/g	301	6	360	461	579	194	296	306	>1**	1,000	n.s.	n.s.	n.s.	n.s.
Strontium	ug/g	24	7	50	36	53	6	17	16	n.s.	n.s.	n.s.	n.s.	20,000	n.s.
Sulfur	ug/g	40	20	<10	110	210	110	90	150	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Thorium	ug/g	<1	2	60	<1	<1	<1	<1	<1	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Titanium	ug/g	4860	16.6	7080	5150	5550	4450	7090	6490	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Uranium	ug/g	<5	5	<5	<5	<5	<5	<5	<5	250	500	150	15	n.s.	n.s.
Vanadium	ug/g	**270**	1	**370**	**230**	**250**	67	**320**	**270**	400	150	n.s.	350	n.s.	n.s.
Zirconium	ug/g	25.5	0.8	53	17.9	8.9	3.9	32.2	21.9	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Notes:

1 - Data excerpted from Quanta Trace Laboratories Inc. analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.1 - Part 1 Numerical Soil Standards, site-specific land use and pathways as noted above

3 - BC CSR Schedule 3.1 - Part 2 Generic Numerical Soil Standard to Protect Human Health, site-specific land use as noted above

4 - BC CSR Schedule 3.1 - Part 3 Generic Numerical Soil Standards to Protect Ecological Health, site-specific land use as noted above

n.s. = No applicable standard

pH = Standard is pH dependant and is specific to each sample with the range noted above

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

* = Regional Background estimates applied due to no reported pH values

Cadmium	0.95 ug/g
Chromium	65 ug/g
Copper	100 ug/g
Lead	40 ug/g
Nickel	50 ug/g
Zinc	150 ug/g

Bold reported detection limits exceed the lowest applied standard.

Table 4. Summary of Borehole Soil Analytical Results - Metals

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC
Envirochem Special Projects, 1994.

Sample ID		MM-6	MM-7	MM-9	MM-10	MM-11	MM-12	CSR Schedule 3.1 - Part 1 Urban Park Land Use[2]				CSR Schedule 3.1 Part 2 Urban Park Land Use[3]	CSR Schedule 3.1 Part 3 Urban Parkland Land Use[4]
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Human Health Protection	Environmental Protection				
Depth (m below surface grade)		0 - 0.61	0 - 0.61	0 - 0.1	0 - 0.1	0 - 0.1	0 - 0.1						
Sample Date		March 1994	March 1994	March 1994	March 1994	March 1994	March 1994	Intake of Contaminated Soil	Toxicity to Invertebrates and Plants	Groundwater Flow to Freshwater	Groundwater Used for Irrigation	Human Health Protection	Ecological Health
Comments		AEC 3- The Mill	AEC 7- Gen. Build/Oil shed	AEC 1- Blacksmith	AEC 1- Blacksmith	AEC 1- Blacksmith	AEC 1- Blacksmith						
PARAMETERS	Units	Analytical Results[1]											
pH	No Units	-	-	-	-	-	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Metals													
Arsenic	ug/g	9.2	**15.2**	**27.2**	**23.2**	9.1	9.7	40	25	10	10	n.s.	n.s.
Barium	ug/g	35.2	168	77	47.4	79.3	231	15,000	700	3,500	n.s.	n.s.	n.s.
Cadmium	ug/g	0.9	0.7	**1.1**	0.98	1.1	3.4	40	30	1 to 50[pH]	1 to 70[pH]	n.s.	n.s.
Chromium	ug/g	**187***	54.9	**97.4***	**83.7***	**75.2***	**69.4***	250	200	60 (CrVI)/300,000 (CrIII)	60 (CrVI)/15,000 (CrIII)	n.s.	n.s.
Cobalt	ug/g	**25.2**	18.5	**30.8**	**26.2**	**27**	**26**	25	45	25	25	n.s.	n.s.
Copper	ug/g	**116***	**104***	**129***	**103***	**98.2***	**104***	7,500	150	75 to 7,500[pH]	75 to 15,000[pH]	n.s.	n.s.
Lead	ug/g	10.0	53	9	12	21	**213***	120	550	200 to 90,000[pH]	350 to 150,000[pH]	n.s.	n.s.
Mercury	ug/g	0.2	<0.05	0.2	0.1	<0.05	<0.05	25	40	n.s.	n.s.	n.s.	n.s.
Molybdenum	ug/g	<1	<1	<1	<1	<1	<1	400	80	650	3	n.s.	n.s.
Nickel	ug/g	56	35.4	55.6	49.3	47.1	44	900	150	90 to 9,500[pH]	70 to 1,500[pH]	n.s.	n.s.
Selenium	ug/g	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	400	1.5	1	1	n.s.	n.s.
Silver	ug/g	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	n.s.	n.s.	n.s.	n.s.	400	20
Tin	ug/g	<1	<1	<1	<1	<1	<1	n.s.	n.s.	n.s.	n.s.	50,000	50
Zinc	ug/g	84	129	68	77.8	103	**744***	25,000	450	150 to 3,000[pH]	150 to 9,000[pH]	n.s.	n.s.
Aluminum	ug/g	**45000**	**50700**	**58600**	**63700**	**62400**	39600	n.s.	n.s.	n.s.	n.s.	40,000	n.s.
Antimony	ug/g	1	8.6	1.1	1	1	8.8	n.s.	n.s.	n.s.	n.s.	500	20
Beryllium	ug/g	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	150	150	1 to 500[pH]	8.5 to 35,000[pH]	n.s.	n.s.
Bismuth	ug/g	<0.1	<0.1	<0.1	<0.1	<5	<5	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Boron	ug/g	-	-	-	-	-	-	n.s.	n.s.	n.s.	n.s.	15,000	n.s.
Calcium	ug/g	21200	12100	12200	9260	16200	14600	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Iron	ug/g	**64800**	**74100**	**96600**	**96000**	**99700**	**67900**	n.s.	n.s.	n.s.	n.s.	35,000	n.s.
Lithium	ug/g	10	7.7	10.7	11.2	9.92	8.2	n.s.	n.s.	n.s.	n.s.	65	n.s.
Magnesium	ug/g	29300	12700	21600	18600	18200	11000	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Manganese	ug/g	894	1080	1400	977	**2280**	1560	10,000	2,000	n.s.	2,000	n.s.	n.s.
Phosphorus	ug/g	443	453	153	291	530	1090	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Potassium	ug/g	870	790	1260	760	99	1620	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Silicon	ug/g	440	102	526	278	291	64	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Sodium	ug/g	604	163	289	193	269	325	>1**	1,000	n.s.	n.s.	n.s.	n.s.
Strontium	ug/g	27	23	22	13	28	72	n.s.	n.s.	n.s.	n.s.	20,000	n.s.
Sulfur	ug/g	130	280	40	70	110	270	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Thorium	ug/g	<1	<1	<1	<1	<1	11	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Titanium	ug/g	4720	4780	5010	5590	4610	3370	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Uranium	ug/g	<5	<5	<5	<5	<5	72	250	500	150	15	n.s.	n.s.
Vanadium	ug/g	**190**	**220**	**270**	**280**	**270**	**180**	400	150	n.s.	350	n.s.	n.s.
Zirconium	ug/g	12.6	14.1	31.3	24	23	27.2	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Notes:

1 - Data excerpted from Quanta Trace laboratories Inc. analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.1 - Part 1 Numerical Soil Standards, site-specific land use and pathways as noted above

3 - BC CSR Schedule 3.1 - Part 2 Generic Numerical Soil Standard to Protect Human Health, site-specific land use as noted above

4 - BC CSR Schedule 3.1 - Part 3 Generic Numerical Soil Standards to Protect Ecological Health, site-specific land use as noted above

n.s. = No applicable standard

pH = Standard is pH dependant and is specific to each sample with the range noted above

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

* = Regional Background estimates applied due to no reported pH values

Cadmium	0.95 ug/g
Chromium	65 ug/g
Copper	100 ug/g
Lead	40 ug/g
Nickel	50 ug/g
Zinc	150 ug/g

Bold reported detection limits exceed the lowest applied standard.

Table 5. Summary of Surface Soil Analytical Results - Polycyclic Aromatic Hydrocarbons

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC
Envirochem Special Projects, 1994.

Sample ID		**T-2**	**BLK-4**	**MILL-4**	**CSR Schedule 3.1 - Part 1 Urban Park Land Use[2]**				**CSR Schedule 3.1 Part 2 Urban Park Land Use[3]**	**CSR Schedule 3.1 Part 3 Urban Parkland Land Use[4]**
Matrix		Soil	Soil	Soil	Human Health Protection	Environmental Protection				
Depth (m below surface grade)		0 - 0.1	0 - 0.1	0 - 0.1						
Sample Date		March 1994	March 1994	March 1994	Intake of Contaminated Soil	Toxicity to Invertebrates and Plants	Groundwater Flow to Freshwater	Groundwater Used for Irrigation	Human Health Protection	Ecological Health
Comments		AEC 13- Scrap burner	AEC 1- Blacksmith	AEC 3- Mill						
PARAMETERS	Units	**Analytical Results[1]**								
Polycyclic Aromatic Hydrocarbons										
Acenaphthene	ug/g	<0.05	<0.05	<0.5	n.s.	n.s.	n.s.	n.s.	2,000	n.s.
Acenaphthylene	ug/g	<0.05	0.06	<0.5	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Anthracene	ug/g	<0.05	<0.05	0.5	25,000	2.5	n.s.	n.s.	n.s.	n.s.
Benzo(a)anthracene	ug/g	<0.05	<0.05	<0.5	n.s.	n.s.	n.s.	n.s.	95	1
Benzo(a)pyrene	ug/g	<0.05	0.11	<0.5	10	20	n.s.	n.s.	n.s.	n.s.
Benzo(g,h,i)perylene	ug/g	<0.05	0.21	<0.5	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Chrysene	ug/g	<0.05	0.11	1.6	n.s.	n.s.	n.s.	n.s.	400	n.s.
Dibenz(a,h)anthracene	ug/g	<0.05	<0.05	<0.5	n.s.	n.s.	n.s.	n.s.	10	1
Fluoranthene	ug/g	0.09	0.27	0.6	3,500	50	n.s.	n.s.	n.s.	n.s.
Fluorene	ug/g	<0.05	<0.05	<0.5	n.s.	n.s.	n.s.	n.s.	1,000	n.s.
Indeno(1,2,3-c,d)pyrene	ug/g	<0.05	0.15	<0.5	n.s.	n.s.	n.s.	n.s.	95	1
Naphthalene	ug/g	0.4	0.3	**0.7**	1,500	0.6	75	n.s.	n.s.	n.s.
Phenanthrene	ug/g	0.18	0.36	2	n.s.	n.s.	n.s.	n.s.	3,500	5
Pyrene	ug/g	0.07	0.19	2.2	n.s.	n.s.	n.s.	n.s.	2,500	10
SOIL VAPOUR		**Calculated Breathing Zone Concentration - Urban Park Outdoor Use**			**CSR Schedule 3.3 Urban Park Land Use[5]**					
Naphthalene	ug/m^3	0.05	0.04	0.09	3					

Notes:

1 - Data excerpted from Can Test Ltd. analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.1 - Part 1 Numerical Soil Standards, site-specific land use and pathways as noted above

3 - BC CSR Schedule 3.1 - Part 2 Generic Numerical Soil Standard to Protect Human Health, site-specific land use as noted above

4 - BC CSR Schedule 3.1 - Part 3 Generic Numerical Soil Standards to Protect Ecological Health, site-specific land use as noted above

5 - BC CSR Schedule 3.3 - Generic Vapour Standards, site-specific land use as noted above

n.s. = No applicable standard

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 6. Summary of Test Pit Borehole Soil Analytical Results - Phenols

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC
Envirochem Special Projects, 1994.

Sample ID		T-8	MM-23	MM-24	MM-25	MM-25	MM-26	MM-28	CSR Schedule 3.1 - Part 1 Urban Park Land Use[2]				CSR Schedule 3.1 Part 2 Urban Park Land Use[3]	CSR Schedule 3.1 Part 3 Urban Parkland Land Use[4]
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Human Health Protection	Environmental Protection				
Depth (m below surface grade)		0.05 - 0.1	0 - 0.1	0 - 0.1	0 - 0.1	0 - 0.1	0 - 0.1	0 - 0.1						
Sample Date		March 1994	March 1994	March 1994	March 1994	March 1994	March 1994	March 1994	Intake of Contaminated Soil	Toxicity to Invertebrates and Plants	Groundwater Flow to Freshwater	Groundwater Used for Irrigation	Human Health Protection	Ecological Health
Comments		AEC 8- Dip Tank	AEC 8- Dip Tank	AEC 8- Dip Tank	AEC 8- Dip Tank	Duplicate of MM-25	AEC 8- Dip Tank	AEC 8- Dip Tank						
PARAMETERS	Units	Analytical Results[1]												
pH		-	-	-	-	-	-	-	n.s	n.s.	n.s.	n.s.	n.s.	n.s.
Chlorinated Phenols														
2,3,4,6-Tetrachlorophenol	mg/kg	0.06	0.19	0.22	0.16	0.14	0.07	<0.02	n.s.	n.s.	n.s.	n.s.	2,500	0.5
Pentachlorophenol	mg/kg	**0.71**	**3.49**	**2.4**	**1.45**	**1.54**	**0.59**	<0.02	200	25	0.1 to 300[pH]	n.s.	n.s.	n.s.

Notes:

1 - Data excerpted from Envirochem Special Projects Inc. analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.1 - Part 1 Numerical Soil Standards, site-specific land use and pathways as noted above

3 - BC CSR Schedule 3.1 - Part 2 Generic Numerical Soil Standard to Protect Human Health, site-specific land use as noted above

4 - BC CSR Schedule 3.1 - Part 3 Generic Numerical Soil Standards to Protect Ecological Health, site-specific land use as noted above

n.s. = No applicable standard

pH = Standard is pH dependant and is specific to each sample with the range noted above

- = No analysis

< = Less than the laboratory method detection limit

Bold reported detection limits exceed the lowest applied standard with no pH reported.

Table 7. Summary of Groundwater Analytical Results - Dissolved Metals

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC
Envirochem Special Projects, 1994.

Sample ID		MM-2	MM-6	T-8	T-16	CSR Schedule 3.2[2]		
Matrix		Groundwater	Groundwater	Groundwater	Groundwater			
Depth to Groundwater from Ground Surface (m)		0.33	0.49	0.22	1.24	Freshwater Aquatic Life	Irrigation	Livestock
Groundwater Elevation (m)		38.09	33.27	38.8	30.27			
Sample Date		Spring 2014	Spring 2014	Spring 2014	Spring 2014			
Comments		AEC 8- Dip Tank	AEC 3- Mill	AEC 8- Dip Tank	AEC 4- Garage			
PARAMETERS	Units	**Analytical Results[1]**						
pH	no unit	7.2	7.5	7.1	7.3	n.s.	n.s.	n.s.
Hardness as $CaCO_3$	mg/L	-	-	-	-	n.s.	n.s.	n.s.
Dissolved Metals								
Aluminum	ug/L	210	10	10	60	n.s.	5,000	5,000
Antimony	ug/L	<20	<20	<20	<20	90	n.s.	n.s.
Arsenic	ug/L	<20	<20	<20	<20	50	100	25
Barium	ug/L	68	276	19	3	10,000	n.s.	n.s.
Beryllium	ug/L	<0.2	<0.2	<0.2	<0.2	1.5	100	100
Bismuth	ug/L	<20	<20	<20	<20	n.s.	n.s.	n.s.
Cadmium	ug/L	<0.5	**0.7**	<0.5	<0.5	0.5 to 4[H]	5	80
Calcium	ug/L	27400	61700	63600	16200	n.s.	n.s.	n.s.
Chromium	ug/L	2	1	<1	1	10 (CrVI)/90 (CrIII)	8 (CrVI)/5 (CrIII)	50 (CrVI)/50 (CrIII)
Cobalt	ug/L	5	15	3	<1	40	50	1,000
Copper	ug/L	6	6	6	4	20 to 90[H]	200	300
Iron	ug/L	390	73	1250	85	n.s.	n.s.	n.s.
Lead	ug/L	<10	<10	<10	<10	40 to 160[H]	200	100
Lithium	ug/L	<2	4	<2	<2	n.s.	2,500	5,000
Magnesium	ug/L	5860	12700	23500	31400	n.s.	n.s.	1000 mg/L
Manganese	ug/L	1160	4950	2370	14.1	n.s.	n.s.	n.s.
Mercury	ug/L	-	-	-	-	0.25	1	2
Molybdenum	ug/L	<5	<5	<5	<5	10,000	10 to 30[5]	50
Nickel	ug/L	8	26	6	<1	250 to 1,500[H]	200	1,000
Phosphorus	ug/L	<50	<50	<50	<50	n.s.	n.s.	n.s.
Potassium	ug/L	800	1900	900	600	n.s.	n.s.	n.s.
Selenium	ug/L	<20	<20	<20	<20	20	20[6] or 50[7]	30
Silver	ug/L	**<1**	**<1**	**<1**	**<1**	0.5 to 15[H]	n.s.	n.s.
Sodium	ug/L	14500	7810	4710	1880	n.s.	n.s.	n.s.
Tin	ug/L	<10	<10	<10	<10	n.s.	n.s.	n.s.
Vanadium	ug/L	<2	<2	2	<2	n.s.	100	100
Zinc	ug/L	<5	9	28	18	75 to 2,400[H]	1,000 to 5,000[H]	2,000

Notes:

1 - Data excerpted from Quanta Trace Laboratories Inc. analytical reports; units have been converted from mg/L to ug/L for comparison with standards as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.2 Generic Numerical Water Standards, site-specific pathways as noted above

3 - Interim background groundwater concentration for cobalt

4 - The standard for boron is crop specific with the lowest of the range noted above

5 - The standard for molybdenum varies with site-specific factors. The lowest of the range is noted above.

6 - The standard for selenium is for continuous applications on crops

7 - The standard for selenium is for intermittent application on crops

H = Standard is hardness dependant and is specific to each sample with the range noted above

n.s. = No applicable standard

\- = Parameter not analyzed

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 8. Summary of Groundwater Analytical Results within 10 m of HWM - Dissolved Metals

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC

Envirochem Special Projects, 1994.

Sample ID		MM-7	MM-7	CSR Schedule 3.2[2]		
Matrix		Groundwater	Groundwater			
Depth to Groundwater from Ground Surface (m)		1.79	1.79	Freshwater Aquatic Life	Irrigation	Livestock
Groundwater Elevation (m)		31.38	31.38			
Sample Date		Spring 2014	Spring 2014			
Comments		AEC 7- Generator building (Within Dilution Zone)				
PARAMETERS	Units					
pH	no unit	7.7	7.7	n.s.	n.s.	n.s.
Hardness as $CaCO_3$	mg/L	-	-	n.s.	n.s.	n.s.
Dissolved Metals						
Aluminum	ug/L	**1720**	**1620**	n.s.	500*	500*
Antimony	ug/L	**<20**	**<20**	9*	n.s.	n.s.
Arsenic	ug/L	**<20**	**<20**	5*	10*	2.5*
Barium	ug/L	18	18	1,000*	n.s.	n.s.
Beryllium	ug/L	**<0.2**	**<0.2**	0.15*	10*	10*
Bismuth	ug/L	<20	<20	n.s.	n.s.	n.s.
Cadmium	ug/L	**<0.5**	**<0.5**	0.05* to 0.4*[H]	0.5*	8*
Calcium	ug/L	44700	45300	n.s.	n.s.	n.s.
Chromium	ug/L	**5**	**5**	1* (CrVI)/9* (CrIII)	0.8* (CrVI)/0.5* (CrIII)	5* (CrVI)/5* (CrIII)
Cobalt	ug/L	<1	<1	4*	5*	100*
Copper	ug/L	**15**	**15**	2* to 9*[H]	20*	30*
Iron	ug/L	2040	1900	n.s.	n.s.	n.s.
Lead	ug/L	**<10**	**<10**	4* to 16*[H]	20*	10*
Lithium	ug/L	<2	<2	n.s.	250*	500*
Magnesium	ug/L	16500	16600	n.s.	n.s.	100* mg/L
Manganese	ug/L	119	118	n.s.	n.s.	n.s.
Mercury	ug/L	-	-	0.025*	0.1*	0.2*
Molybdenum	ug/L	**<5**	**<5**	1,000*	1* to 30.5*	5*
Nickel	ug/L	5	3	25* to 150*[H]	20*	100*
Phosphorus	ug/L	<50	<50	n.s.	n.s.	n.s.
Potassium	ug/L	1800	1900	n.s.	n.s.	n.s.
Silicon	ug/L	11400	11300	n.s.	n.s.	n.s.
Selenium	ug/L	**<20**	**<20**	2*	2*[4] or 5*[5]	3*
Silver	ug/L	<1	<1	0.05* to 1.5*[H]	n.s.	n.s.
Sodium	ug/L	8070	7940	n.s.	n.s.	n.s.
Strontium	ug/L	63	66	n.s.	n.s.	n.s.
Sulfur	ug/L	2560	2690	n.s.	n.s.	n.s.
Thorium	ug/L	<10	<10	n.s.	n.s.	n.s.
Titanium	ug/L	**156**	**145**	100	n.s.	n.s.
Tin	ug/L	<10	<10	n.s.	n.s.	n.s.
Uranium	ug/L	**<60**	**<60**	8.5*	1*	20*
Vanadium	ug/L	10	9	n.s.	10*	10*
Zinc	ug/L	**31**	**28**	7.5* to 240*[H]	100* to 500*[H]	200*
Zirconium	ug/L	<1	<1	n.s.	n.s.	n.s.

Notes:

1 - Data excerpted from Quanta Trace Laboratories Inc. analytical reports; units have been converted from mg/L to ug/L for comparison with standards as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.2 Generic Numerical Water Standards, site-specific pathways as noted above

3 - Interim background groundwater concentration for cobalt

4 - The standard for selenium is for continuous applications on crops

5 - The standard for selenium is for intermittent application on crops

H = Standard is hardness dependent and is specific to each sample with the range noted above

n.s. = No applicable standard

- = Parameter not analyzed

* = Standard has been diluted by 10 times as per BC CSR Technical Guidance 15.

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

Bold reported detection limits exceed the lowest applied standard.

Table 9. Summary of Surface Water Analytical Results - Total Metals

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC

Envirochem Special Projects, 1994.

Sample ID		**Creek Downstream**	**Creek Upstream**	**Creek Upstream**	**BC MoE AWQG Short Term Maximum Exposure[2]**				**CSR Schedule 3.2[3]**		
Matrix		Surface Water	Surface Water	Surface Water							
Depth to Groundwater from Ground Surface (m)		0	0	0							
Sample Date		Spring 2014	Spring 2014	Spring 2014	Freshwater Aquatic Life	Wildlife	Livestock	Irrigation	Freshwater Aquatic Life	Irrigation	Livestock
Comments		Sample location not provided									
PARAMETERS	Units	**Analytical Results[1]**									
pH	no units	-	-	-	6.5 to 9.0	n.s.	n.s.	n.s.			
Hardness as $CaCO_3$	mg/L	-	-	-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Total Metals											
Aluminum	ug/L	20	30	30	n.s.	5,000*	5,000*	5,000*	n.s.	5,000	5,000
Antimony	ug/L	<20	<20	<20	n.s.	n.s.	n.s.	n.s.	90	n.s.	n.s.
Arsenic	ug/L	**<20**	**<20**	**<20**	5	25[l]	25[l]	100[l]	50	100	25
Barium	ug/L	6	6	7	n.s.	n.s.	n.s.	n.s.	10,000	n.s.	n.s.
Beryllium	ug/L	<0.2	<0.2	<0.2	n.s.	n.s.	n.s.	n.s.	1.5	100	100
Bismuth	ug/L	<20	<20	<20	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Cadmium	ug/L	<0.5	<0.5	<0.5	n.s.	n.s.	n.s.	n.s.	0.5 to 4[H]	5	80
Calcium	ug/L	23800	24700	24700	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Chromium	ug/L	<1	2	<1	n.s.	n.s.	n.s.	n.s.	10 (CrVI)/90 (CrIII)	8 (CrVI)/5 (CrIII)	50 (CrVI)/50 (CrIII)
Cobalt	ug/L	1	<1	1	110	n.s.	n.s.	n.s.	40	50	1,000
Copper	ug/L	**45**	**132**	**175**	WQG= 0.094 (H)+2	300	300	200	20 to 90[H]	200	300
Iron	ug/L	172	**<u>2090</u>**	422	1,000*	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Lead	ug/L	<10	<10	<10	WQG= 3 ug/L if (H < 8mg/L)[8]	100	100	200 or 400[7]	40 to 160[H]	200	100
Lithium	ug/L	<2	<2	<2	n.s.	n.s.	n.s.	n.s.	n.s.	2,500	5,000
Magnesium	ug/L	2800	2840	2880	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	1000 mg/L
Manganese	ug/L	17	21	18	WQG ≤ 0.01102 (H) + 0.54	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Mercury	ug/L	-	-	-	n.s.	n.s.	3.0	2.0	0.25	1	2
Molybdenum	ug/L	<5	<5	<5	2,000*	50*	50* or 80*	50*	10,000	10 to 30[4]	50
Nickel	ug/L	<1	2	<1	n.s.	n.s.	n.s.	n.s.	250 to 1,500[H]	200	1,000
Phosphorus	ug/L	<50	<50	<50	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Potassium	ug/L	<200	300	300	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Selenium	ug/L	<20	<20	<20	n.s.	n.s.	n.s.	n.s.	20	20[5] or 50[6]	30
Silicon	ug/L	3010	3060	3050	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Silver	ug/L	**<1**	**<1**	**<1**	0.1 to 3.0[H]	n.s.	n.s.	n.s.	0.5 to 15[H]	n.s.	n.s.
Sodium	ug/L	1640	1650	1660	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Strontium	ug/L	30	36	35	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Sulfur	ug/L	980	1000	1100	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Thorium	ug/L	<10	<10	<10	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Titanium	ug/L	3	4	4	n.s.	n.s.	n.s.	n.s.	1,000	n.s.	n.s.
Tin	ug/L	<10	<10	<10	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Vanadium	ug/L	<2	<2	<2	n.s.	n.s.	n.s.	n.s.	n.s.	100	100
Zinc	ug/L	<5	<5	<5	WQG= 33 if (H ≤ 90 mg/L)[9]	n.s.	n.s.	n.s.	75 to 2,400[H]	1,000 to 5,000[H]	2,000
Zirconium	ug/L	<1	<1	<1	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Notes:

1 - Data excerpted from Quanta Trace Laboratories Inc. analytical reports; units have been converted from mg/L to ug/L for comparison with standards as indicated

2 - BC Ministry of Environment (BC MoE) British Columbia Approved Water Quality Guidelines (AWQG) (March 2018) Summary Report

3 - BC Contaminated Sites Regulation (CSR) Schedule 3.2 Generic Numerical Water Standards, site-specific pathways as noted above

4 - The standard for molybdenum varies with site-specific factors. The lowest of the range is noted above.

5 - The standard for selenium is for continuous applications on crops

6 - The standard for selenium is for intermittent application on crops

7 - Standard is dependant on type of soil

8- If Hardness > 8 mg/L, WQG= $e^{[1.273 \ln (hardness)-1.460]}$

9- If Hardness > 90 mg/L, WQG= 33+ 0.75 (hardness - 90)

H = Standard is hardness dependant and is specific to each sample with the range noted above

pH = Standard is pH dependant and is specific to each sample with the range noted above

n.s. = No applicable standard

- = Parameter not analyzed

* = Standard has been converted to ug/L to correspond with laboratory results

< = Less than the laboratory method detection limit

Bold, <u>underlined</u>, and shaded grey indicates concentration exceeds lowest of the applicable standards

Bold reported detection limits exceed the lowest applied standard, or standards are pH or Hardness dependant and exceedance can not be confirmed.

Table 10. Summary of Groundwater Analytical Results - Mono- Aromatic Hydrocarbons

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC

Envirochem Special Projects, 1994.

Sample ID		T-11	T-16	CSR Schedule 3.2[2]		
Matrix		Groundwater	Groundwater			
Depth to Groundwater from Ground Surface (m)		2.02	1.24	Freshwater Aquatic Life	Irrigation	Livestock
Groundwater Elevation (m)		30.54	30.27			
Sample Date		April 1994	April 1994			
Comments		AEC 5- Gas & oil shed	AEC 6- Garage			
PARAMETERS	Units	**Analytical Results[1]**				
Mono-Aromatic Hydrocarbons						
Benzene	ug/L	<0.1	<0.1	400	n.s.	n.s.
Ethylbenzene	ug/L	2.1	<0.1	2,000	n.s.	n.s.
Styrene	ug/L	<0.1	<0.1	720	n.s.	n.s.
Toluene	ug/L	0.4	0.6	5	n.s.	n.s.
Total Xylenes (m,p,o)	ug/L	2.3	<0.1	300	n.s.	n.s.
GROUNDWATER VAPOUR		**Calculated Breathing Zone Concentration - Urban Park Land Outdoor Use**		**CSR Schedule 3.3 Urban Park Land Use[3]**		
Benzene	ug/m^3	n.c.	n.c.	1.5		
Ethylbenzene	ug/m^3	0.0007	n.c.	1,000		
Styrene	ug/m^3	n.c.	n.c.	1,000		
Toluene	ug/m^3	0.0001	0.0002	5,000		
Total Xylenes	ug/m^3	0.0006	n.c.	100		

Notes:

1 - Data excerpted from Can Test Ltd. analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.2 Generic Numerical Water Standards, site-specific pathways as noted above

3 - BC CSR Schedule 3.3 - Generic Numerical Vapour Standards, site-specific land use as noted above

n.c. = Not calculable as results are less than the method detection limit

n.s. = No applicable standard

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 11. Summary of Groundwater Analytical Results within 10 m of HWM - Mono- Aromatic Hydrocarbons

Phase II Environmental Site Assessment- McLean Mill, Port Alberni, BC

Envirochem Special Projects, 1994.

Sample ID		**MM-7**	**CSR Schedule 3.2[2]**		
Matrix		Groundwater			
Depth to Groundwater from Ground Surface (m)		1.79	Freshwater Aquatic Life	Irrigation	Livestock
Groundwater Elevation (m)		31.38			
Sample Date		Spring 2014			
Comments		AEC 7- Generator building (Within Dilution Zone)			
PARAMETERS	Units	**Analytical Results[1]**			
Mono-Aromatic Hydrocarbons					
Benzene	ug/L	<0.1	40*	n.s.	n.s.
Ethylbenzene	ug/L	1.1	200*	n.s.	n.s.
Styrene	ug/L	<0.1	72*	n.s.	n.s.
Toluene	ug/L	<0.1	0.5*	n.s.	n.s.
Total Xylenes (m,p,o)	ug/L	6.3	30*	n.s.	n.s.
GROUNDWATER VAPOUR		**Calculated Breathing Zone Concentration - Urban Park Outdoor Use**	**CSR Schedule 3.3 Urban Park Land Use[3]**		
Benzene	ug/m^3	n.c.	1.5		
Ethylbenzene	ug/m^3	0.0004	1,000		
Styrene	ug/m^3	n.c.	1,000		
Toluene	ug/m^3	n.c.	5,000		
Total Xylenes	ug/m^3	0.0017	100		

Notes:

1 - Data excerpted from Can Test Ltd. analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.2 Generic Numerical Water Standards, site-specific pathways as noted above

3 - BC CSR Schedule 3.3 - Generic Numerical Vapour Standards, site-specific land use as noted above

n.c. = Not calculable as results are less than the method detection limit

n.s. = No applicable standard

* = Standard has been diluted by 10 times as per BC CSR Technical Guidance 15.

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 12. Summary of Blacksmith Shop (AEC 1) Soil Analytical Results - Metals

Soil Remediation Summary- McLean Mill, Port Alberni, BC
Envirochem Special Projects, 1995.

Sample ID		A1-2 & A1-3	A1-4 & A1-5	SA1-(1,2,3)	SA1-4	A1-1	A1-6	A1-7	A1-8	FS-A1-1	FS-A1-2	FS-A1-3	CSR Schedule 3.1 - Part 1 Urban Park Land Use[2]				CSR Schedule 3.1 Part 2 Urban Park Land Use[3]	CSR Schedule 3.1 Part 3 Urban Parkland Land Use[4]
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Human Health Protection	Environmental Protection				
Depth (m below surface grade)		Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	0.30	0.30	0.30						
Sample Date		21-Feb-95	21-Feb-95	21-Feb-95	28-Feb-95	21-Feb-95	21-Feb-95	28-Feb-95	28-Feb-95	25-Mar-95	25-Mar-95	25-Mar-95	Intake of Contaminated Soil	Toxicity to Invertebrates and Plants	Groundwater Flow to Freshwater	Groundwater Used for Irrigation	Human Health Protection	Ecological Health
Comments		AEC 1- Confirmatory- Excavated	AEC 1- Confirmatory- Excavated	AEC 1- Stockpile	AEC 1- Stockpile	AEC 1- Confirmatory- Final Surface Sample	AEC 1- Confirmatory- Final Surface Sample	AEC 1- Confirmatory- Final Surface Sample	AEC 1- Confirmatory- Final Surface Sample	AEC 1-Final surface sample	AEC 1-Final surface sample	AEC 1-Final surface sample						
PARAMETERS	Units	**Analytical Results[1] -Soils Excavated From Site**				**Analytical Results[1] -Confirmation Soils Remaining on Site**												
pH	No Units	-	-	-	-	-	-	-	-			-	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Metals																		
Arsenic	ug/g	**<30**	**<30**	**<30**	**<30**	**<30**	**<30**	**<30**	**<30**	**<30**	**<30**	**<30**	40	25	10	10	n.s.	n.s.
Barium	ug/g	**1760**	503	587	642	569	75	279	140	**1150**	156	81	15,000	700	3,500	n.s.	n.s.	n.s.
Cadmium	ug/g	**1.1***	**1***	**1.1***	<0.25	<0.25	<0.25	<0.25	0.3	<0.25	0.33	<0.25	40	30	1 to 50^{pH}	1 to 70^{pH}	n.s.	n.s.
Chromium	ug/g	36	24	**68***	30	32	**97***	**78***	**98***	30	**81***	**81***	250	200	60 (CrVI)/300,000 (CrIII)	60 (CrVI)/15,000 (CrIII)	n.s.	n.s.
Cobalt	ug/g	11	9	16	12	10	**26**	**27**	**34**	9	23	**26**	25	45	25	25	n.s.	n.s.
Copper	ug/g	**200**	95	**205**	**101***	93	**105***	**119***	**154**	**162**	**111***	**108***	7,500	150	75 to 7,500^{pH}	75 to 15,000^{pH}	n.s.	n.s.
Lead	ug/g	**803**	**735**	**634**	114	99	4	39	**171**	86	**251**	16	120	550	200 to 90,000^{pH}	350 to 150,000^{pH}	n.s.	n.s.
Mercury	ug/g	0.086	0.077	0.084	0.018	0.011	0.042	0.026	0.094	0.012	0.06	0.085	25	40	n.s.	n.s.	n.s.	n.s.
Molybdenum	ug/g	**<4**	**<4**	**<4**	**<4**	**<4**	**<4**	**<4**	**<4**	**<4**	**<4**	**<4**	400	80	650	3	n.s.	n.s.
Nickel	ug/g	37	28	62	27	24	28	**55***	**63***	37	49	50	900	150	90 to 9,500^{pH}	70 to 1,500^{pH}	n.s.	n.s.
Selenium	ug/g	**<3**	**<3**	**<3**	**<3**	**<3**	**<3**	**<3**	**<3**	**<3**	**<3**	**<3**	400	1.5	1	1	n.s.	n.s.
Silver	ug/g	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	n.s.	n.s.	n.s.	n.s.	400	20
Tin	ug/g	190	98	213	12	22	7	11	69	11	<5	7	n.s.	n.s.	n.s.	n.s.	50,000	50
Zinc	ug/g	**1690**	**3880**	**1490**	90	51	90	134	107	81	117	105	25,000	450	150 to 3,000^{pH}	150 to 9,000^{pH}	n.s.	n.s.

Notes:

1 - Data excerpted from Can Test Ltd. analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.1 - Part 1 Numerical Soil Standards, site-specific land use and pathways as noted above

3 - BC CSR Schedule 3.1 - Part 2 Generic Numerical Soil Standard to Protect Human Health, site-specific land use as noted above

4 - BC CSR Schedule 3.1 - Part 3 Generic Numerical Soil Standards to Protect Ecological Health, site-specific land use as noted above

n.s. = No applicable standard

pH = Standard is pH dependant and is specific to each sample with the range noted above

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

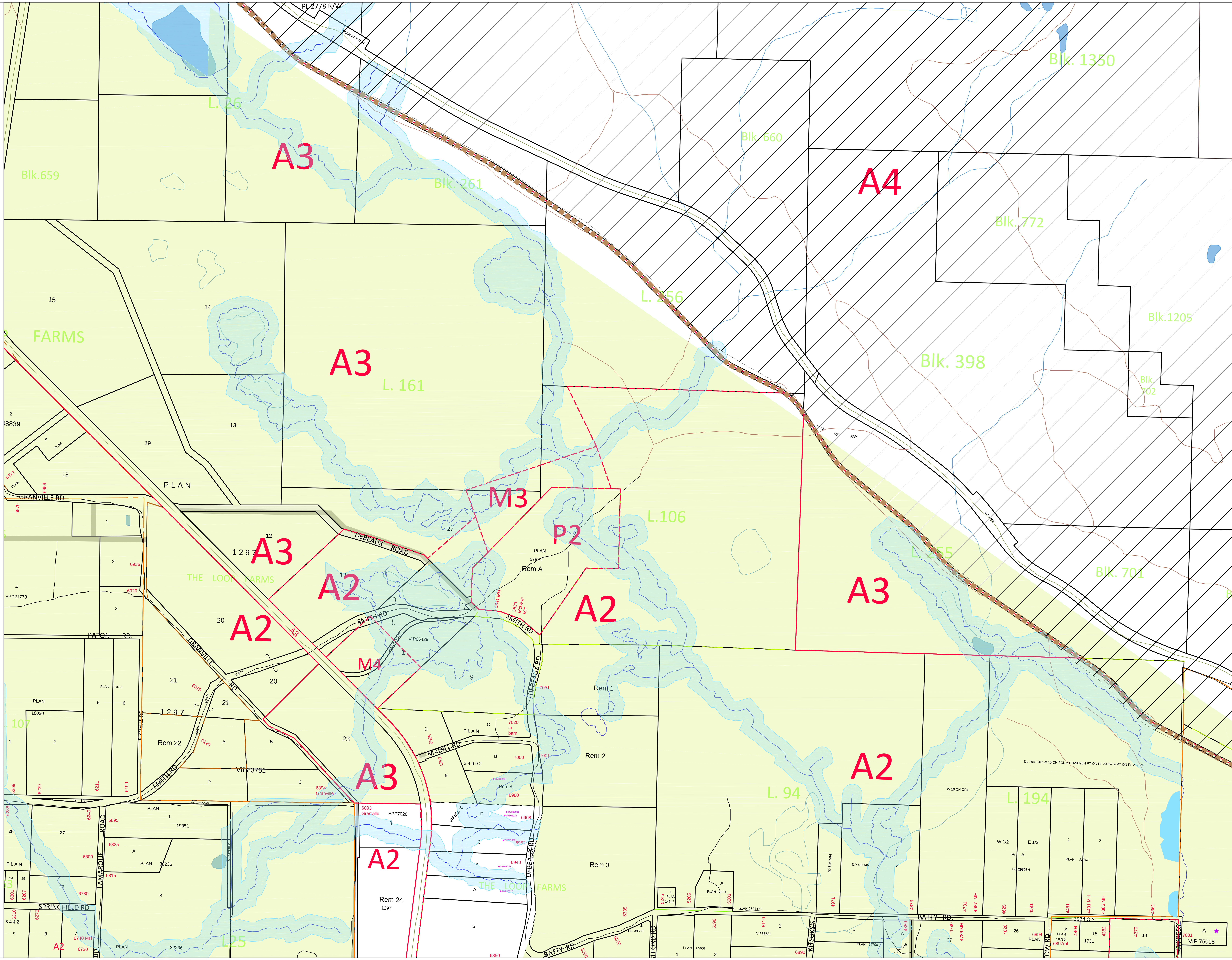
Bold reported detection limits exceed the lowest applied standard and or due to no pH reported for comparison.

* = Regional Background estimates applied due to no reported pH values

Cadmium	0.95 ug/g
Chromium	65 ug/g
Copper	100 ug/g
Lead	40 ug/g
Nickel	50 ug/g
Zinc	150 ug/g

APPENDIX A.

MUNICIPAL ZONING



ALBERNI-CLAYOQUOT REGIONAL DISTRICT

This map depicts subdivision relationship only and should not be used to establish legal lot size or dimensions. For accurate lot dimensions and other relevent information, please see the registered survey plans.

DPA-I Riparian Areas

DPA-II Natural Hazard Areas

DPA-III Form and Character

Development Approval Information Area

AGRICULTURAL LAND RESERVE

SPROAT LAKE FIRE PROTECTION BOUNDARY

BEAVER CREEK FIRE PROTECTION BOUNDARY

CHERRY CREEK FIRE PROTECTION BOUNDARY

ZONING BOUNDARY

UNBUILT ROAD

VARIANCE

RESTRICTIVE COVENANT

92F.036.2.2

D10

1:5000

0 100 400

APPENDIX B.

LAND TITLES

REFERENCE PLAN OF PARTS OF D.L. 106 AND LOT 27, LOOP FARMS, PLAN 1297, BOTH IN ALBERNI DISTRICT, PURSUANT TO SEC. 99(1)(h) L.T.A.

PLAN NO. VIP57991

Deposited in the Land Title Office of Victoria, B.C. this 7 day of January 1997

Deputy Registrar

BCGS. 92F.036

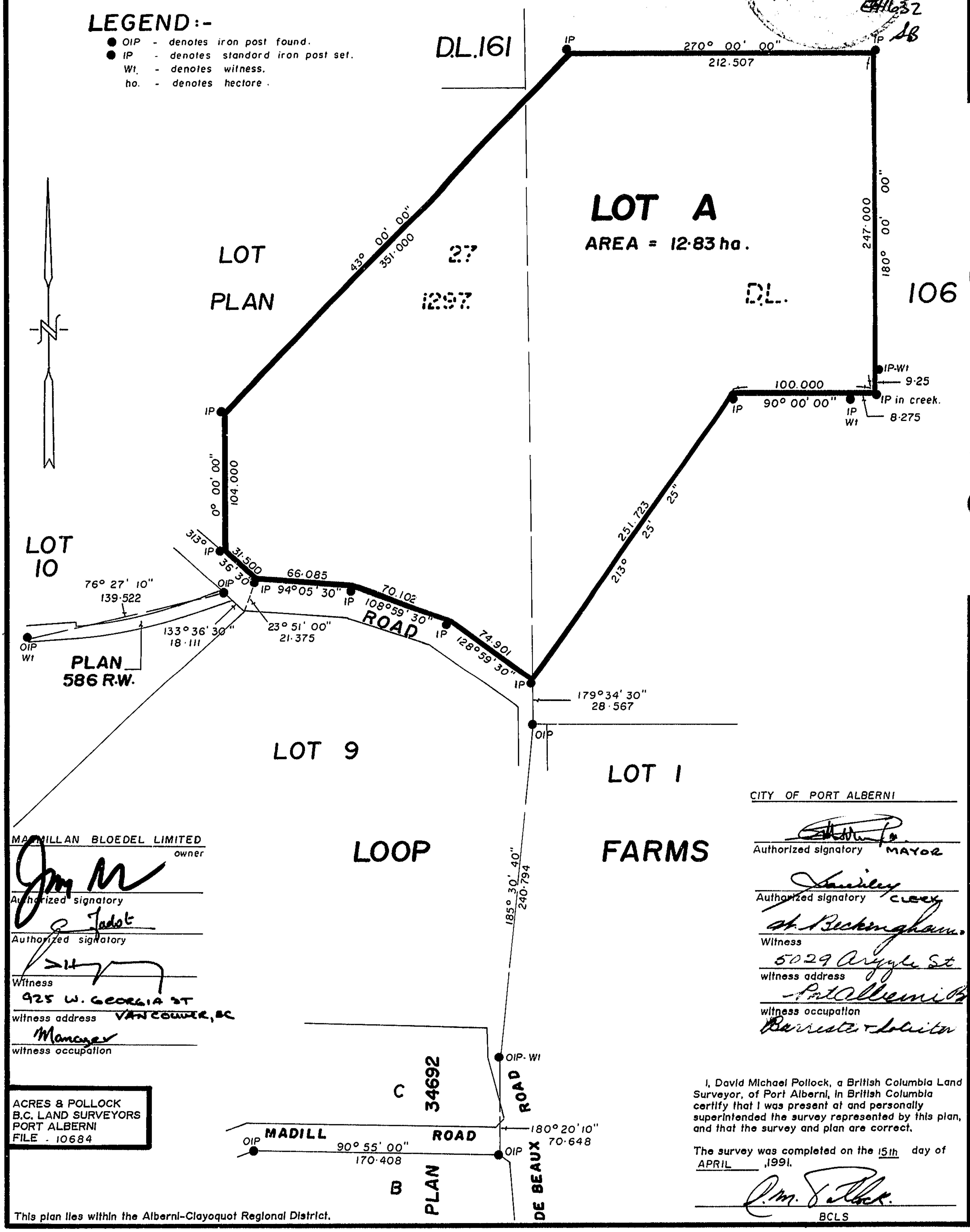
SCALE :- 1 : 2,500

50 25 0 50 100 metres

All distances are in metres & decimals thereof.
Bearings are astronomic and are derived from Plan 34692

LEGEND :-

- ● OIP - denotes iron post found.
- ● IP - denotes standard iron post set.
- Wt. - denotes witness.
- ha. - denotes hectare.



05-223-R60

EH16632 SB

MACMILLAN BLOEDEL LIMITED
owner

Authorized signatory

Authorized signatory

Witness

925 W. GEORGIA ST
witness address VANCOUVER, BC

Manager
witness occupation

CITY OF PORT ALBERNI

Authorized signatory MAYOR

Authorized signatory CLERK

Witness

5029 Argyle St
witness address

Port Alberni BC
witness occupation

Barrister & Solicitor

ACRES & POLLOCK
B.C. LAND SURVEYORS
PORT ALBERNI
FILE - 10684

I, David Michael Pollock, a British Columbia Land Surveyor, of Port Alberni, in British Columbia certify that I was present at and personally superintended the survey represented by this plan, and that the survey and plan are correct.

The survey was completed on the 15th day of APRIL, 1991.

BCLS

This plan lies within the Alberni-Clayoquot Regional District.

The requested title search results are displayed below. There is no fee for these results.

bc Land
Title & Survey

2019-01-07 16:21:00

Title Search Results

Requestor: Shaheen Domay

File Reference:

PID 018-572-871 S/VIP57991/////A REM
PENDING APPLICATIONS: There are no pending applications

Title Number	Land Title District	Status	First Owner Name on Title
EL41873	Victoria	REGISTERED	CI*
EH1632	Victoria	CANCELLED	CI*

EH 1629

1 EB 78557
48612N
47676N
AFB.9.693.7434a

2 EB 78560
50138N
7777N
7776N

West Coast Title Search

ENVIRONMENTAL SEARCH FORM

CURRENT LEGAL: LOT A, LOOP FARMS AND DISTRICT LOT 106, ALBERNI DISTRICT, PLAN VIP57991 EXCEPT THAT PART IN PLAN VIP65071

Client: TERRA WEST ENVIRONMENTAL INC.

Invoice #: W179999

PID: 018-572-871

File Ref.: DCMM19-01

Title No.	Registered Owner	Title Registered	Title Cancelled	Prior Legal(s)	See Title attached for Charges *Pertinent Charges noted below*
EL41873	CITY OF PORT ALBERNI	10/APR/1997	CURRENT	LOT A, LOOP FARMS AND DISTRICT LOT 106, ALBERNI DISTRICT, PLAN VIP57991 EXCEPT THAT PART IN PLAN VIP65071	EXCEPTIONS AND RESERVATIONS RESTRICTIVE COVENANT EASEMENT
EH1632	CITY OF PORT ALBERNI	20/JAN/1994	14/APR/1997	LOT A, LOOP FARMS AND DISTRICT LOT 106, ALBERNI DISTRICT, PLAN VIP57991	EXCEPTIONS AND RESERVATIONS RESTRICTIVE COVENANT
EH1629	CITY OF PORT ALBERNI	20/JAN/1994	20/JAN/1994	THAT PART OF LOT 27, LOOP FARMS, ALBERNI DISTRICT, PLAN 1297 AND THAT PART OF DISTRICT LOT 106, ALBERNI DISTRICT, INCLUDED IN PLAN VIP57991	"
FROM 2 TITLES					
(1)					
EB78557	MACMILLAN BLOEDEL LIMITED	08/SEP/1988	20/JAN/1994	LOT 27, LOOP FARMS, ALBERNI DISTRICT, PLAN 1297	EXCEPTIONS AND RESERVATIONS

DISCLAIMER: ***It is recommended to always obtain online titles (current and cancelled) showing live and cancelled charges.*** If requested, we will print online titles reflecting all current/former registered owners and any live and cancelled charges. The notation "*online title not viewed*" indicates we have only confirmed the name of one registered owner and have not checked charge information. Information on the form can be verified by checking the LTO documents. If you have any questions, please contact West Coast Title Search Ltd. in New Westminster at 604-659-8600 or 1-800-553-1936 and in Victoria at 250-405-6000 or 1-800-667-7767.

C:\Users\shaheen\Desktop\Blank Enviro Form.docx

West Coast Title Search

ENVIRONMENTAL SEARCH FORM

PID: 018-572-871

File Ref.: DCMM19-01

Title No.	Registered Owner	Title Registered	Title Cancelled	Prior Legal(s)	See Title attached for Charges *Pertinent Charges noted below*
48612N	R.B. MCLEAN LUMBER CO. LIMITED	04/JUN/1948	08/SEP/1988	LOT 27, LOOP FARMS, ALBERNI DISTRICT, PLAN 1297	EXCEPTIONS AND RESERVATIONS
47676N	ROBERT BARTLETT MCLEAN	08/MAR/1948	04/JUN/1948	LOT 27, LOOP FARMS, ALBERNI DISTRICT, PLAN 1297	RESERVATIONS OF MINERALS
AFB. 9.693.7434a	**SEE ATTACHED**				
(2)					
EB78560	MACMILLAN BLOEDEL LIMITED	08/SEP/1988	20/JAN/1994	DISTRICT LOT 106, ALBERNI DISTRICT, EXCEPT THAT PART IN PLAN 277 RW	EXCEPTIONS AND RESERVATIONS
50138N	R.B. MCLEAN LUMBER CO. LIMITED	01/OCT/1948	08/SEP/1988	"	"
7777N	ROBERT BARTLETT MCLEAN	20/APR/1925	01/OCT/1948	LOT 106, CONTAINING 160 ACRES MORE OR LESS, AND LOT 161, CONTAINING 160 ACRES MORE OR LESS, ALBERNI DISTRICT	RESERVATIONS OF MINERALS
7776N	ROBERT DE BEAUX	20/APR/1925	09/?/?	LOT 106, CONTAINING 160 ACRES MORE OR LESS, AND LOT 161, CONTAINING 160 ACRES MORE OR LESS, ALBERNI DISTRICT	RESERVATIONS OF MINERAL
AFB. 9. 693.7434a	**SEE ATTACHED**				

CURRENT AND CANCELLED INFORMATION SHOWN

Title Issued Under	SECTION 185 LAND TITLE ACT
Land Title District	VICTORIA
Land Title Office	VICTORIA
Title Number	EL41873
From Title Number	EH1632
Application Received	1997-04-10
Application Entered	1997-04-14

Registered Owner in Fee Simple
Registered Owner/Mailing Address: CITY OF PORT ALBERNI
4850 ARGYLE STREET
PORT ALBERNI, BC
V9Y 1V8

Taxation Authority Port Alberni Assessment Area
Cherry Creek Waterworks District

Description of Land
Parcel Identifier: 018-572-871
Legal Description:
LOT A, LOOP FARMS AND DISTRICT LOT 106, ALBERNI DISTRICT, PLAN VIP57991 EXCEPT THAT PART IN PLAN VIP65071

Legal Notations
THIS CERTIFICATE OF TITLE MAY BE AFFECTED BY THE AGRICULTURAL LAND COMMISSION ACT, SEE AGRICULTURAL LAND RESERVE PLAN NO. 1, DEPOSITED APRIL 26, 1974 (SEE DF EE1304, 07.01.91)

Charges, Liens and Interests

Nature:	EXCEPTIONS AND RESERVATIONS
Registration Number:	M76300
Registered Owner:	ESQUIMALT AND NANAIMO RAILWAY COMPANY
Remarks:	INTER ALIA A.F.B. 9.693.7434A 55213G; DD 47676N; 130363G; SECTION 172(3) FOR ACTUAL DATE AND TIME OF REGISTRATION SEE ORIGINAL GRANT FROM E & N RAILWAY COMPANY

Nature:	RESTRICTIVE COVENANT
Registration Number:	EH1630
Registration Date and Time:	1994-01-07 10:52
Remarks:	APPURTENANT TO LOT 27, PLAN 1297, EXCEPT PART IN PLAN VIP57991; DISTRICT LOT 106, ALBERNI DISTRICT, EXCEPT PARTS IN PLANS 277 RW AND VIP57991; AND DISTRICT LOT 161, ALBERNI DISTRICT

Nature:	OPTION TO PURCHASE
Registration Number:	EH1631
Registration Date and Time:	1994-01-07 10:52
Registered Owner:	MACMILLAN BLOEDEL LIMITED INCORPORATION NO. 247324
Transfer Number:	EH1631 NAME CHANGED BY EX25480
Registered Owner:	WEYERHAEUSER COMPANY LIMITED INCORPORATION NO. A0051955
Transfer Number:	EX25480 TRANSFERRED TO EX60269
Registered Owner:	ISLAND TIMBERLANDS GP LTD. INCORPORATION NO. 714328 FOR CHANGE OF ADDRESS SEE FA6735 AND FB33848
Transfer Number:	EX60269

Nature:	EASEMENT
Registration Number:	EN101508
Registration Date and Time:	1999-11-03 09:39
Remarks:	PART AS SHOWN ON PLAN VIP69751 APPURTENANT TO DISTRICT LOT 106, ALBERNI DISTRICT EXCEPT PLANS 277 RW, VIP57991 AND VIP65072

Nature:	MORTGAGE
Registration Number:	EX70839
Registration Date and Time:	2005-06-14 13:19
Registered Owner:	THE BANK OF NOVA SCOTIA
Remarks:	INTER ALIA OF OPTION TO PURCHASE EH1631
Cancelled By:	**EX112024**
Cancelled Date:	**2005-09-01**

Nature:	ASSIGNMENT OF RENTS
Registration Number:	EX70840
Registration Date and Time:	2005-06-14 13:19
Registered Owner:	THE BANK OF NOVA SCOTIA
Remarks:	INTER ALIA OF OPTION TO PURCHASE EH1631
Cancelled By:	**EX112025**
Cancelled Date:	**2005-09-01**

Nature:	MORTGAGE
Registration Number:	EX112026
Registration Date and Time:	2005-09-01 13:48
Registered Owner:	BNY TRUST COMPANY OF CANADA INCORPORATION NO. A55985
Remarks:	INTER ALIA OF OPTION TO PURCHASE EH1631

Nature:	ASSIGNMENT OF RENTS
Registration Number:	EX112027
Registration Date and Time:	2005-09-01 13:48
Registered Owner:	BNY TRUST COMPANY OF CANADA INCORPORATION NO. A55985
Remarks:	INTER ALIA OF OPTION TO PURCHASE EH1631

Duplicate Indefeasible Title NONE OUTSTANDING

Transfers NONE

Pending Applications NONE

Corrections

ET62424A CHARGE OWNER NAME CORRECTED M76300 2002-06-05 09:30:00

FA6735 CHANGE OF ADDRESS NOTED EH1631 2006-01-17 09:11:00

FB33848 CHANGE OF ADDRESS NOTED EH1631 2007-04-12 10:13:00

PARCEL INFORMATION & MISCELLANEOUS NOTES PRINT

2019-01-07, 16:21:33

File Reference:

Requestor: Shaheen Domay

PARCEL IDENTIFIER (PID): 018-572-871

SHORT LEGAL DESCRIPTION:S/VIP57991/////A
MARG:REM

TAXATION AUTHORITY:

1 Port Alberni Assessment Area
2 Cherry Creek Waterworks District

FULL LEGAL DESCRIPTION: CURRENT
LOT A, LOOP FARMS AND DISTRICT LOT 106, ALBERNI DISTRICT, PLAN VIP57991
EXCEPT THAT PART IN PLAN VIP65071

MISCELLANEOUS NOTES:

ASSOCIATED PLAN NUMBERS:
SUBDIVISION PLAN VIP1297
SUBDIVISION PLAN VIP277
SUBDIVISION PLAN VIP57991
PLAN VIP65071
PLAN VIP65072
PLAN VIP69751

AFB/IFB: MN: N PE: 0 SL: 1 TI: 1

CURRENT AND CANCELLED INFORMATION SHOWN

Title Issued Under SECTION 98 LAND TITLE ACT

Land Title District VICTORIA
Land Title Office VICTORIA

Title Number EH1632
From Title Number EH1629

Application Received 1994-01-07

Application Entered 1994-01-20

Title Cancelled **1997-04-14**

Registered Owner in Fee Simple
Registered Owner/Mailing Address: CITY OF PORT ALBERNI
4850 ARGYLE STREET
PORT ALBERNI, BC
V9Y 1V8

Taxation Authority Port Alberni Assessment Area

Description of Land
Parcel Identifier: 018-572-871
Legal Description:
LOT A, LOOP FARMS AND DISTRICT LOT 106, ALBERNI DISTRICT, PLAN VIP57991

Legal Notations
SUBJECT TO SECTION 31 FOREST ACT SEE DF ED46147 FILED 26.04.1990
CANCELLED BY EL23751 1997-02-26

THIS CERTIFICATE OF TITLE MAY BE AFFECTED BY THE AGRICULTURAL LAND COMMISSION ACT, SEE AGRICULTURAL LAND RESERVE PLAN NO. 1, DEPOSITED APRIL 26, 1974 (SEE DF EE1304, 07.01.91)

SUBJECT TO SECTION 28 FOREST ACT, R.S.B.C. 1979, C.140. SEE DF ED46154 FILED 26/04/1990
CANCELLED BY EL23751A 1997-02-26

Charges, Liens and Interests

Nature:	EXCEPTIONS AND RESERVATIONS
Registration Number:	M76300
Registered Owner:	ESQUIMALT AND NANAIMO RAILWAY COMPANY
Remarks:	A.F.B. 9.693.7434A 55213G; DD 47676N; 130363G; SECTION 172(3) FOR ACTUAL DATE AND TIME OF REGISTRATION SEE ORIGINAL GRANT FROM E & N RAILWAY COMPANY FOR ACTUAL DATE AND TIME OF REGISTRATION SEE ORIGINAL GRANT FROM E & N RAILWAY COMPANY

Nature:	RESTRICTIVE COVENANT
Registration Number:	EH1630
Registration Date and Time:	1994-01-07 10:52
Remarks:	APPURTENANT TO LOT 27, PLAN 1297, EXCEPT PART IN PLAN VIP57991; DISTRICT LOT 106, ALBERNI DISTRICT, EXCEPT PARTS IN PLANS 277 RW AND VIP57991; AND DISTRICT LOT 161, ALBERNI DISTRICT

Nature:	OPTION TO PURCHASE
Registration Number:	EH1631
Registration Date and Time:	1994-01-07 10:52
Registered Owner:	MACMILLAN BLOEDEL LIMITED INCORPORATION NO. 247324
Transfer Number:	EH1631
Registered Owner:	
Registered Owner:	FOR CHANGE OF ADDRESS SEE FA6735 AND FB33848

Duplicate Indefeasible Title NONE OUTSTANDING

Transfers

Registration Date:	1997-04-10
Description:	PART IN PLAN VIP65071, ROAD ONLY EL41872

Registration Date:	1997-04-14
Description:	REM EL41873

Corrections

M76300 CHARGE NUMBER DATE: M76300 1986-09-22 12:31:00 PREVIOUS TEXT: 01/08/1983
M76300 CHARGE NUMBER TIME: M76300 1986-09-22 12:31:00 PREVIOUS TEXT: 08:00

ET62424A CHARGE OWNER NAME CORRECTED M76300 2002-06-05 09:30:00

FA6735 CHANGE OF ADDRESS NOTED EH1631 2006-01-17 09:11:00

FB33848 CHANGE OF ADDRESS NOTED EH1631 2007-04-12 10:13:00

Declared Value $$19,245.00

CURRENT AND CANCELLED INFORMATION SHOWN

Land Title District VICTORIA
Land Title Office VICTORIA

Title Number EH1629
From Title Number EB78557
EB78560

Application Received 1994-01-07

Application Entered 1994-01-20

Title Cancelled **1994-01-20**

Registered Owner in Fee Simple
Registered Owner/Mailing Address: CITY OF PORT ALBERNI
4850 ARGYLE STREET
PORT ALBERNI, BC
V9Y 1V8

Taxation Authority Port Alberni Assessment Area

Description of Land
Parcel Identifier: 018-572-766
Legal Description:
THAT PART OF LOT 27, LOOP FARMS, ALBERNI DISTRICT, PLAN 1297 AND THAT PART OF DISTRICT LOT 106, ALBERNI DISTRICT, INCLUDED IN PLAN VIP57991

Legal Notations
SUBJECT TO SECTION 31 FOREST ACT SEE DF ED46147 FILED 26.04.1990

THIS CERTIFICATE OF TITLE MAY BE AFFECTED BY THE AGRICULTURAL LAND COMMISSION ACT, SEE AGRICULTURAL LAND RESERVE PLAN NO. 1, DEPOSITED APRIL 26, 1974 (SEE DF EE1304, 07.01.91)

SUBJECT TO SECTION 28 FOREST ACT, R.S.B.C. 1979, C.140. SEE DF ED46154 FILED 26/04/1990

Charges, Liens and Interests

Nature:	EXCEPTIONS AND RESERVATIONS
Registration Number:	M76300
Registered Owner:	ESQUIMALT AND NANAIMO RAILWAY COMPANY
Remarks:	A.F.B. 9.693.7434A 55213G; DD 47676N; 130363G; SECTION 172(3) FOR ACTUAL DATE AND TIME OF REGISTRATION SEE ORIGINAL GRANT FROM E & N RAILWAY COMPANY

Nature:	RESTRICTIVE COVENANT
Registration Number:	EH1630
Registration Date and Time:	1994-01-07 10:52
Remarks:	APPURTENANT TO LOT 27, PLAN 1297, EXCEPT PART IN PLAN VIP57991; DISTRICT LOT 106, ALBERNI DISTRICT, EXCEPT PARTS IN PLANS 277 RW AND VIP57991; AND DISTRICT LOT 161, ALBERNI DISTRICT

Nature:	OPTION TO PURCHASE
Registration Number:	EH1631
Registration Date and Time:	1994-01-07 10:52
Registered Owner:	MACMILLAN BLOEDEL LIMITED INCORPORATION NO. 247324
Transfer Number:	EH1631
Registered Owner:	
Registered Owner:	FOR CHANGE OF ADDRESS SEE FA6735 AND FB33848

Duplicate Indefeasible Title NONE OUTSTANDING

Transfers

Registration Date:	1994-01-20
Description:	ALL---SUBDIVIDED BY PLAN VIP57991 EH1632

Corrections

M76300 CHARGE NUMBER DATE: M76300 1986-09-22 12:31:00 PREVIOUS TEXT:
01/08/1983
M76300 CHARGE NUMBER TIME: M76300 1986-09-22 12:31:00 PREVIOUS TEXT:
08:00

ET62424A CHARGE OWNER NAME CORRECTED M76300 2002-06-05 09:30:00

FA6735 CHANGE OF ADDRESS NOTED EH1631 2006-01-17 09:11:00

FB33848 CHANGE OF ADDRESS NOTED EH1631 2007-04-12 10:13:00

CURRENT AND CANCELLED INFORMATION SHOWN

Land Title District VICTORIA
Land Title Office VICTORIA

Title Number EB78557
From Title Number 48612N

Application Received 1988-08-31

Application Entered 1988-09-08

Title Cancelled **1994-01-20**

Registered Owner in Fee Simple
Registered Owner/Mailing Address: MACMILLAN BLOEDEL LIMITED, INC.NO. 247324
925 WEST GEORGIA STREET
VANCOUVER, BC
V6C 3L2

Taxation Authority Port Alberni Assessment Area

Description of Land
Parcel Identifier: 007-628-145
Legal Description:
LOT 27, LOOP FARMS, ALBERNI DISTRICT, PLAN 1297

Legal Notations
SUBJECT TO SECTION 31 FOREST ACT SEE DF ED46147 FILED 26.04.1990

THIS CERTIFICATE OF TITLE MAY BE AFFECTED BY THE AGRICULTURAL LAND COMMISSION ACT, SEE AGRICULTURAL LAND RESERVE PLAN NO. 1
(SEE DF EE1304, 07.01.91)

HERETO INTER ALIA IS ANNEXED RESTRICTIVE COVENANT EH1630 OVER LOT A, PLAN VIP57991

Charges, Liens and Interests

Nature:	EXCEPTIONS AND RESERVATIONS
Registration Number:	M76300
Registered Owner:	ESQUIMALT AND NANAIMO RAILWAY COMPANY
Remarks:	A.F.B. 9.693.7434A DD 47676N; 130363G; SECTION 172(3) FOR ACTUAL DATE AND TIME OF REGISTRATION SEE ORIGINAL GRANT FROM E & N RAILWAY COMPANY

Duplicate Indefeasible Title NONE OUTSTANDING

Transfers

Registration Date:	1994-01-20
Description:	PART EH1629
Registration Date:	1994-01-20
Description:	REM EH1633

Corrections

T0001 REGISTERED OWNER IN FEE-SIMPLE: 1991-12-10 14:57:00
PREVIOUS TEXT:
MACMILLAN BLOEDEL LIMITED,(AML N0. 247,324),
1075 WEST GEORGIA STREET,
VANCOUVER, B. C.,
V6E 3R9
CORRECTION REFERENCE: EE138359
M76300 CHARGE NUMBER DATE: M76300 1986-09-22 12:31:00 PREVIOUS TEXT:
01/08/1983
M76300 CHARGE NUMBER TIME: M76300 1986-09-22 12:31:00 PREVIOUS TEXT:
08:00

ET62424A CHARGE OWNER NAME CORRECTED M76300 2002-06-05 09:30:00

CURRENT AND CANCELLED INFORMATION SHOWN

Title Issued Under	SECTION 172 LAND TITLE ACT
Land Title District	VICTORIA
Land Title Office	VICTORIA
Title Number	48612N
From Title Number	47676N
Application Received	1948-06-01
Application Entered	1948-06-04
Title Cancelled	**1988-09-08**

Registered Owner in Fee Simple
Registered Owner/Mailing Address: R.B. MCLEAN LUMBER CO. LIMITED
PORT ALBERNI, BC

Taxation Authority Port Alberni Assessment Area

Description of Land
Parcel Identifier: 007-628-145
Legal Description:
LOT 27, LOOP FARMS, ALBERNI DISTRICT, PLAN 1297

Legal Notations NONE

Charges, Liens and Interests

Nature:	EXCEPTIONS AND RESERVATIONS
Registration Number:	M76300
Registered Owner:	ESQUIMALT AND NANAIMO RAILWAY COMPANY
Remarks:	A.F.B. 9.693.7434A DD 47676N; 130363G; SECTION 172(3) FOR ACTUAL DATE AND TIME OF REGISTRATION SEE ORIGINAL GRANT FROM E & N RAILWAY COMPANY

Duplicate Indefeasible Title ISSUED 1948-07-05

To:	P.T. POWER
Application Number:	48612N
Surrendered:	1988-09-08

Transfers

Registration Date: 1988-09-08
Description: ALL EB78557

Corrections

M76300 CHARGE NUMBER DATE: M76300 1986-09-22 12:31:00 PREVIOUS TEXT: 01/08/1983
M76300 CHARGE NUMBER TIME: M76300 1986-09-22 12:31:00 PREVIOUS TEXT: 08:00

ET62424A CHARGE OWNER NAME CORRECTED M76300 2002-06-05 09:30:00

This Certificate of Indefeasible Title is void as against the title of any person adversely in actual possession of and rightly entitled to the land included in same at the time of the application upon which this Certificate was granted, and who continues in possession, and is subject to—

(a) The subsisting exceptions or reservations contained in the original grant from the Crown:

(b) Any Dominion or Provincial tax, rate, or assessment at the date of the application for registration imposed or made a lien or which may thereafter be imposed or made a lien on the land:

(c) Any municipal charge, rate, or assessment at the date of the application for registration imposed or which may thereafter be imposed on the land, or which had theretofore been imposed for local improvements or otherwise and which was not then due and payable, including any charge, rate, or assessment imposed by any public corporate body having taxing powers over an area in which the land is situate:

(d) Any lease, or agreement for lease, for a period not exceeding three years, where there is actual occupation under the same:

(e) Any public highway or right-of-way, watercourse, or right of water, or other public easement:

(f) Any right of expropriation by Statute:

(g) Any lis pendens or mechanics' lien, judgment, caveat, or other charge, or any assignment for the benefit of creditors or receiving order or authorized assignment under the "Bankruptcy Act," registered since the date of the application for registration:

(h) Any condition, exception, reservation, charge, lien, or interest noted or endorsed hereon:

(i) The right of any person to show that the whole or any portion of the land is by wrong description of boundaries or parcels improperly included in this certificate:

(j) The right of any person to show fraud, wherein the registered owner or wherein the person from or through whom the registered owner derived his right or title otherwise than *bona fide* for value has participated in any degree:

(k) Any restrictive condition, right of reverter, or obligation imposed on the land by the "Forest Act" when noted and endorsed hereon.

From Certificate No.

A.F.B. 9.693.7434-A

THE GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA

No. 47676-N

Certificate of Indefeasible Title

Date of Application for registration, the 8th day of March at 10.42 a.m., 1948

Register, Vol. 191

This is to certify that ROBERT BARTLETT McLEAN,
Alberni, B.C.

is *absolutely and indefeasibly entitled in fee-simple, subject to such charges, liens, and interests as are notified by endorsement hereon, and subject to the conditions, exceptions, and reservations set out hereon, to* that *piece of land situate in the* Alberni Assessment District *and Province of British Columbia, and more particularly known and described as:—*

Lot	Twenty-seven (27)
District	Alberni
Plan	1297

THE FOLLOWING PIECES OF LAND HAVE BEEN TRANSFERRED:

LAND.	CERT. No.
All	48612

Land Registry Office
CANCELLED
Date 4.6.48
H. J. CRAKE, Registrar
PER

In witness whereof *I have hereunto set my hand and seal of office at* Victoria, *British Columbia, this* 11th *day of* March *19*48

[OVER.]

Registrar.

FORM F.

GD

CHARGES, LIENS AND INTERESTS

E—Reservations of Minerals, Etc.

Date	Nature of Charge	No.	Date of Application	Time	Owner of Charge	Value or Amount	Particulars, Term, Rate, etc.	Discharge No.	Discharge Date	Registrar's Signature to Release
A12	E	130363-[illegible]			ESQUIMALT AND NANAIMO RAILWAY COMPANY		D.D. 47676-[illegible]			

"LAND REGISTRY ORDINANCE, 1870."

FORM A.

3.30

DATE, 20th May 1887

I, Charles E. Pooley, of Victoria

Solicitor for the Esquimalt & Nanaimo Ry Co, of Victoria

declare that they are the owner in Fee of the Real Estate hereunder described, and they claim to be Registered accordingly.

DESCRIPTION OF REAL ESTATE.

TOWN OR DISTRICT.	LOT OR SECTION.	ADMEASUREMENT OR ACREAGE.
Vancouver Island	According to E&N Settlement Act 1884	

LIST OF INSTRUMENTS.

DATE.	PARTIES.	CHARACTER OF DEED.
21 April 1887	Government of Dominion [illegible] to Esquimalt & Nanaimo Ry Co.	Conveyance

And I Charles E. Pooley

declare that to the best of my knowledge the value of the said Real Estate is One Million [illegible] Thousand dollars.

Charles E. Pooley

Received for Registration at the

day of 18 , at o'clock, m.

No. 7434[a]

Registered the 26th day of May 1887

In Absolute Feesbook Vol. 9 Fol.693

CHAS. JAS. LEGGATT
Registrar General

THIS WAS TYPED BY
A LTO STAFF MEMBER.

WE CANNOT GUARANTEE
ITS ACCURACY BUT
WILL GIVE YOU AN IDEA
AS TO
AFB 9.693.7434[a]

C A N A D A

DEPUTY GOVERNOR

VICTORIA, by the Grace of God, of the United Kingdom of Great Britain and Ireland, QUEEN, Defender of the Faith, Etc., Etc., Etc.,

TO ALL TO WHOM THESE PRESENTS SHALL COME,

GREETING:

WHEREAS, by an Act of the Legislature of British Columbia passed in the forty-seventh year of Our Reign Chapter 14, and intituled an "Act relating to the Islands Railway, the Graving Dock, and Railway lands of the Province", after reciting as is therein cited there was by section three of the said Act granted to the Dominion Government for the purpose of constructing and to aid in the construction of a railway between Esquimalt and Nanaimo, and in trust to be appropriated as they may deem advisable, but save as is therein excepted, all that piece or parcel of land situate, in Vancouver Island described as follows; Bounded on the South by a straight-line drawn from the head of Saanich Inlet, to Muir Creek on the Straits of Fuca; On the West by a straight line drawn from Muir Creek aforesaid to Crown Mountain; on the North by a straight line drawn from Crown Mountain to Seymour Narrows; and on the East by the coast line of Vancouver Island to the point of commencement, and including all coal, coal oil, ores, stones, clay, marble, slate, mines, minerals and substances whatsoever thereupon, therein and thereunder.

AND WHEREAS by section Four of the said Act there was excepted out of the tract of land granted by the said Section Three, all that portion thereof, lying to the Northward of a line running East and West half way between the mouth of the Courtenay River (Comox district) and Seymour Narrows.

AND WHEREAS by Section Five of the said Act, it was provided that the Government of Canada should be entitled out of such excepted tract to lands equal in extent to those alienated up to the date of the said Act by Crown Grant, Pre-emption or otherwise, within the limits of the grant mentioned in the said Section Three.

AND WHEREAS by Section Six of the said Act it was provided that the grant mentioned in Section Three of the said Act should not include any lands then held under Crown Grant, Lease, Agreement for sale or other alienation by the Crown nor should it include Indian Reserves or Settlements or Naval or Military reserves.

AND WHEREAS by section Twenty-three of the said Act it was provided that the Company which might acquire the said lands from the Dominion Government for the construction of the railway should be governed by sub-section (f) of the agreement in the said Act recited and that each bona fide squatter who had continuously occupied and improved any of the lands within the tract of land to be acquired by the Company from the Dominon Government for a period of of one year prior to the first (day) day of January 1883 should be entitled to a grant of the freehold of the surface rights of the said squatted lands to the extent of one hundred and sixty acres to each squatter at the rate of one dollar an acre.

AND WHEREAS by sub-section (f) of the Agreement in the said Act recited it is provided that the said lands should, except as to coal and other minerals, and also except as to timber lands, as thereinafter mentioned be open for Four years from the passing of the said act to actual settlers for Agricultural purposes, at the rate of one dollar an acre to the extent of 160 acres to each such actual settler, and that in any grants to settlers the right to cut timber for Railway purposes, and rights of way for the Railway and stations and workshops should be reserved.

AND WHEREAS by Section Twenty-four of the said Act it was enacted that the Company should at all times sell coals gotten from the lands that might be acquired by them from the Dominion Government to any Canadian Railway Company having the terminus of its Railway on the sea-board of British Columbia, and to the Imperial, Dominion, and Provincial authorities, at the same rate as might be charged to any Railway Company owning or operating any Railway in the United States, or to any foreign customer whatsoever.

AND WHEREAS by Section Twenty-five of the said Act it was provided that all lands acquired by the Company from the Dominion Government under the said act containing belts of timber fit for milling purposes should be sold at a price to be thereafter fixed by the Government of the Dominion or by the Company.

AND WHEREAS by Section Twenty-six of the said Act it was provided that the existing rights, if any, of any persons or corporations in any of the lands so to be acquired by the Company should not be affected by the said Act nor should it affect Military or Naval Reserves.

AND WHEREAS by an Act of the Parliament of Canada passed in the forty-seventh year of Our Reign Chapter Six and intituled "An Act respecting the Vancouver Island Railway the Esquimalt Graving Dock and certain railway lands of the Province of British Columbia granted to the Dominion" after reciting as is therein recited it is amongst other things in effect enacted that the Governor in Council may grant to the Esquimalt and Nanaimo Railway Company

(in)

in aid of the construction of a railway from Esquimalt to Nanaimo British Columbia, and of a telegraph line of the said railway, beside the subsidy in money mentioned in the said Act. All of the land situated on Vancouver Island which has been granted to Us by the Legislature of British Columbia by the Act hereinbefore in part recited in aid of the construction of the said line of railway in so far as such land shall be vested in Us, and held by Us for the purposes of the said railway or to aid in the construction of the same; and also all coal, coal oil, ores, stones, clay, marble, slate, mines minerals and substances whatsoever in, on or under, the lands so to be granted to the said Company as aforesaid, and the foreshore rights in respect of all such lands as aforesaid, which are to be granted to the said Company as aforesaid and which border (on?) the sea, together with the privilege of mining under the foreshore and sea opposite any such land, and of mining and keeping for their own use all coal and minerals herein mentioned, under the foreshore or sea opposite any such lands, in so far as such coal, coal oil, ores, stones, clay, marble, slates, mines, minerals and substances whatsoever and foreshore rights are vested in Us, as represented by the Government of Canada. And further that no lands shall be conveyed to the said Company until the road is fully completed and equipped and further that the land grant shall be made and the land in so far as the same shall be vested in Us and held by Us for the purposes of the said railway or to aid in the construction of the same shall be conveyed to the said Company upon the completion of the whole work to the entire satisfaction of the Governor in Council but so nevertheless that the said lands and the coal oil, coal and other minerals and timber thereunder therein or thereon shall be subject in every respect to certain provisions set out in the seventh section of the said Act.

AND WHEREAS it has been agreed by and between the Government of Canada, the Government of British Columbia and the said Company that the Grant of the said lands to the said Company shall be by the description hereinafter contained, that the exact boundaries of the lands covered by such grant shall be as settled and agreed upon by and between the Government of British Columbia and the said Company and further that it shall not be necessary for settlers under sub-section (f) of the agreement recited in the said Act of the Legislature of British Columbia to pay the price of lands pre-empted by them in full before the expiry of four years from the passing of the said Act and that the terms of payment by such settlers for their land shall be those provided by the laws affecting Crown Lands in British Columbia, and that the Company shall grant them their conveyances upon

(demand)

demand when such price shall have been paid in full.

AND WHEREAS the whole work undertaken by the said Company has been completed to the entire satisfaction of Our Governor in Council, and Our Governor in Council has recommended that the land grant provided for by the said Acts should now be made subject however to the stipulations and conditions hereinafter mentioned and We deem it expedient that such grant shall be so made.

NOW KNOW YE, that We do by these presents in consideration of the premises and under and by virtue of the said Acts of the Parliament of Canada and of the Legislature of British Columbia hereinbefore in part recited, and by virtue of every other power Us in that behalf enabling, and by and with the advice of Our Privy Council for Canada Grant Assign and Convey unto the Esquimalt and Nanaimo Railway Company its successors and assigns All and Singular the land situated on Vancouver Island which has been granted to Us by the Act of the Legislature of the Province of British Columbia passed in the Forty-seventh year of Our Reign Chaptered Fourteen and intituled "An Act relating to the Island Railway the Graving Dock, and Railway lands of the Province", in aid of the construction of the said line of Railway in so far as such lands are vested in Us and held by Us for the purposes of the said Railway or to aid in the construction of the same, and also all coal, coal oil, ores, stones, clay, marble, slate, mines, minerals and substances whatsoever in on or under such lands, and the foreshore rights in respect of such of the said lands as border on the sea together with the privilege of mining under the foreshore and sea opposite any such land, and of mining and keeping for its and their own use all coal and minerals herein mentioned under the foreshore or sea opposite any such lands in so far as such coal, coal oil, ores, stones, clay, marble, slate, mines, minerals and substances and foreshore rights are vested in Us as represented by the Government of Canada. And also the full benefit and advantage of the rights and privileges granted to Us by Section Five of the said Act of the Legislature of British Columbia.

TO HAVE AND TO HOLD the said lands, coal, coal oil, ores, stones, clay, marble, slate, mines, minerals and substances and the said foreshore rights and privileges of mining and the said rights and privileges in the said Section Five of the said Act of the Legislature of British Columbia referred to unto and to the use of the said Company its successors and assigns, forever:

(Subject)

SUBJECT NEVERTHELESS to the several stipulations and conditions affecting the same hereinbefore recited and which are contained in the Acts of the Parliament of Canada and of the Legislature of the British Columbia hereinbefore in part recited, as such stipulations are modified by the terms hereinbefore recited of the agreement so made as aforesaid by and between the Government of Canada, the Government of British Columbia and the said Company.

Given under the Great Seal of Canada:

Witness, John Joseph McGee, Esquire, Deputy of Our Right - Trusty and Entirely Beloved Cousin, the Most Honourable Henry Charles Keith Petty Fitzmaurice, Marquess of Lansdowne, in the County of (???), Earl of Wycombe of Chipping Wycombe in the County of Bucks, Viscount Calne and Calnstone in the County of Wills, and Lord Wycombe, Baron of Chipping Wycombe in the County of Bucks, in the peerage of Great Britain; Earl of Kerry and Earl of Shelburne, Viscount Clanmaurice and Fitzmaurice, Baron of Kerry, Luxnaw, and Dunkerrow, in the peerage of Ireland, Knight Grand Cross of Our Most Distinguished Order of St. Michael and St. George; Governor General of Canada and Vice-Admiral of the same, etc., etc., etc.

AT OTTAWA, this Twenty-first day of April, in the year of Our Lord, one thousand eight hundred and eighty-seven and in the fiftieth year of Our Reign.

BY COMMAND,

G. Powell"
Under Secretary of State

A.M. B.......
"illegible"
Deputy of the Minister of the Interior

M76300

Received for Record at Victoria B.C. the 20th day of May 1887 at 3:30 pm

Chas. Jas. Leggatt
Reg^{r} Genl

Recorded the 25th day of May 1887. In record of Conveyances. Vol 2 Fol 283

Chas. Jas. Leggatt
Registrar-General

Undersurface Rights and Exceptions and Reservations

The following information is designed to give some general background and is not to be regarded as exhaustive or conclusive in any way.

From time to time questions are raised about undersurface rights which are shown as a charge against a title.

One of the most frequently encountered of these is a charge registered in favour of the Esquimalt and Nanaimo Railway Co. (E & N) under the notation "Exceptions and Reservations".

The exceptions and reservations which the E & N reserved to themselves are contained in the original instrument of grant by which a particular parcel of land was conveyed, "granted" from the E & N to a purchaser. (The E & N is now a subsidiary of Canadian Pacific Limited)

There are a number of different forms of grant from the E & N and the substances and rights reserved to themselves therein vary. Keeping in mind the variations in individual grants, the reservations typically fall into three broad groups.

First, the right to enter upon land and cut and carry away any timber for railway purposes without paying compensation.

Secondly, Rights of Way for their railway and the right to take such parts of the said land as may be required for the stations and workshops of the said company without paying compensation therefore. (Certain grants, however, do provide for compensation to be paid).

The third group pertains to the reservation of undersurface rights. However, following the enactment of the Mineral Land Tax Act, in 1973, it is no longer possible to determine the mineral ownership by looking at the E & N grants alone because of a surrender by the E & N to the Crown of minerals as defined by the Mineral Land Tax Act under certain lands.

A variety of factors must therefore be considered, including the Mineral Land Tax Act, possible forfeiture to the Crown for non payment of taxes and surrender positions when ascertaining mineral ownership regardless of whether they are endorsed on the Certificate of Title in the name of the Crown, the Esquimalt and Nanaimo Railway Company or that of a private owner's name.

While it is possible to search back to the original grants in this office, it is time consuming and expensive. Moreover, as stated before, the grant must be considered in conjunction with other factors some of which are mentioned above.

Therefore, an expert legal opinion must be obtained at all times with regard to mineral ownership. It is outside the jurisdiction of the Land Title Office to pass judgment or give an opinion in this respect.

CURRENT AND CANCELLED INFORMATION SHOWN

Land Title District	VICTORIA
Land Title Office	VICTORIA
Title Number	EB78560
From Title Number	50138N
Application Received	1988-08-31
Application Entered	1988-09-08
Title Cancelled	**1994-01-20**

Registered Owner in Fee Simple
Registered Owner/Mailing Address: MACMILLAN BLOEDEL LIMITED, INC.NO. 247324
925 WEST GEORGIA STREET
VANCOUVER, BC
V6C 3L2

Taxation Authority Port Alberni Assessment Area

Description of Land
Parcel Identifier: 008-770-883
Legal Description:
DISTRICT LOT 106, ALBENRI DISTRICT, EXCEPT PART IN PLAN 277 RW

Legal Notations
THIS CERTIFICATE OF TITLE MAY BE AFFECTED BY THE AGRICULTURAL LAND COMMISSION ACT; SEE AGRICULTURAL LAND RESERVE PLAN NO. 1, DEPOSITED APRIL 26, 1974

SUBJECT TO SECTION 28 FOREST ACT, R.S.B.C. 1979, C.140. SEE DF ED46154 FILED 26/04/1990

HERETO INTER ALIA IS ANNEXED RESTRICTIVE COVENANT EH1630 OVER LOT A, PLAN VIP57991

Charges, Liens and Interests

Nature:	EXCEPTIONS AND RESERVATIONS
Registration Number:	M76300
Registered Owner:	ESQUIMALT AND NANAIMO RAILWAY COMPANY
Remarks:	A.F.B. 9.693.7434A 55213G; SECTION 172(3) FOR ACTUAL DATE AND TIME OF REGISTRATION SEE ORIGINAL GRANT FROM E & N RAILWAY COMPANY

Duplicate Indefeasible Title NONE OUTSTANDING

Transfers

Registration Date:	1994-01-20
Description:	PART EH1629
Registration Date:	1994-01-20
Description:	REM EH1634

Corrections

T0001 REGISTERED OWNER IN FEE-SIMPLE: 1991-12-10 14:58:00
PREVIOUS TEXT:
MACMILLAN BLOEDEL LIMITED,(AML N0. 247,324),
1075 WEST GEORGIA STREET,
VANCOUVER, B. C.,
V6E 3R9
CORRECTION REFERENCE: EE138359
M76300 CHARGE NUMBER DATE: M76300 1986-09-22 12:31:00 PREVIOUS TEXT:
01/08/1983
M76300 CHARGE NUMBER TIME: M76300 1986-09-22 12:31:00 PREVIOUS TEXT:
08:00

ET62424A CHARGE OWNER NAME CORRECTED M76300 2002-06-05 09:30:00

CURRENT AND CANCELLED INFORMATION SHOWN

Title Issued Under	SECTION 172 LAND TITLE ACT
Land Title District	VICTORIA
Land Title Office	VICTORIA
Title Number	50138N
From Title Number	7777N
Application Received	1948-09-28
Application Entered	1948-10-01
Title Cancelled	**1988-09-08**

Registered Owner in Fee Simple
Registered Owner/Mailing Address: R.B. MCLEAN LUMBER CO. LIMITED
PORT ALBERNI, BC

Taxation Authority Port Alberni Assessment Area

Description of Land
Parcel Identifier: 008-770-883
Legal Description:
DISTRICT LOT 106, ALBENRI DISTRICT, EXCEPT PART IN PLAN 277 RW

Legal Notations
THIS CERTIFICATE OF TITLE MAY BE AFFECTED BY THE AGRICULTURAL LAND COMMISSION ACT; SEE AGRICULTURAL LAND RESERVE PLAN NO. 1, DEPOSITED APRIL 26, 1974

Charges, Liens and Interests

Nature:	EXCEPTIONS AND RESERVATIONS
Registration Number:	M76300
Registered Owner:	ESQUIMALT AND NANAIMO RAILWAY COMPANY
Remarks:	A.F.B. 9.693.7434A 55213G; SECTION 172(3) FOR ACTUAL DATE AND TIME OF REGISTRATION SEE ORIGINAL GRANT FROM E & N RAILWAY COMPANY

Duplicate Indefeasible Title ISSUED 1948-10-21
To: G.E. LAMONT
Application Number: 50138N
Surrendered: 1988-09-08

Transfers
Registration Date: 1988-09-08
Description: ALL EB78560

Corrections
M76300 CHARGE NUMBER DATE: M76300 1986-09-22 12:31:00 PREVIOUS TEXT: 01/08/1983
M76300 CHARGE NUMBER TIME: M76300 1986-09-22 12:31:00 PREVIOUS TEXT: 08:00

ET62424A CHARGE OWNER NAME CORRECTED M76300 2002-06-05 09:30:00

This Certificate of Indefeasible Title is void as against the title of any person adversely in actual possession of and rightly entitled to the hereditaments included in same at the time of the application upon which this Certificate was granted, and who continues in possession, and is subject to—

(a.) The subsisting exceptions or reservations contained in the original grant from the Crown:

(b.) Any Dominion or Provincial tax, rate, or assessment at the date of the application for registration imposed or made a lien or which may thereafter be imposed or made a lien on the land.

(c.) Any municipal charge, rate, or assessment at the date of the application for registration imposed or which may thereafter be imposed on the land, or which had theretofore been imposed for local improvements or otherwise and which was not then due and payable, including any charge, rate, or assessment imposed by any public corporate body having taxing powers over an area in which the land is situate:

(d.) Any lease, or agreement for lease, for a period not exceeding three years, where there is actual occupation under the same:

(e.) Any public highway or right-of-way, watercourse or right of water, or other public easement:

(f.) Any right of expropriation by Statute:

(g.) Any lis pendens or mechanic's lien, judgment, caveat, or other charge, or any assignment for the benefit of creditors or receiving order or authorized assignment under the "Bankruptcy Act," registered since the date of the application for registration:

(h.) Any condition, exception, reservation, charge, lien or interest noted or endorsed hereon:

(i.) The right of any person to show that the whole or any portion of the land is by wrong description of boundaries or parcels improperly included in this certificate:

(j.) The right of any person to show fraud, wherein the registered owner or wherein the person from or through whom the registered owner derived his right or title otherwise than bona fide for value has participated in any degree.

From Certificate No. 7776-[illegible]

THE GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA

No. 7777-[illegible]

Certificate of Indefeasible Title

Date of Application for registration, the Twentieth day of April at 10.57 a.m., 192[illegible]

Register, Vol. [illegible]

This is to certify that ROBERT BARTLETT MCLEAN, Cloverdale, British Columbia, Landed Proprietor,

is *absolutely and indefeasibly entitled in Fee-simple, subject to such charges, liens, and interests as are notified by endorsement hereon, and subject to the conditions, exceptions, and reservations set out hereon, to* those *pieces of land situate in the* Assessment District of Alberni *and Province of British Columbia, and more particularly known and described as:—* Lot One HUNDRED and Six (106), containing One Hundred and Sixty (160) acres more or less, and Lot One Hundred and Sixty-one (161), containing One Hundred and Sixty (160) acres more or less, ALBERNI DISTRICT.

THE FOLLOWING PIECES OF LAND HAVE BEEN TRANSFERRED:

Land	Cert. No.
Part of [illegible]	[illegible]
Lot 161	49122
Remainder	50138

Land Registry Office
CANCELLED
Date 1.10.48
Per [illegible]

In witness whereof I have hereunto set my hand and seal of office at Victoria*, British Columbia, this* 9th *day of* May*, 192*[illegible]

[illegible]
Registrar.

[over.]

FORM F

ABBREVIATIONS:
M. = Mortgage in fee.
R. P. = Right to purchase.
S. R. P. = Sub-right to purchase.
L. P. = Lis pendens.
L. = Lease.
R. C. = Restrictive Covenant.

Charges, Liens, and Interests.

FOR OTHER ABBREVIATIONS FILL IN HERE:
R = Reservations of Minerals, Etc.

LAND.	Nature of Charge.	No.	Date of Application.	Time.	OWNER OF CHARGE.	Value or Amount.	PARTICULARS, TERM, RATE, etc.	Releases. No.	Releases. Date.	Registrar's Signature to Releases.
All (inter alia)	R	55213 G	11.5.25	10.12 am	ESQUIMALT AND NANAIMO RAILWAY COMPANY					

TRANSFERRED FROM NO. 55213 G
TO CERTIFICATE OF TITLE NO. 20959 C
AS TO Part of Lot (not included in Plan 2774?)

This Certificate of Indefeasible Title is void as against the title of any person adversely in actual possession of and rightly entitled to the hereditaments included in same at the time of the application upon which this Certificate was granted, and who continues in possession, and is subject to—

(a.) The subsisting exceptions or reservations contained in the original grant from the Crown:

(b.) Any Dominion or Provincial tax, rate, or assessment at the date of the application for registration imposed or made a lien or which may thereafter be imposed or made a lien on the land.

(c.) Any municipal charge, rate, or assessment at the date of the application for registration imposed or which may thereafter be imposed on the land, or which had theretofore been imposed for local improvements or otherwise and which was not then due and payable, including any charge, rate, or assessment imposed by any public corporate body having taxing powers over an area in which the land is situate;

(d.) Any lease, or agreement for lease, for a period not exceeding three years, where there is actual occupation under the same;

(e.) Any public highway or right-of-way, watercourse or right of water, or other public easement;

(f.) Any right of expropriation by Statute:

(g.) Any lis pendens or mechanic's lien, judgment, caveat, or other charge, or any assignment for the benefit of creditors or receiving order or authorized assignment under the "Bankruptcy Act," registered since the date of the application for registration;

(h.) Any condition, exception, reservation, charge, lien or interest noted or endorsed hereon;

(i.) The right of any person to show that the whole or any portion of the land is by wrong description of boundaries or parcels improperly included in this certificate;

(j.) The right of any person to show fraud, wherein the registered owner or wherein the person from or through whom the registered owner derived his right or title otherwise than bona fide for value has participated in any degree.

THE FOLLOWING PIECES OF LAND HAVE BEEN TRANSFERRED:

Land.					Cert. No.
		[illegible]			[illegible]

A.F.B. Vol. 9, Fol. 693
From Certificate No. 7424-A

THE GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA

No. 7770-[illegible]

Certificate of Indefeasible Title

Date of Application for registration, the Twentieth day of April at 10.43 a.m., 192[illegible]

Register, Vol. [illegible]

This is to certify that ROBERT DE BEAUX, Port Alberni, British Columbia, Farmer

is *absolutely and indefeasibly entitled in Fee-simple, subject to such charges, liens, and interests as are notified by endorsement hereon, and subject to the conditions, exceptions, and reservations set out hereon, to* those *pieces of land situate in the* Assessment District of Alberni *and Province of British Columbia, and more particularly known and described as:—* Lot One Hundred and Six (106), containing One Hundred and Sixty (160) acres more or less, and Lot One Hundred and Sixty-one (161), containing One Hundred and Sixty (160) acres more or less, ALBERNI DISTRICT.

LAND REGISTRY OFFICE
CANCELLED
DATE [illegible]
H. J. CRANE, Registrar

In witness whereof *I have hereunto set my hand and seal of office at* Victoria, *British Columbia, this* 9th *day of* May *192*[illegible]

H. J. Crane
Registrar.

[OVER.]

FORM [illegible]

ABS

Abbreviations:
M. = Mortgage in fee.
R.P. = Right to purchase.
S.R.P. = Sub-right to purchase.
L.P. = Lis pendens.
L. = Lease.
R.C. = Restrictive Covenant.

Charges, Liens, and Interests.

For other abbreviations fill in here:
R = Reservations of Minerals, Etc.

Land	Nature of Charge	No.	Date of Application	Time	Owner of Charge	Value or Amount	Particulars, Term, Rate, etc.	Releases No.	Releases Date	Registrar's Signature to Releases
All (inter alia)	R	55213 g	11 5 25	10.12 a.m.	ESQUIMALT AND NANAIMO RAILWAY COMPANY					

APPENDIX C.

ALBERNI-CLAYOQUOT REGIONAL DISTRICT DOCUMENTS

Alberni-Clayoquot Regional District
BUILDING PERMIT

Electoral Area:	B - Beaufort	Permit #:	BC17-10
Folio #:	02160.001	Application Received:	03/22/2017
Building Inspector:	Luc Stefani	Date Entered:	04/11/2017

	Owner Information:	Contractor Information (if applicable):
Name:	PORT ALBERNI (CITY)	MCLEAN MILL SOCIETY
Mailing Address:	4850 ARGYLE ST	5633 SMITH ROAD
City/Town:	PORT ALBERNI	PORT ALBERNI
Province/State:	BC	BC
Postal/Zip Code:	V9Y 1V8	V9Y 8M1
Phone #:	(250) 723-2146	(250) 723-1376 DEANNA BEAUDOIN
Alternate Phone #:		(250) 650-4327
Email Address:	citypa@portalberni.ca	deanna@albernisteamtrain.ca

Applicant Name & Phone # (if different): ____________ ____________

Architect Name & Phone # (if applicable): ____________ ____________

Type of Building:	630-Library, museum, art gallery, aquarium, botanical garden, archive building, scientific center	Type of Work:	03-Alteration and improvements
Dimensions of Building (Width x Depth x Height):	x x	Estimated Square Footage:	

Inspector's Comments: **PLEASE CALL FOR ALL RELEVANT INSPECTIONS AS NOTED. BUILDING IS TO COMPLY WITH THE 2012 BUILDING CODE**
Alterations to existing kitchen within the McLean Mill exhibit/multi-use area. Upgrade HVAC and NFPA 96 conformance. No Change to Industrial Museum building footprint.

ESTIMATED CONSTRUCTION VALUE:	$5,000.00	BUILDING PERMIT FEE:	$71.00

REQUIRED INSPECTIONS

You must notify the Regional District when the following stages of work have been completed so that inspections can be carried out:

- Excavation
- Footing and Forms (prior to pour)
- Foundation & Damp Proofing
- Drains & Drain Rock
- Framing
- Chimney & Fireplace
- Rough Plumbing
- Insulation & Vapour Barrier
- Heating Installation
- Cladding – Interior & Exterior
- Solid Fuel Burning Appliance(s)
- Final Inspection before Occupancy

****Failure to notify will be deemed a violation of the Regional District Building Bylaw!!****

FILE COPY

Alberni-Clayoquot Regional District
BUILDING PERMIT

Owner Name: PORT ALBERNI (CITY) **Permit #:** BC17-10
Civic Address: 5633 SMITH RD **Contractor:**

This permit authorizes PORT ALBERNI (CITY) to construct 630-Library, museum, art gallery, aquarium, botanical garden, archive building, scientific center, 03-Alteration and improvements on lands legally described as:

Lot:	A	District Lot:	106	Land District:	Alberni	Plan:	57991
Block:		Section:		Township:		Range:	

located at:

Civic Address: 5633 SMITH RD BC
Folio #: 02175.001 Electoral Area: B - Beaufort

All construction and work shall be carried out in strict accordance with the Building Bylaw of the Regional District, the Building Regulations of British Columbia, the application for the Building Permit including plans submitted to the Regional District in support of the application and all other enactments, including bylaws applicable to the construction and use of the proposed building or structure. The Regional District does not imply any warranty for building inspection services.

PERMIT CONDITIONS

Every Permit is issued upon the following conditions:

- that the Permit shall **expire two (2) years after the signature date** (below);
- that construction shall be started within six (6) months from the date of issuing the Permit;
- that the work is not to be discontinued or suspended for a period of more than six (6) months;
- that the Permit shall lapse in the event that either of the preceding two conditions are not met;
- that a lapsed Permit shall not be renewed nor the fee refunded;
- if the work is not completed when a Permit lapses or expires, a new Permit for the remaining construction shall be applied for;
- that, at any time after the issuance of a Permit but before the work under the Permit has commenced, the Permit holder may apply for cancellation of the Permit. Upon receipt of such application, the Building Inspector, if satisfied that the work has not commenced, shall cancel the Permit and shall refund to the Permit holder fifty percent (50%) of the original fee paid by the Permit holder; and
- that the registered owner of the land authorizes/signs this permit.

If a sewage disposal permit should be altered so that the building authorized by this building permit must be changed, then an amendment to this building permit is required.
The Regional District may revoke a building permit where a sewage disposal permit is revoked or where a material term or condition of the sewage disposal permit is altered.

Agreement, Release and Indemnity

I/we agree that the information in this application or gathered by the Regional District of Alberni-Clayoquot in connection with a building permit may be used by the Regional District of Alberni-Clayoquot for any purpose connected with the exercise of its powers or the performance of its duties including enforcement of Regional District of Alberni-Clayoquot bylaws. In consideration of the granting of a building permit, I/we agree to release and indemnify the Regional District of Alberni-Clayoquot, its board members, employees and agents from and against all liability, demands, claims of action, suits, judgements, losses, damages, costs, expenses of whatever kind which I/we or any other person, partnership or corporation or my/our respective heirs, successors, administrators or assignees may have or incur in consequence of or incidental to the granting of this permit or any inspection, failure to inspect, certification, approval, enforcement, or failure to enforce the Regional District of Alberni-Clayoquot Building Bylaw or the British Columbia Building Code and I/we agree that the Regional District of Alberni-Clayoquot owes me/us no duty of care in respect of these matters.

I have read the above Agreement, Release and Indemnity and understand it.

OWNER'S SIGNATURE

21 - APRIL 2017
SIGNATURE DATE

SCHEDULE B

Forming Part of Subsection 2.2.7, Div. C of the British Columbia Building Code

BC17-10
Building Permit No.
(for *authority having jurisdiction's* use)

ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW

Notes: (i) This letter must be submitted prior to the commencement of construction activities of the components identified below. A separate letter must be submitted by each *registered professional of record*.
(ii) This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Building Officials' Association of B.C., and Union of B.C. Municipalities.
(iii) In this letter the words in italics have the same meaning as in the British Columbia Building Code.

To: The *authority having jurisdiction*

City of Port Alberni
Name of Jurisdiction (Print)

Re: McLean Mill - Kitchen Renovation
Name of Project (Print)

5633 Smith Rd., Port Alberni, BC V9Y 8M1
Address of Project (Print)

The undersigned hereby gives assurance that the design of the
(Initial those of the items listed below that apply to this *registered professional of record*. All the disciplines will not necessarily be employed on every project.)

________ **ARCHITECTURAL**
________ **STRUCTURAL**
JR. **MECHANICAL**
________ **PLUMBING**
________ **FIRE SUPPRESSION SYSTEMS**
________ **ELECTRICAL**
________ **GEOTECHNICAL — temporary**
________ **GEOTECHNICAL — permanent**

PROFESSIONAL ENGINEER, PROVINCE OF BRITISH COLUMBIA, J. A. LOSCHIAVO # 39377

(Professional's Seal and Signature)

March 24, 2017
Date

components of the plans and supporting documents prepared by this *registered professional of record* in support of the application for the *building* permit as outlined below substantially comply with the B.C. Building Code and other applicable enactments respecting safety except for construction safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during construction, as indicated on the "SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS" below.

____
CRP's Initials

Schedule B - *Continued*

BL17-10
Building Permit No.
(for *authority having jurisdiction's* use)

5633 Smith Rd., Port Alberni, BC V9Y 8M1
Project Address

Mechanical
Discipline

The undersigned also undertakes to notify the *authority having jurisdiction* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during construction.

I certify that I am a *registered professional* as defined in the British Columbia Building Code.

Jancsi Loschiavo, P.Eng.
Registered Professional of Record's Name (Print)

181 Prince John Way
Address (Print)
Nanaimo, BC V9T 1K1

(250)758-8139
Phone No.

PROFESSIONAL
PROVINCE OF
J. A. LOSCHIAVO
39377
BRITISH COLUMBIA
ENGINEER

(Professional's Seal and Signature)

March 24, 2017
Date

(If the *Registered Professional of Record* is a member of a firm, complete the following.)

I am a member of the firm Designed Air Systems Ltd
(Print name of firm)
and I sign this letter on behalf of the firm.

Note: The above letter must be signed by a *registered professional of record*, who is a *registered professional*. The British Columbia Building Code defines a *registered professional* to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or
(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

CRP's Initials

Schedule B - *Continued*

BC17-10
Building Permit No.
(for *authority having jurisdiction's* use)

5633 Smith Rd., Port Alberni, BC V9Y 8M1
Project Address

Mechanical
Discipline

SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS

(Initial applicable discipline below and cross out and initial only those items not applicable to the project.)

_______ **ARCHITECTURAL**

1.1 Fire resisting assemblies
1.2 *Fire separations* and their continuity
1.3 *Closures*, including tightness and operation
1.4 Egress systems, including *access to exit* within *suites* and *floor areas*
1.5 Performance and physical safety features (guardrails, handrails, etc.)
1.6 Structural capacity of architectural components, including anchorage and seismic restraint
1.7 Sound control
1.8 Landscaping, screening and site grading
1.9 Provisions for fire fighting access
1.10 *Access* requirements for *persons with disabilities*
1.11 Elevating devices
1.12 Functional testing of architecturally related fire emergency systems and devices
1.13 Development Permit and conditions therein
1.14 Interior signage, including acceptable materials, dimensions and locations
1.15 Review of all applicable shop drawings
1.16 Interior and exterior finishes
1.17 Dampproofing and/or waterproofing of walls and slabs below *grade*
1.18 Roofing and flashings
1.19 Wall cladding systems
1.20 Condensation control and cavity ventilation
1.21 Exterior glazing
1.22 Integration of building envelope components
1.23 Environmental separation requirements (Part 5)
1.24 Building Envelope, Part 10/ASHRAE or NECB Requirements

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
J. A. LOSCHIAVO
30377

(Professional's Seal and Signature)

March 24, 2017
Date

_______ **STRUCTURAL**

2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
2.2 Structural aspects of *deep foundations*
2.3 Review of all applicable shop drawings
2.4 Structural aspects of unbonded post-tensioned concrete design and construction

JL **MECHANICAL**

3.1 HVAC systems and devices, including high *building* requirements where applicable
3.2 *Fire dampers* at required *fire separations*
3.3 Continuity of *fire separations* at HVAC penetrations
3.4 Functional testing of mechanically related fire emergency systems and devices
3.5 Maintenance manuals for mechanical systems
3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
3.7 Review of all applicable shop drawings
3.8 Mechanical Systems, Part 10/ASHRAE or NECB Requirements

____
CRP's Initials

Schedule B - *Continued*

BC17-10
Building Permit No.
(for authority having jurisdiction's use)

5633 Smith Rd., Port Alberni, BC V9Y 8M1
Project Address

Mechanical
Discipline

_______ **PLUMBING**

4.1 Roof *drainage systems*
4.2 Site and foundation *drainage systems*
4.3 *Plumbing systems* and devices
4.4 Continuity of *fire separations* at plumbing penetrations
4.5 Functional testing of plumbing related fire emergency systems and devices
4.6 Maintenance manuals for *plumbing systems*
4.7 Structural capacity of plumbing components, including anchorage and seismic restraint
4.8 Review of all applicable shop drawings
4.9 Plumbing Systems, Part 10/ASHRAE or NECB Requirements

_______ **FIRE SUPPRESSION SYSTEMS**

5.1 Suppression system classification for type of *occupancy*
5.2 Design coverage, including concealed or special areas
5.3 Compatibility and location of electrical supervision, ancillary alarm and control devices
5.4 Evaluation of the capacity of city (municipal) water supply versus system demands and domestic demand, including pumping devices where necessary
5.5 Qualification of welder, quality of welds and material
5.6 Review of all applicable shop drawings
5.7 Acceptance testing for "Contractor's Material and Test Certificate" as per NFPA Standards
5.8 Maintenance program and manual for suppression systems
5.9 Structural capacity of sprinkler components, including anchorage and seismic restraint
5.10 For partial systems — confirm sprinklers are installed in all areas where required
5.11 Fire Department connections and hydrant locations
5.12 Fire hose standpipes
5.13 Freeze protection measures for fire suppression systems
5.14 Functional testing of fire suppression systems and devices

_______ **ELECTRICAL**

6.1 Electrical systems and devices, including high building requirements where applicable
6.2 Continuity of *fire separations* at electrical penetrations
6.3 Functional testing of electrical related fire emergency systems and devices
6.4 Electrical systems and devices maintenance manuals
6.5 Structural capacity of electrical components, including anchorage and seismic restraint
6.6 Clearances from *buildings* of all electrical utility equipment
6.7 Fire protection of wiring for emergency systems
6.8 Review of all applicable shop drawings
6.9 Electrical Systems, Part 10/ASHRAE or NECB requirements

_______ **GEOTECHNICAL — Temporary**

7.1 *Excavation*
7.2 Shoring
7.3 Underpinning
7.4 Temporary construction dewatering

_______ **GEOTECHNICAL — Permanent**

8.1 Bearing capacity of the soil
8.2 Geotechnical aspects of deep *foundations*
8.3 Compaction of engineered fill
8.4 Structural considerations of soil, including slope stability and seismic loading
8.5 Backfill
8.6 Permanent dewatering
8.7 Permanent underpinning

PROFESSIONAL
PROVINCE OF
J. A. LOSCHIAVO
39377
BRITISH COLUMBIA
ENGINEER

(Professional's Seal and Signature)

March 24, 2017
Date

____
CRP's Initials

BOWERMAN EXCAVATING LTD.
PHONE (250) 723-8775
FAX (250) 723-8785

March 21, 2017

Re: McLean Mill Site

Attn: Mark Zenko

Upon review of the drawings and inspection of the septic system at McLean Mill servicing the banquet facility area, I find that this system meets the requirements of field size and tank size to accommodate 100 person banquet facility with commercial kitchen providing there no other flow is added. The system does not show any signs of failure but does require some minor repair which will take place shorty when weather improves.

Any questions please call

Regards

REGISTERED ONSITE WASTEWATER PRACTITIONER
ASTTBC
CRAIG A. BOWERMAN

Craig Bowerman

2365 OLD NANAIMO HWY
PORT ALBERNI, BC V9Y 8P5

ALBERNI-CLAYOQUOT
REGIONAL DISTRICT

3008 Fifth Avenue
Port Alberni, BC V9Y 2E3
Telephone:
(250) 720-2700
Fax (250) 723-1327

BUILDING PERMIT NO. BC17-10

DATE APRIL 11TH, 2017

FILE COPY

REVIEWED BY L.S.

The attached drawings and specifications have been reviewed and are subject to compliance with the corrections and additions as indicated below.

This sheet forms part of the permit drawings and shall remain attached thereto and be kept on the job site until completion of construction.

Review of the drawings, specifications and issuance of the building permit does not prevent the building inspector from thereafter requesting the correction of errors in the application or specifications and in no way relieves the owner from full responsibility for compliance with the requirements of the BC Building Code (current edition) and all applicable bylaws.

1. ***All construction to meet 2012 BC Building Code.***
2. ***All plumbing to adhere to 2012 BC Building and Plumbing Codes - protect water lines from freezing.***
3. ***Provide a "Schedule B" from a mechanical engineer prior to first inspection.*** ✓ LS.
4. ***Every fixture or group of fixtures in the same room shall be fitted with a shut-off. 2.6.1.3. (6). Shut –offs also required at the source of the supply and as close as possible to where the supply enters the building.***
5. ***Gas installer's certification required prior to occupancy (9.33.5.2).***
6. ***Electrical permit required prior to framing inspection for accessory buildings, additions, renovations and alterations.***
7. ***Approved Building Permit Plans MUST be on site for ALL inspections. If approved plans are not on site no inspection will be done.***

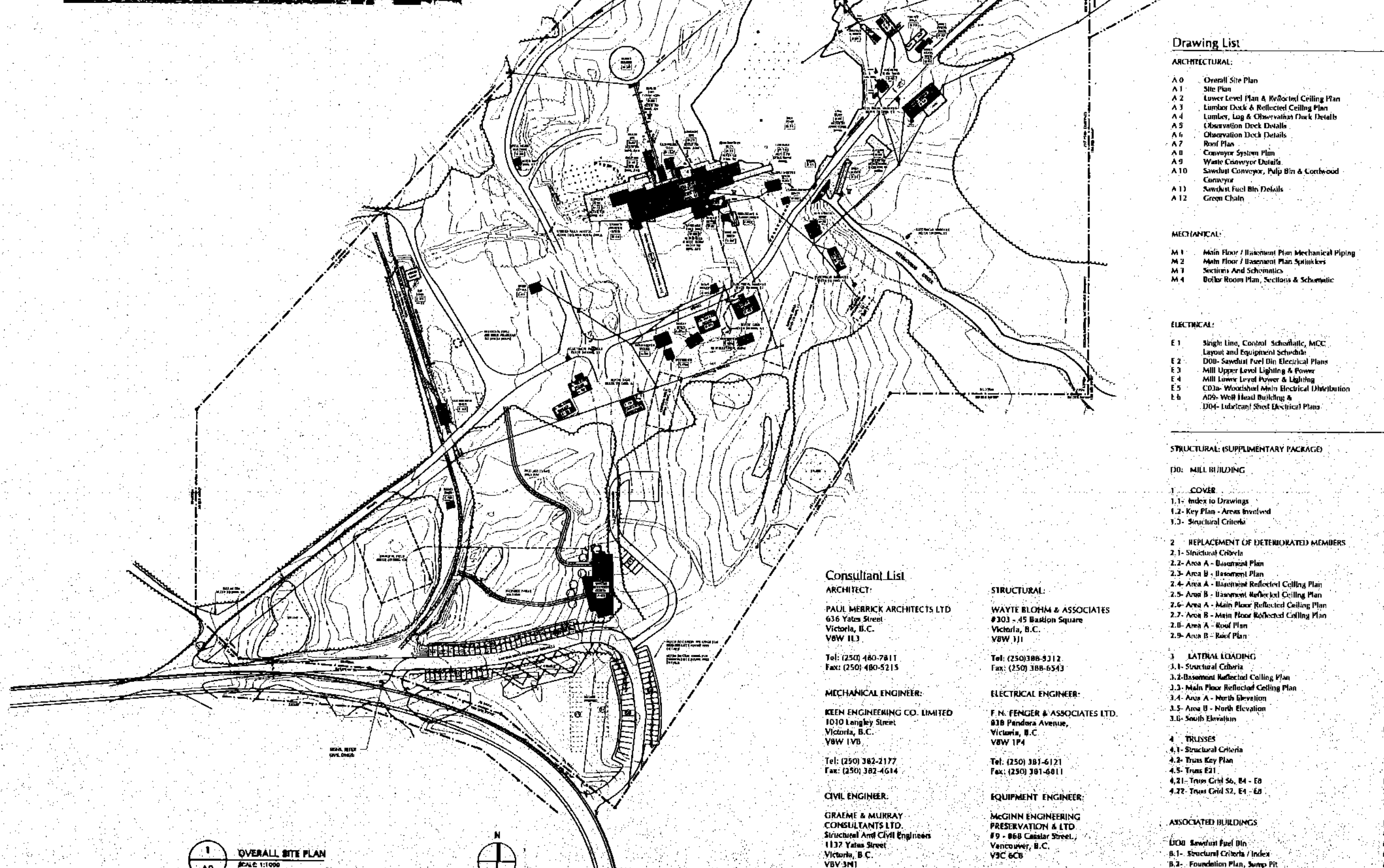
*Building Permit Received by*__________________________

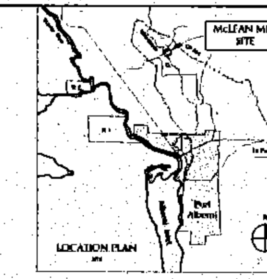
FILE COPY

McLEAN MILL

McLEAN MILL NATIONAL HISTORIC SITE

PORT ALBERNI, BRITISH COLUMBIA





1 A0 OVERALL SITE PLAN
SCALE 1:1000

N

Drawing List

ARCHITECTURAL:

A 0	Overall Site Plan
A 1	Site Plan
A 2	Lower Level Plan & Reflected Ceiling Plan
A 3	Lumber Deck & Reflected Ceiling Plan
A 4	Lumber, Log & Observation Deck Details
A 5	Observation Deck Details
A 6	Observation Deck Details
A 7	Roof Plan
A 8	Conveyor System Plan
A 9	Waste Conveyor Details
A 10	Sawdust Conveyor, Pulp Bin & Cordwood Conveyor
A 11	Sawdust Fuel Bin Details
A 12	Green Chain

MECHANICAL:

M 1	Main Floor / Basement Plan Mechanical Piping
M 2	Main Floor / Basement Plan Sprinklers
M 3	Sections And Schematics
M 4	Boiler Room Plan, Sections & Schematic

ELECTRICAL:

E 1	Single Line, Control Schematic, MCC Layout and Equipment Schedule
E 2	D08- Sawdust Fuel Bin Electrical Plans
E 3	Mill Upper Level Lighting & Power
E 4	Mill Lower Level Power & Lighting
E 5	C03a- Woodshed Main Electrical Distribution
E 6	A09- Well Head Building & D04- Lubricant Shed Electrical Plans

CIVIL:

C 1	Site Servicing Plan
C 2	Storm Drainage
C 3	Potable Water Supply System
C 4	Fire Suppression Water Supply System
C 5	Site Access And Parking
C 6	Septic Disposal System
CT 1	Site Plan
CT 2	Details

MILL EQUIPMENT:

EQ 1	Attic Equipment Plan - East Side
EQ 2	Attic Equipment Plan - West Side
EQ 3	Main Fl. Equipment Plan - East Side
EQ 4	Main Fl. Equipment Plan - West Side
EQ 5	Basement Equipment Plan - East side
EQ 6	Basement Equipment Plan
EQ 7	
EQ 8	Log Carriage Plan / Details
EQ 9	
EQ 10	
EQ 11	Green Chain Equipment Restoration

STRUCTURAL: (SUPPLIMENTARY PACKAGE)

D01 MILL BUILDING

1 COVER
1.1- Index to Drawings
1.2- Key Plan - Areas Involved
1.3- Structural Criteria

2 REPLACEMENT OF DETERIORATED MEMBERS
2.1- Structural Criteria
2.2- Area A - Basement Plan
2.3- Area B - Basement Plan
2.4- Area A - Basement Reflected Ceiling Plan
2.5- Area B - Basement Reflected Ceiling Plan
2.6- Area A - Main Floor Reflected Ceiling Plan
2.7- Area B - Main Floor Reflected Ceiling Plan
2.8- Area A - Roof Plan
2.9- Area B - Roof Plan

3 LATERAL LOADING
3.1- Structural Criteria
3.2-Basement Reflected Ceiling Plan
3.3- Main Floor Reflected Ceiling Plan
3.4- Area A - North Elevation
3.5- Area B - North Elevation
3.6- South Elevation

4 TRUSSES
4.1- Structural Criteria
4.2- Truss Key Plan
4.5- Truss E21
4.21- Truss Grid S6, E4 - E8
4.22- Truss Grid S2, E4 - E8

ASSOCIATED BUILDINGS

D08 Sawdust Fuel Bin
8.1- Structural Criteria / Index
8.2- Foundation Plan, Sump Pit
8.3- Plans
8.4- Wall Sections

ASSOCIATED BUILDINGS CON'T

D09 Waste Conveyor
9.1- Structural Criteria / Index
9.2- Elevation, Plan
9.3- Frame Elevations
9.4- Frame Elevations
9.5- Frame Elevations
9.6- Steel Frame

D11 Lumber Deck
11.1- Structural Criteria / Index
11.2- Main Floor Plan
11.3- Details
11.4- Details

D12 Observation Deck
12.1- Structural Criteria / Index
12.2- Lower Floor Plan
12.3- Main Floor Plan
12.4- Details
12.5- Details
12.6- Details
12.7- Details

D14 Log Haul
14.1- Structural Criteria / Index
14.2- Elevation
14.3- Details

B07 Log Dump
7.1- Structural Criteria / Index
7.2- Plan, Details

B08 A Frame
8.1- Structural Criteria / Index
8.2- Site Plan
8.3- Elevations
8.4- Details
8.5- Details

Consultant List

ARCHITECT:

PAUL MERRICK ARCHITECTS LTD
636 Yates Street
Victoria, B.C.
V8W 1L3

Tel: (250) 480-7811
Fax: (250) 480-5215

STRUCTURAL:

WAYTE BLOHM & ASSOCIATES
#303 - 45 Bastion Square
Victoria, B.C.
V8W 1J1

Tel: (250)388-5312
Fax: (250) 388-6543

MECHANICAL ENGINEER:

KEEN ENGINEERING CO. LIMITED
1010 Langley Street
Victoria, B.C.
V8W 1V8

Tel: (250) 382-2177
Fax: (250) 382-4614

ELECTRICAL ENGINEER:

F.N. FENGER & ASSOCIATES LTD.
838 Pandora Avenue,
Victoria, B.C.
V8W 1P4

Tel: (250) 381-6121
Fax: (250) 381-6811

CIVIL ENGINEER:

GRAEME & MURRAY CONSULTANTS LTD.
Structural And Civil Engineers
1137 Yates Street
Victoria, B.C.
V8V 3N1

Tel: (250) 388-9161
Fax: (250) 382-0514

EQUIPMENT ENGINEER:

McGINN ENGINEERING PRESERVATION & LTD
#9 - 868 Cambie Street,
Vancouver, B.C.
V6B 6C8

Tel: (604) 473-9866
Fax: (604) 473-9877

Paul Merrick Architects
Limited

Revisions

No.	Date	Description
1	MAY, 23 /97	FINAL REVIEW
2	JUNE, 2 /97	100% COMPLETE
3	JULY, 21 /97	UPDATE

Construction		
Tendering	July 31/97	
Building Permit	July 11/97	
Issued for:	Date	Signature

Issue

Seal

Seal

Client

CITY OF PORT ALBERNI

McLean Mill National Historic Site

Consultants

Project

McLEAN MILL

McLEAN MILL NATIONAL HISTORIC SITE

PORT ALBERNI, BRITISH COLUMBIA

Drawn By: DJG / ABF

Date: JUNE 2, 1997

Project Number: 9634

Scale: AS NOTED

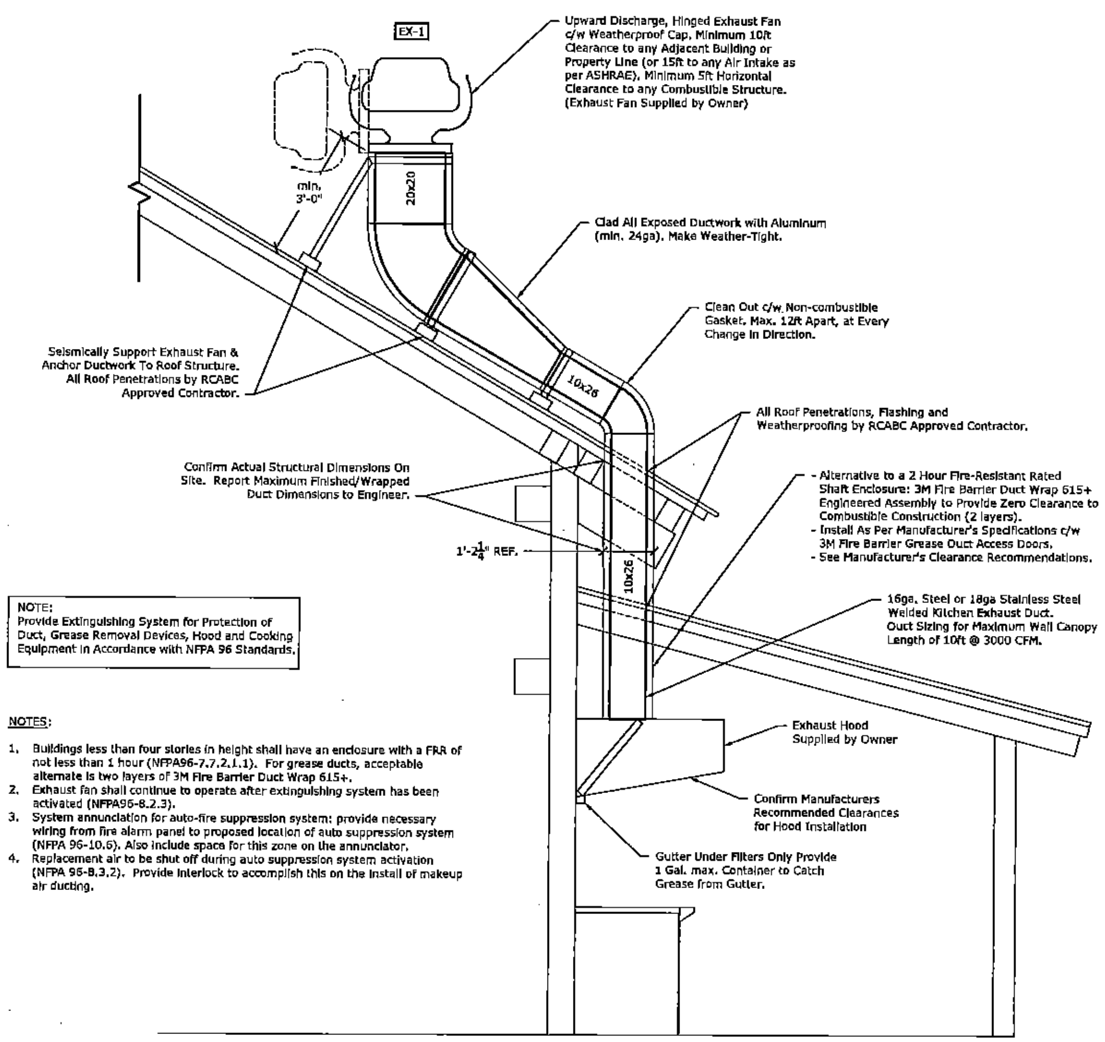
Sheet Title: OVERALL SITE PLAN

Sheet Number: A0

Revision: 0

NEW MECHANICAL - H.V.A.C

FILE COPY

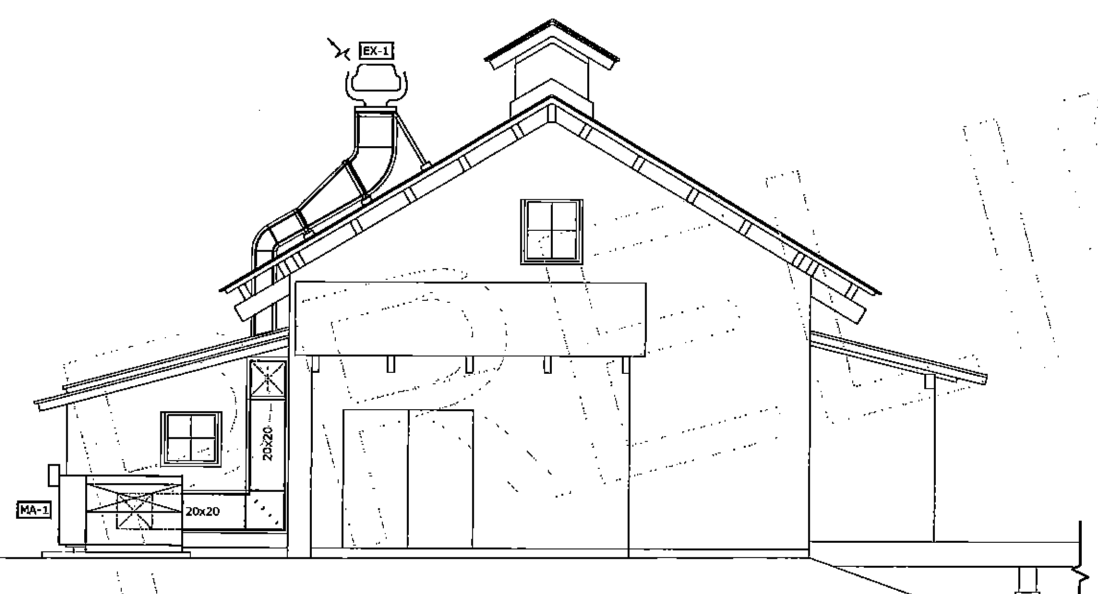


NOTE:
Provide Extinguishing System for Protection of Duct, Grease Removal Devices, Hood and Cooking Equipment in Accordance with NFPA 96 Standards.

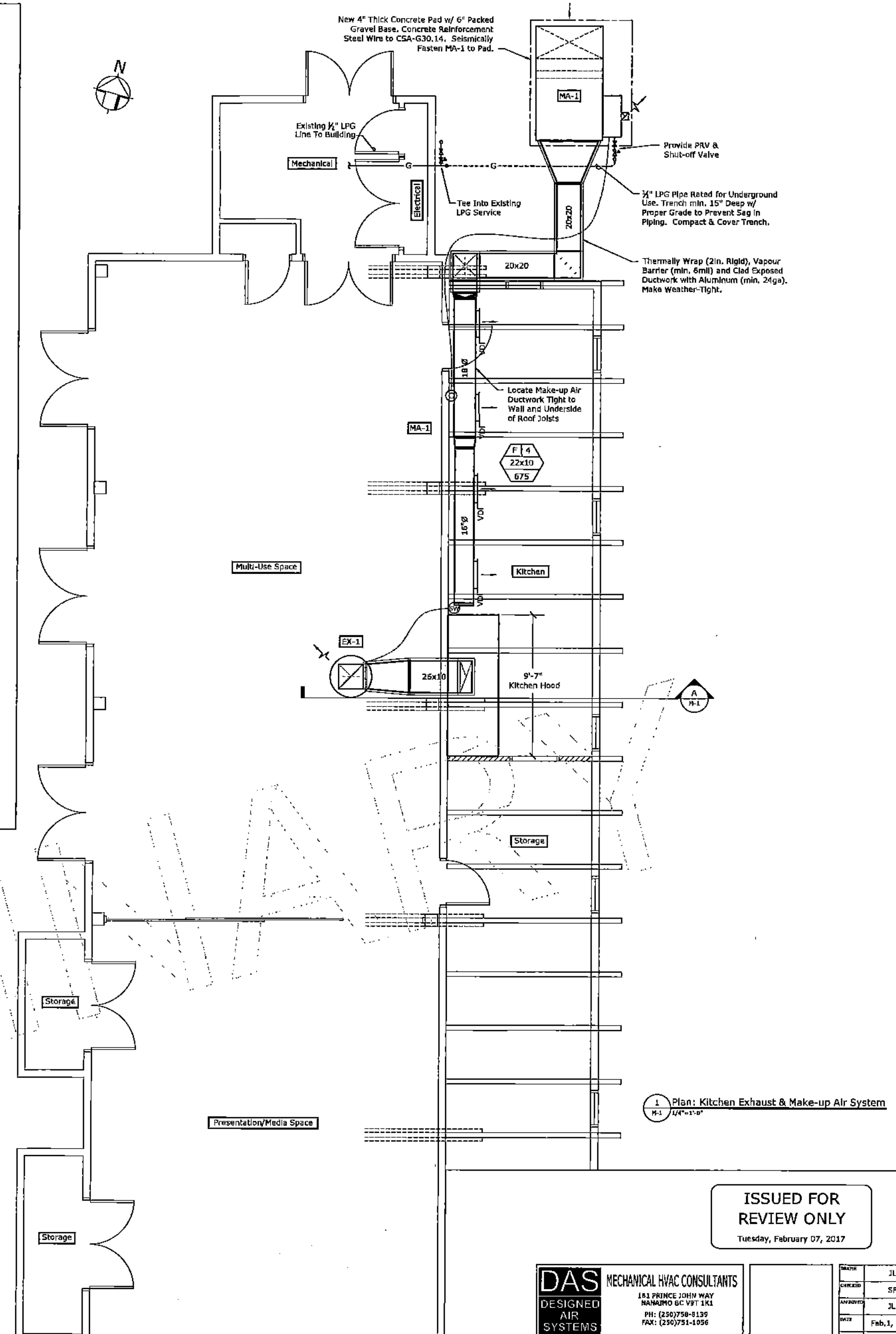
NOTES:

1. Buildings less than four stories in height shall have an enclosure with a FRR of not less than 1 hour (NFPA96-7.7.2.1.1). For grease ducts, acceptable alternate is two layers of 3M Fire Barrier Duct Wrap 615+.
2. Exhaust fan shall continue to operate after extinguishing system has been activated (NFPA96-8.2.3).
3. System annunciation for auto-fire suppression system: provide necessary wiring from fire alarm panel to proposed location of auto suppression system (NFPA 96-10.6). Also include space for this zone on the annunciator.
4. Replacement air to be shut off during auto suppression system activation (NFPA 96-8.3.2). Provide interlock to accomplish this on the install of makeup air ducting.

A / M-1 Section: Kitchen Hood Exhaust Duct
1/2"=1'-0"



2 / M-1 North Elevation: Kitchen Exhaust & Make-up Air System
1/4"=1'-0"



1 / M-1 Plan: Kitchen Exhaust & Make-up Air System
1/4"=1'-0"

ISSUED FOR REVIEW ONLY
Tuesday, February 07, 2017

DAS DESIGNED AIR SYSTEMS Limited
MECHANICAL HVAC CONSULTANTS
181 PRINCE JOHN WAY
NANAIMO BC V9T 1K1
PH: (250)758-8139
FAX: (250)751-1056

DRAWN	JL
CHECKED	SF
APPROVED	JL
DATE	Feb.1, 2017
PAGE	1 of 2

NO	DATE	REVISIONS
A	07/02/17	Issued For Review

SHEET TITLE
Kitchen Exhaust & Make-Up Air Plans & Details

PROJECT
McLean Mill
Visitor's Reception Centre
5633 Smith Rd.
Port Alberni, BC

PROJECT NO.

DWG SCALE
1/4"=1'-0"

SHEET NO.
M-1

REVISION
A

HVAC EQUIPMENT SCHEDULE

Equip. #	Area Serviced	Equipment Description	Model	MBH (Heating)	MBH (Cooling)	CFM (Min/ Max)	"W.G.	Wght (Lbs)	Voltage	Elec. Heat (Kw)	FLA	MCA	MOCP	HP	RPM
EX-1	Kitchen	Rooftop Exhaust Fan	Penn Barry: FX16BFT (Supplied By Owner)			3000	1.00	144	208/1/60					1	1075
MA-1	Kitchen	Indirect Fired Make-Up Air Unit	Engineered Air: DJS40/D-12/12	300MBH In/ 246MBH Out		2700	0.50	990	208/1/60					2	

Equipment Notes:

EX-1 Complete With:
- Factory Roof Curb Or Equal
- Hinged Base
- Grease Trough
(Note: Not In Contract - Supplied By Owner)

MA-1 Complete With:
- Horizontal flow configuration
- Propane Kit
- Inlet Hood w/ Bird screen
- Inlet Damper
- Filter Section
- DJM controller

GAS PIPING NOTES:

GENERAL

1. Provide complete, fully tested and operation gas piping system to meet the requirements described herein and in complete accordance with all applicable codes and ordinances.
2. The drawing indicates the general location and route to be followed by the piping. Exact routing to be confirmed on site and to be coordinated with all new and existing equipment, structure and piping.
3. The contractor shall be responsible for and keep one set of white prints, including revision drawings, in job site office. Set of white prints shall be maintained in constant up-to-date condition (as-built conditions marked in red pencil).
4. Give all necessary notices; obtain all necessary permits and pay all fees in order that the work herein specified may be carried out. furnish and certificates necessary as evidence that the work installed conforms with the laws and regulations of all authorities having jurisdiction.
5. Demonstrate to and instruct the representative designated by the owner on the complete systems operating and maintenance procedures.
6. Provide seismic restraints for all equipment and piping greater that 1"Ø installed by this division in accordance with all current applicable building codes.
7. Visit site prior to submitting bid to verify service pressure, system capacity, and all existing site conditions (inverts, existing service locations, etc.). No allowance shall be made for failure to include all necessary work.
8. All gas piping shall be painted yellow - C.G.S.B.505-101.

SUPPORTS AND ANCHORS

1. Provide hangers and supports to secure equipment and piping in place, prevent vibration, protect against earthquake, maintain grade and provide for expansion and contraction. Use "E-Z Sleeper/Quick Block" supports on rooftop gas lines.

PIPING MATERIALS

1. Provide materials, equipment and labour to install gas piping as required by provincial and local codes and as specified herein.
2. Gas piping shall be steel schedule 40 black, welded for 2½"Ø and larger and with threaded malleable iron fittings, 150psi banded air-tested for 2"Ø and under. Pressure tests to be witnessed by engineer or official representative.
3. All piping to be grounded in accordance with the authority having jurisdiction.

VALVES

1. Use plug cocks or gas ball valves for gas service.
2. Plug cocks: Iron body, Brass plugs and washers, air tested, solder or screwed ends or iron body and plug, pressure lubricated, flanged ends.

PENETRATIONS

1. Where piping pierces waterproofing, including waterproof concrete, the method of installation shall be approved by the engineer before the work is done. Furnish and install all necessary sleeves, caulking and flashing required to make openings absolutely waterproof.

GAS PIPE SIZING

1. Pipe sizing based on a total load of 300,000 Btuh, a maximum total equivalent pipe length of 50Ft and a pressure of 2psig.

CONTROLS - SEQUENCE OF OPERATIONS

HVAC contractor is responsible to provide all low voltage control wiring and components for the following sequence of operation, and is to co-ordinate with electrical contractor for all line voltage connections.

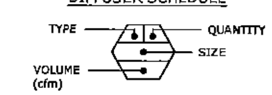
1. Sequence of Operation MA-1 & EX-1:
   a. EX-1 to be interlocked to MA-1 (make up air unit). Provide a pressure regulated switch to prove exhaust flow for EX-1 before starting MA-1. If flow is not proven, MA-1 must be locked out.
   b. At supply air temperature above 62°F lock out gas burner section. At supply air temperatures below 59°F modulate gas burner to maintain 64°F supply air temperature. If supply air temperature falls below 53°F, shut MA-1 down.
   c. MA-1 to be adjusted to specified CFM and interlocked to run with EX-1.

Note: All Line Voltage wiring, Low Voltage wiring, and component connectors are to be in conduit.

HVAC NOTES

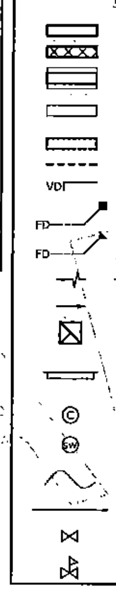
1. All ductwork shall be fabricated for G90 coated galvanized steel lock forming grade to ASTM A525 & A527. All duct construction and installation shall be to current SMACNA standards. In addition, all ductwork shall be constructed and installed to meet the seismic requirements of part 4 of the National Building Code, and the SMACNA Seismic Restraint Guide. All round ductwork larger and 8"Ø shall be spiral lock seam pipe to SMACNA standards. Seal all ductwork.
2. Flexible ductwork shall be non-corrosive spiral wound reinforcing with flexible vinyl coated Fiberglas cloth membrane, rated for max 10"w.g. positive pressure and 1"w.g. negative pressure. UL or ULC labelled. Use stainless steel or plastic banded connections. Maximum 3ft Flexible ductwork per duct branch.
3. Any existing equipment, grilles, diffusers, flex duct, controls etc. that are removed from service in the alteration, and which are no longer required in the new installation, shall be turned over the building owners' representative on site.
4. All air systems shall be balanced to air quantities shown. All outlet pattern controllers shall be adjusted to obtain proper air distribution. Submit balance reports complete with diffuser locations for approval. Balancing to be carried out by a certified, independent balancing agency, following ASHRAE TAB procedures.
5. Where existing ductwork is removed, maintain fire rating of any penetration in fire rated walls.
6. Provide fire dampers where required. Supply and install access panels in the ductwork adjacent to the dampers. Fire dampers shall be 1.5 Hr rated and UL fire rated.
7. Provide neoprene flexible connections to all ducted mechanical equipment.
8. Line the first 8ft of supply and return plenums with 1" acoustic lining.
9. Constructed plenums and hoods to be fabricated from minimum 22ga. galvanized steel and reinforced for rigidity.
10. Thermally wrap all ductwork and vents in unheated spaces with min. 1" insulation. (example: Attic or crawl spaces)
11. The electrical information provided here is for coordination purposes only. Mechanical, Electrical and Controls contractors are to coordinate and review each other's drawings, specifications and addenda before submitting tender. Contractors are to coordinate and review HVAC equipment shop drawings before ordering equipment or starting the work. Co-ordinate to provide electrical connections and controls as required for a complete and operational system. No Extra costs for replacing or repairing uncoordinated electrical or controls work will be allowed.

DIFFUSER SCHEDULE



F Supply Diffuser: Titus Model 272FL-1A-AG35-26

HVAC LEGEND



- New Ductwork or Equipment
- Acoustically Lined Ductwork
- Insulated Ductwork (min 1")
- Existing Trunk line Ductwork or Ductwork to Remain in Service
- Ductwork or Equipment to Remove
- Volume Damper
- Horizontal Fire Damper
- Vertical Fire Damper
- Return/Exhaust Air Flow Direction
- Supply/Fresh Air Flow Direction
- Exhaust Grille
- Supply Diffuser
- Temperature Controller
- Manual Switch
- Control Wire
- Propane Lines (LPG)
- Ball Valve (Red&White/Toyo 5049 or equal)
- Pressure Reducing Valve

GENERAL MECHANICAL NOTES:

1. It is the intention of the specifications and drawings to call for finished work tested and ready for operation. Unless otherwise noted or specified, provide all equipment and/or materials as shown on drawings and defined in the specifications. Any apparatus, appliances, materials, or work not shown on the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed under this division without additional expense to the owner.
2. Drawings are of schematic nature only. Contractor shall make due allowance in bid for relocation and/or rerouting of piping/ductwork where conflicts may occur.
3. Verify the location of all existing equipment, ductwork, piping, controls etc., by site inspection before preparing bid. No consideration or allowance will be given for failure to determine existing as-built conditions.
4. All new equipment and materials shall match existing equipment and materials and manufacturer and type unless specifically noted otherwise.
5. All work performed and materials supplied shall be in accordance with the original contract specifications.
6. Where pipes, ducts, cables etc., partially penetrate or pass through fire rated wall or floors, or smoke separation walls of floors, seal all voids between pipe or duct and wall with a U.L.C. approved caulking to the hourly rating required by the B.C. Building Code (Latest Edition) and local codes. Fire stopping shall be installed by a firm regularly engaged in this work. Submit a report confirming this work has been completed at the end of the project.
7. Shutdown of all existing systems shall be coordinated with the owner, and all authorities having jurisdiction of the time and duration of shutdown.
8. Confirm with and obtain permission from base building owner prior to cutting and/or coring of existing structure. Contract structural engineer to provide review and schedules for all wall or roof penetrations, and new equipment installation. Structural Engineer to provide details for installation and/or additional structural support if required. Contractor to make good all exposed surfaces at completion of mechanical work.
9. All new and relocated equipment including, but not limited to ductwork, diffusers, grills, VAV boxes, fans and piping, shall be executed in accordance with the SMACNA "Seismic Restraint Manual Guidelines For Mechanical Systems", and all applicable codes. All seismic restraint devices shall be equal to Mason Industries, as supplied by Vibra-Sonic Control. Certified shop drawings are required for all materials supplied. Contract seismic engineer to provide a sign-off of all equipment and/or seismic devices installed.
10. CODES & STANDARDS - All work shall comply with National and Local Building Codes. Sheet metal work shall comply with ASHRAE and SMACNA standards.
11. GUARANTEE - The completed installation shall be guaranteed for a period of 1 year from the date of substantial completion.
12. SUBMISSIONS - Submit to the consultant the following documents: Operation and Maintenance manuals including Balance Reports and As-built drawings (3 sets). Equipment submittals/shop drawings. Submit AutoCAD files of the As-Built drawings. All documents & files must be approved by consultant prior to completion.
13. PERMITS - All applicable permits and associated fees are to be included in the contract.
14. ROOFING - All roof penetrations by RCABC approved contractor.

1. Base Building Architectural plan is for reference only and to be confirmed as needed on site.
2. HVAC contractor to provide all necessary transformers, relays, contactors and time delays.
3. Maintain recommended unit service clearances as specified by the manufacturer.
4. Install turning vanes in all square/rectangular ducts with 90° elbows.
5. Locate all ductwork as high as possible to maximize ceiling heights.

ISSUED FOR REVIEW ONLY
Tuesday, February 07, 2017

NO	DATE	REVISIONS
A	07/02/17	Issued For Review

SHEET TITLE: Equipment Schedule & Specifications

PROJECT: McLean Mill Visitor's Reception Centre, 5633 Smith Rd., Port Alberni, BC

PROJECT NO.:

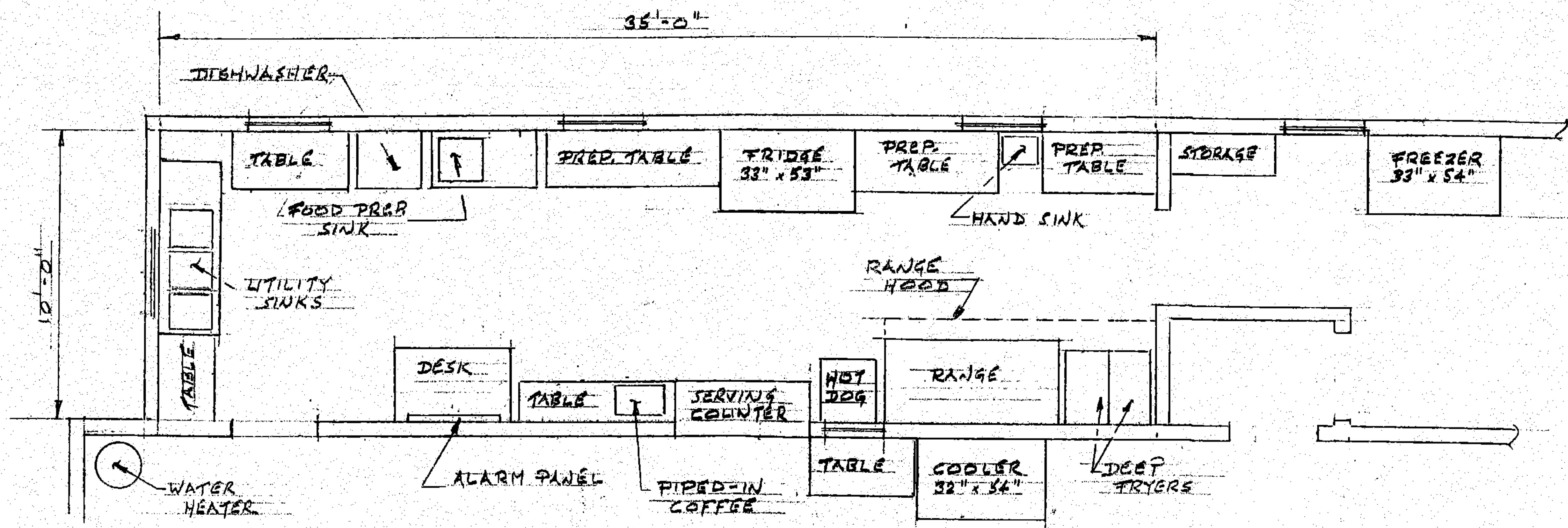
DWG SCALE: 1/4"=1'-0"

DAS DESIGNED AIR SYSTEMS Limited
MECHANICAL HVAC CONSULTANTS
181 PRINCE JOHN WAY
NANAIMO BC V9T 1K1
PH: (250)758-8139
FAX: (250)751-1056

DRAWN	JL
CHECKED	SF
APPROVED	JL
DATE	Feb.1, 2017
PAGE	2 of 2

SHEET NO. M-2

REVISION A



McLEAN MILL
PROPOSED KITCHEN LAYOUT
SCALE 1/4" = 1'-0"

Paul Merrick Architects
Limited

Bette Hambrook
B.Ed., B.Arch.

Graham D. Fligg, B.E.S., M. Arch.,
M.A.I.B.C., M.R.A.I.C.

Paul Merrick, B. Arch,
M.A.I.B.C., F.R.A.I.C., R.C.A.

Roger Bayley, B.E. Civil,
P. Eng.

Christopher M. Mooi, B. Eng.,
B. Arch., M.A.I.B.C., M.R.A.I.C.

Robert W. Baxter, B. Arch.,
M.A.I.B.C., M.R.A.I.C.

June 18, 1997

Mr. Harold Graboski
Building Inspector
Alberni-Clayoquot Regional District
3008 Fifth Avenue
Port Alberni, B.C.
V9Y 2E3

Dear Mr. Graboski,

RE: PROPOSED CONSTRUCTION ACTIVITIES - McLEAN MILL NATIONAL HISTORIC SITE

We enclose the following summary of construction activities proposed to be undertaken at the McLean Mill National Historic Site over a projected period of approximately three years commencing June 1997 and concluding in the fall of 1999. The anticipated schedule of construction allows the majority of site services to be placed in 1997 as well as repair and upgrading activities to stabilize and protect the Mill Building from further deterioration. Mill Equipment including WCB upgrades, the Observation Deck and Outbuildings associated with Mill Building functions shall be included in the 1998 construction season. It is also anticipated that a portion of the Visitor Reception Centre be included in 1998 (shell only). The remainder of the Visitor Reception Centre may be completed in 1999 along with the majority of the Historic Structures (outbuildings) in the final year. For clarification purposes we have broken the proposed construction activity into New Construction/Code Compliance and Replacement, Upgrading and Repair.

1.0 NEW CONSTRUCTION AND CODE COMPLIANCE

The structures which constitute new construction shall comply with the British Columbia Building Code (1992) requirements for accessibly, life safety and technical aspects of the design. As such, letters of assurance will be submitted to the City of Port Alberni by the Design Consultants confirming code compliance for the following structures;

.1 Observation Deck D-12 (2 Storey Open Timber Structure for Presentation/Viewing of the Mill)
.2 Sawdust Fuel Bin D-08 (New Boiler and Electrical Services to the Mill Building)
.3 R.B. McLean House C-05 (Staff Facilities and Public Washrooms)
.4 Caretaker Residence F-10 (Year round residential facility)
.5 Visitor Reception Centre A-05 (Reception facility c/w washrooms, meeting/multi-purpose areas and admission to the site)
.6 Service Outbuildings
- Woodshed C-03a (Electrical Distribution Room)
- Lubricant Shed D-04 (Fire Pump)
- Well Head Building A-09 (Domestic Water Supply)

e-mail: info@pmapma.com

No. 1 Gaoler's Mews
Vancouver, B.C. V6B 4K7
Phone: (604) 683-4131
Fax: (604) 683-9313

636 Yates Street
Victoria, B.C. V8W 1L3
Phone: (250) 480-7811
Fax: (250) 480-5215

2.0 REPLACEMENT, UPGRADING AND REPAIR

It is intended to reinstate the majority of the Historic Structures with a mandate to preserve the historic fabric and to halt further deterioration or collapse. Existing as found material shall be salvaged, modified and reused where applicable to meet the Historic Mandate of the site, and existing methods of construction shall be respected. Work undertaken to sustain the Historic Structures generally comprises the following construction activities.

.1 Where select foundation members are deteriorated beyond salvage, existing members shall be removed and replaced with identical members in keeping with historic precedent. Generally this includes wood pillow blocks, grade beams, sills and skids.

.2 Where select floor, wall and roof structural members are deteriorated beyond salvage, existing members shall be removed and replaced with identical members in keeping with historic precedent. Generally this would include wood columns, beams, joists, flooring or decking, studs, sills, lintels, rafters, truss members or purlins.

.3 Where select exterior finishes are deteriorated beyond salvage, existing items shall be removed, modified where applicable or replaced with identical items in keeping with historic precedent. Generally this includes wood siding, sheet metal or shingle roofs.

A list of the anticipated structures which fall under this construction program is as follows;

- B-01 Machine Shop
- B-02 Small Parts Shed
- B-03 Small Parts Shed
- B-04 Gin Pole and Winch
- B-05 Gasoline and Oil Shed
- B-06 Main Garage
- B-07 Log Dump
- B-08 A-Frame
- B-10 Blacksmith Shop
- B-15 Boom
- B-19 Grease Rack

- C-01 Bunkhouse
- C-02 Machinery Shed
- C-03 Cookhouse
- C-04 Roothouse
- C-06 Bookkeeper House
- C-09 A.McLean House
- C-10 McLean House Garage

- D-01a Mill Building Structure
- D-02 Boiler House
- D-03 Millwright Shed
- D-05 Green Chain
- D-07 Wood Bin
- D-09 Waste Conveyors
- D-10 Waste Burner
- D-11 Lumber Deck
- D-14 Log Haul
- D-16 Lumber Grader Shed
- D-18 Pulp Bin
- D-18a Debarking Shed
- D-20 Log Deck
- D-21 Sawdust Bin
-

- E-01 Yard Office
- E-02 First Aid Shed
- E-03 Locomotive Shed
- E-05 Sand House

The restoration of the Mill Building generally comprises the above procedures and will be maintained under a program of Knowledgeable Stewardship. The structure will be upgraded to assure a level of life safety that will not jeopardize life, and will be continually monitored and repaired over time by a knowledgeable staff. The building will be winterized with temporary bracing and the addition of rain screens will provide further protection against winter storms. A dry sprinkler system will also be installed for long term protection purposes, and a new roof system will be installed over the existing roof to prevent further deterioration.

The existing Mill Equipment shall also be repaired to an operational level that will allow the cutting of timber for demonstration purposes. Access to the Mill Building shall be restricted to knowledgeable workers only and equipment shall be upgraded to comply with WCB safety requirements. Public access is restricted to the Observation Deck, and to secure, screened viewing corridors located at the lower level.

3.0 BUILDING PERMIT AND ASSOCIATED FEES

Based on our site meeting of April 1997, it is our understanding that a single Building Permit Application is desirable for this project and that no time limit will be applicable. Based upon preliminary costing, which will be adjusted when firm quotations are received, the present construction estimates for each construction season are as follows

1997	$1,460,000.00
1998	$1,585,000.00
1999	$ 645,000.00
TOTAL	$3,690,000.00

In conclusion the McLean Mill National Historic Site is intended to be rejuvenated as a working demonstration facility that captures the character and nature of the complex as it was when it closed in 1965. Every effort will be made to reinstate the materials and techniques of the original construction to preserve our cultural heritage and to create an authentic experience for the Visitor. We look forward to working with you on this exciting and significant project.

Should you have any questions or require any clarification's, please do not hesitate in contacting our office. Thank you.

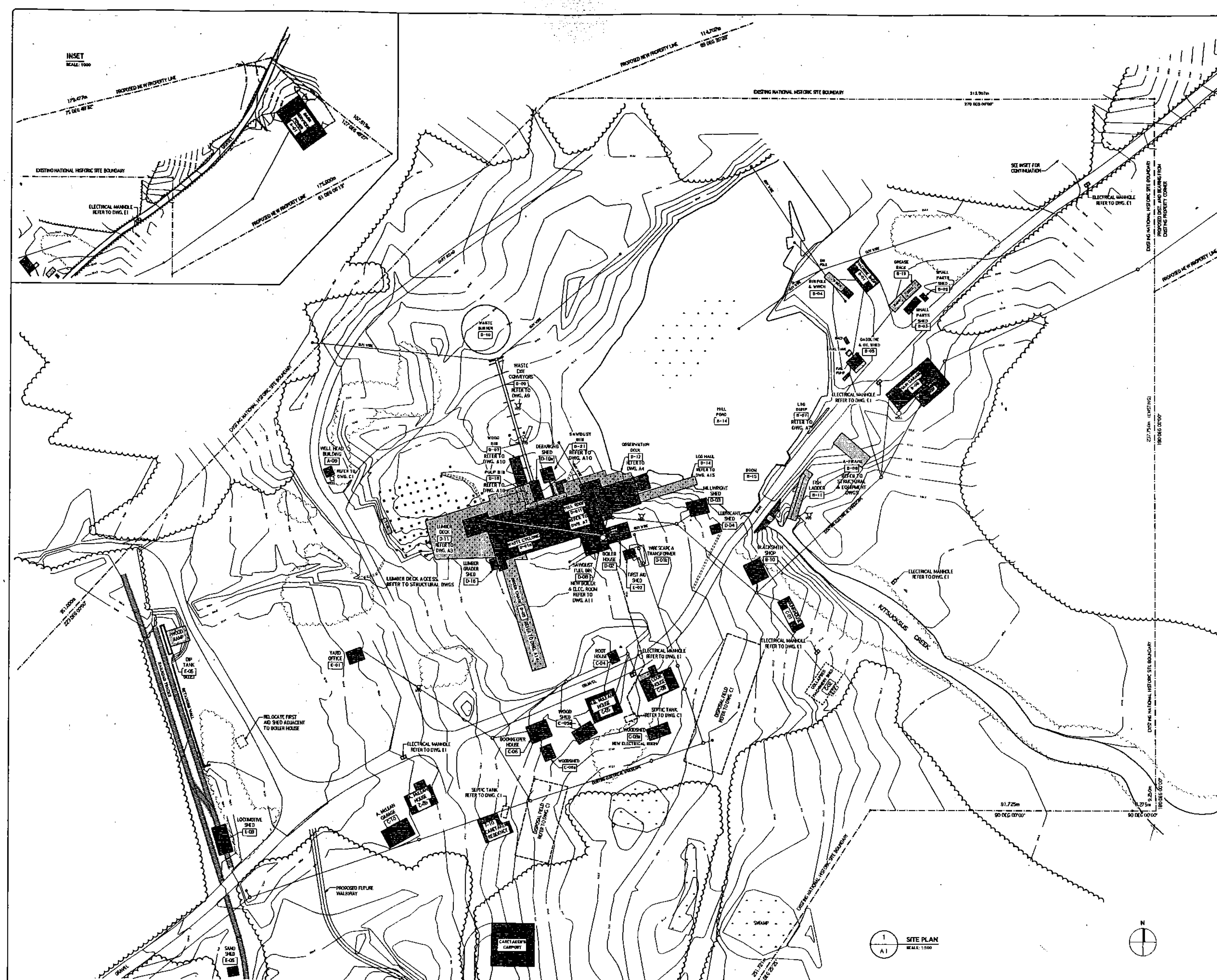
Yours truly,

PAUL MERRICK ARCHITECTS LIMITED

Darrell Campbell MAIBC

cc Mr. Eric McCormick - Director of Parks and Recreation
cc Mr. John MacFarlane - Project Manager
cc Mr. Roger Bayley - PMA Vancouver

enclosure: Dwg. A1, Site Plan



Paul Merrick Architects
Limited

Revisions		
No	Date	Description
1	MAY, 23 /97	FINAL REVIEW
2	JUNE, 2 /97	100% COMPLETE

Issued for:	Date	Signature
Construction		
Tendering		
Building Permit		

Issue

Seal

Seal

Client

CITY OF PORT ALBERNI

McLean Mill National Historic Site

Consultants

Project

McLEAN MILL

McLEAN MILL NATIONAL HISTORIC SITE

PORT ALBERNI, BRITISH COLUMBIA

Drawn By: DJS

Date: JUNE, 2, 1997

Project Number: 9634

Scale: AS NOTED

Sheet Title: SITE PLAN

Sheet Number: A1

Revision: 0

Paul Merrick Architects
Limited

Bette Hambrook
B.Ed., B.Arch.

Graham D. Fligg, B.E.S., M. Arch.,
M.A.I.B.C., M.R.A.I.C.

Paul Merrick, B. Arch,
M.A.I.B.C., F.R.A.I.C., R.C.A.

Roger Bayley, B.E. Civil,
P. Eng.

Christopher M. Mooi, B. Eng.,
B. Arch., M.A.I.B.C., M.R.A.I.C.

Robert W. Baxter, B. Arch.,
M.A.I.B.C., M.R.A.I.C.

July 14, 1997

Mr. Harold Graboski
Building Inspector
Alberni-Clayoquot Regional District
3008 Fifth Avenue
Port Alberni, B.C.
V9Y 2E3

Dear Mr. Graboski,

RE: BUILDING PERMIT APPLICATION

We enclose 1 set of drawings complete with Letters of Assurance as required for the purpose of a Building Permit Application. As agreed, this application represents a 'blanket' submission for work to be carried out over a period of three years. As such, we have indicated the relevant structures directly on the Letters of Assurance although not all of the drawings are complete at this time. We anticipate submission of the remainder of the drawings by the latter part of 1997. Our specification will follow early next week.

Mr. Barry McGinn shall be making the building permit application on behalf of our client in his role as the project's Construction Manager. Mr. McGinn shall indicate the extent of construction to be carried out this season at the time of his application.

We trust you will find this submission in order. Should you have any questions or require any clarification's, please do not hesitate in contacting our office. Thank you.

Yours truly,

PAUL MERRICK ARCHITECTS LIMITED

Darrell Campbell.

Darrell Campbell MAIBC

cc Mr. Eric McCormick - Director of Parks and Recreation
cc Mr. John MacFarlane - Project Manager
cc Mr. Barry McGinn - Construction Manager
cc Mr. Roger Bayley - PMA Vancouver

e-mail: info@pmapma.com

No. 1 Gaoler's Mews
Vancouver, B.C. V6B 4K7
Phone: (604) 683-4131
Fax: (604) 683-9313

636 Yates Street
Victoria, B.C. V8W 1L3
Phone: (250) 480-7811
Fax: (250) 480-5215

Schedule A — *Continued*

The *owner* and the *coordinating registered professional* understand that where the *coordinating registered professional* or a *registered professional* ceases to be retained at any time during construction, work on the above project will cease until such time as

(a) a new *coordinating registered professional* or *registered professional*, as the case may be, is retained, and

(b) a new letter in the form set out in Schedule A or in the forms set out in Schedules B-1 and B-2, as the case may be, is filed with the *authority having jurisdiction.*

The undersigned *coordinating registered professional* certifies that he or she is a *registered professional* as defined in the British Columbia Building Code.

Coordinating Registered Professional

Paul Merrick
Coordinating Registered Professional's Name (Print)

[signature]
Coordinating Registered Professional's Signature

July 11,1997
Date

636 Yates Street
Address (Print)
Victoria, B.C.
V8W 1L3

Architect
Occupation (Print)

(Affix Coordinating Registered Professional's Seal here)

Owner

CITY OF PORT ALBERNI
Owner's Name (Print)

[signature]
Owner's or Owner's appointed agent's Signature (If owner is a corporation the signature of a signing officer must be given here. If the signature is that of the agent, a copy of the document that appoints the agent must be attached.)

97-08-08
Date

G. A. WILEY
Name of Agent or Signing Officer if applicable (Print)

4850 ARGYLE ST
Address (Print)
PORT ALBERNI, BC.

(If the Coordinating Registered Professional is a member of a firm, complete the following.)

I am a member of the firm Paul Merrick Architects Limited
(Print name of firm)
and I sign this letter on behalf of the firm.

This letter must be signed by the *owner* or the *owner*'s appointed agent and by the *coordinating registered professional*. An agent's letter of appointment must be attached. If the *owner* is a corporation, the letter must be signed by a signing officer of the corporation and the signing officer must set forth his or her position in the corporation.

The British Columbia Building Code defines a *registered professional* to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or

(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

2 of 2

SCHEDULE A

Forming Part of Sentence 2.6.2.1.(1) of the
British Columbia Building Code

CONFIRMATION OF COMMITMENT BY OWNER AND BY COORDINATING REGISTERED PROFESSIONAL

Note: 1. This letter must be submitted before issuance of a *building* permit.
2. This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Building Inspectors Association of B.C., and Union of B.C. Municipalities
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

Re: Design and *Field Review* of Construction
by a *Coordinating Registered Professional*

To: The Building Inspector
Date: [illegible]y 11 1997

Alberni-Clayoquot Regional District

Address (Print)

3008 Fifth Avenue

Port Alberni, B.C.

Dear Sir:

Re: McLean Mill National Historic Site 5633 Smith Road

Address of Project (Print)

Lot A Plan VIP [illegible]79[illegible]1 Alberni Land District

Legal Description of Project (Print)

The undersigned has retained Paul Merrick Architects Limited as a *coordinating registered professional* to coordinate the design work and *field reviews* of the *registered professionals* required for this project. The *coordinating registered professional* shall coordinate the design work and *field reviews* of the *registered professionals* required for the project in order to ascertain that the design will substantially comply with the B.C. Building Code and other applicable enactments respecting safety and that the construction of the project will substantially comply with the B.C. Building Code and other applicable enactments respecting safety, not including the construction safety aspects.

"*field reviews*" are defined in the British Columbia Building Code to mean those reviews of the work

(a) at a project site of a development to which a *building* permit relates, and
(b) where applicable, at fabrication locations where *building* components are fabricated for use at the project site

that a *registered professional* in his or her professional discretion considers necessary to ascertain whether the work substantially complies in all material respects with the plans and supporting documents prepared by the *registered professional* for which the *building* permit is issued.

The *owner* and the *coordinating registered professional* have read Section 2.6 of the British Columbia Building Code. The *owner* and the *coordinating registered professional* acknowledge their responsibility to each notify the addressee of this letter of the date the *coordinating registered professional* ceases to be retained by the *owner* before the date the *coordinating registered professional* ceases to be retained or, if that is not possible, then as soon as possible.

1 of 2

For the following structures:

D-12 Observation Deck
D-08 Sawdust Fuel Bin
C-05 R.B.McLean House
F-10 Caretaker Residence
A-05 Visitor Reception Centre
C-03a Woodshed
D-04 Lubricant Shed
A-09 Well Head Building

SCHEDULE B-1

Forming Part of Section 2.6 of the
British Columbia Building Code

ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW

Note:
1. This letter must be submitted along with Schedule B-2 before issuance of a *building* permit. A separate letter must be submitted by each *registered professional.*
2. This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Building Inspectors Association of B.C., and Union of B.C. Municipalities.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

To: The Building Inspector
Alberni-Clayoquot Regional District

Date: July 11, 199

Address (Print)
3008 Fifth Avenue
Port Alberni, B.C.

Dear Sir:

Re: McLean Mill National Historic Site 5633 Smith Road
Address of Project (Print)
Lot A Plan VIP 57997 Alberni Land District
Legal Description of Project (Print)

The undersigned hereby gives assurance that the design of the
(Initial those of the items listed below that apply to this *registered professional.* All the disciplines will not necessarily be employed on every project.)

X **ARCHITECTURAL**
______ **STRUCTURAL**
______ **MECHANICAL**
______ **PLUMBING**
______ **FIRE SUPPRESSION SYSTEMS**
______ **ELECTRICAL**
______ **GEOTECHNICAL — temporary**
______ **GEOTECHNICAL — permanent**

For the following structures

D-12 Observation Deck
D-08 Sawdust Fuel Bin
C-o5 R.B.McLean House
F-10 Caretaker Residence
A-05 Visitor Reception Centre
C-03a Woodshed
D-04 Lubricant Shed
A-09 Well Head Building

components of the plans and supporting documents prepared by this *registered professional* in support of the application for the *building* permit substantially comply with the B.C. Building Code and other applicable enactments respecting safety except for construction safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during construction as indicated on the attached "SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS" (SCHEDULE B-2).

1 of 2

Schedule B-1 — *Continued*

The undersigned also undertakes to notify the *authority having jurisdiction* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during construction.

I certify that I am a *registered professional* as defined in the British Columbia Building Code.

Paul Merrick

Name (Print)

July 11,1997

Signed

Date

636 Yates Street

Address (Print)

Victoria, B.C.

V8W 1L3

(250) 480-7811

Phone

(Affix PROFESSIONAL SEAL here)

(If the *Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm Paul Merrick Architects Limited

(Print name of firm)

and I sign this letter on behalf of the firm.

Note: The above letter must be signed by a *registered professional*. The British Columbia Building Code defines a "*registered professional*" to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or

(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

2 of 2

SCHEDULE B-2

Forming Part of Section 2.6 of the
British Columbia Building Code

SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS

Note:
1. This form must be submitted with Schedule B-1 before issuance of a *building* permit.
2. This form is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Union of B.C. Municipalities and Building Inspectors Association of B.C.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

Date: July 11, 1997

(Initial applicable discipline below and cross out and initial non-applicable items within the discipline.)

X ______ **ARCHITECTURAL**

1.1 Fire resisting assemblies
1.2 *Fire separations* and their continuity
1.3 *Closures*, including tightness and operation
1.4 Interior and exterior finishes
1.5 Egress systems, including *access to exit* within *suites* and *floor areas*
1.6 Performance and physical safety features (guardrails, handrails, etc.)
1.7 Structural capacity of architectural components, including anchorage and seismic restraint
1.8 Roofing and flashings
1.9 Wall cladding systems
1.10 Dampproofing and/or waterproofing of walls and slabs below *grade*
1.11 Thermal insulation systems, including condensation control and cavity ventilation
1.12 Sound control
1.13 ~~Landscaping, screening and site grading~~
1.14 Provisions for firefighting access
1.15 *Access* requirements for persons with disabilities
1.16 Elevating devices
1.17 Coordination of testing of fire emergency systems and maintenance programs
1.18 Development Permit and conditions therein
1.19 Exterior glazing
1.20 Exterior signage, including acceptable materials, dimensions and locations
1.21 Review of all applicable shop drawings

______ **STRUCTURAL**

2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
2.2 Structural aspects of *deep foundations*
2.3 Review of all applicable shop drawings

______ **MECHANICAL**

3.1 HVAC systems and devices, including high *building* requirements where applicable
3.2 *Fire dampers* at required *fire separations*
3.3 Continuity of *fire separations* at HVAC penetrations
3.4 Functional testing of mechanically related fire emergency systems and devices
3.5 Maintenance manuals for mechanical systems
3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
3.7 Review of all applicable shop drawings

1 of 2

For the following structures:

D-12 Observation Deck
D-08 Sawdust Fuel Bin
C-05 R.B.McLean House
F-10 Caretaker residence
A-05 Visitor Reception Centre
C-03a Woodshed
D-04 Lubricant Shed
A-09 Well Head Building

Schedule B-2 — *Continued*

________		**PLUMBING**
	4.1	Roof *drainage systems*
	4.2	Site and *foundation drainage systems*
	4.3	*Plumbing systems* and devices
	4.4	Continuity of *fire separations* at plumbing penetrations
	4.5	Functional testing of plumbing related fire emergency systems and devices
	4.6	Maintenance manuals for *plumbing systems*
	4.7	Structural capacity of plumbing components, including anchorage and seismic restraint
	4.8	Review of all applicable shop drawings
________		**FIRE SUPPRESSION SYSTEMS**
	5.1	Suppression system classification for type of *occupancy*
	5.2	Design coverage, including concealed or special areas
	5.3	Compatibility and location of electrical supervision, ancillary alarm and control devices
	5.4	Evaluation of the capacity of city (municipal) water supply versus system demands and domestic demand, including pumping devices where necessary
	5.5	Qualification of welder, quality of welds and material
	5.6	Review of all applicable shop drawings
	5.7	Acceptance testing for "Contractor's Material and Test Certificate" as per NFPA Standards
	5.8	Maintenance program and manual for suppression systems
	5.9	Structural capacity of sprinkler components, including anchorage and seismic restraint
	5.10	For partial systems — confirm sprinklers are installed in all areas where required
	5.11	Fire Department connections and hydrant locations
	5.12	Fire hose standpipes
	5.13	Functional testing of fire suppression systems and devices
________		**ELECTRICAL**
	6.1	Electrical systems and devices, including high *building* systems where applicable
	6.2	Continuity of *fire separations* at electrical penetrations
	6.3	Functional testing of electrical related fire emergency systems and devices
	6.4	Electrical systems and devices maintenance manuals
	6.5	Structural capacity of electrical components, including anchorage and seismic restraint
	6.6	Clearances from *buildings* of all electrical utility equipment
	6.7	Fire protection of wiring for emergency systems
	6.8	Review of all applicable shop drawings
________		**GEOTECHNICAL — Temporary**
	7.1	*Excavation*
	7.2	Shoring
	7.3	Underpinning
	7.4	Temporary construction dewatering
________		**GEOTECHNICAL — Permanent**
	8.1	Bearing capacity of the *soil*
	8.2	Geotechnical aspects of *deep foundations*
	8.3	Compaction of engineered fill
	8.4	Structural considerations of *soil*, including slope stability and seismic loading
	8.5	Backfill
	8.6	Permanent dewatering
	8.7	Permanent underpinning

2 of 2

SCHEDULE B-1

Forming Part of Section 2.6 of the
British Columbia Building Code

ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW

Note: 1. This letter must be submitted along with Schedule B-2 before issuance of a *building* permit. A separate letter must be submitted by each *registered professional*.
2. This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Building Inspectors Association of B.C., and Union of B.C. Municipalities.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

To: The Building Inspector   Date: 11 July 1997

Alberni-Clayoquot Regional District
Address (Print)
3008 Fifth Avenue

Port Alberni, BC

Dear Sir:

Re: McLean Mill National Historic Site, 5633 Smith Road
Address of Project (Print)
Lot A, Plan VIP 57991, Alberni Land District
Legal Description of Project (Print)

The undersigned hereby gives assurance that the design of the
(Initial those of the items listed below that apply to this *registered professional*. All the disciplines will not necessarily be employed on every project.)

FOR THE FOLLOWING STRUCTURES

_______ **ARCHITECTURAL**	D-12 Observation Deck
JL **STRUCTURAL**	D-08 Sawdust Fuel Bin
	C-03aWoodshed
_______ **MECHANICAL**	D-04 Lubricant Shed
	A-09 Well Head Building
_______ **PLUMBING**	D-01 Mill Buildigg
	D-02 Boiler House
_______ **FIRE SUPPRESSION SYSTEMS**	D-09 External Waste Conveyor
	D-11 Lumber Deck
_______ **ELECTRICAL**	D-14 Log Haul
	D21 Sawdust Bin
_______ **GEOTECHNICAL — temporary**	B-07 Log Dump
	B-08 A-Frame
_______ **GEOTECHNICAL — permanent**	B18 Gin Pole

components of the plans and supporting documents prepared by this *registered professional* in support of the application for the *building* permit substantially comply with the B.C. Building Code and other applicable enactments respecting safety except for construction safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during construction as indicated on the attached "SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS" (SCHEDULE B-2).

Schedule B-1 — *Continued*

The undersigned also undertakes to notify the *authority having jurisdiction* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during construction.

I certify that I am a *registered professional* as defined in the British Columbia Building Code.

James K. Blohm, P.Eng.
Name (Print)

James K Blohm
Signed

11 July 1997
Date

#303 - 45 Bastion Square
Address (Print)
Victoria, BC
V8W 1J1

388-5312
Phone

(Affix PROFESSIONAL SEAL here)

(If the *Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm Wayte Blohm & Associates (Print name of firm)
and I sign this letter on behalf of the firm.

NOTE: The above letter must be signed by a *registered professional*. The British Columbia Building Code defines a "*registered professional*" to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or

(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

2 of 2

BRITISH COLUMBIA BUILDING CODE

For the Following Structures: D12 Observation Deck, D08 Sawdust Fuel Bin, C03a Wood Shed, D04 Lubricant Shed, A09 Well Head Building, D01 Mill Building, D02 Boiler House, D09 External Waste Conveyor, D11 Lumber Deck, D14 Log Haul, D21 Sawdust Bin, B07 Log Dump, B08 A-Frame, B18 Gin Pole

SCHEDULE B-2

Forming Part of Section 2.6 of the British Columbia Building Code

SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS

Note:
1. This form must be submitted with Schedule B-1 before issuance of a *building* permit.
2. This form is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Union of B.C. Municipalities and Building Inspectors Association of B.C.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

Date: 11 July 1997

(Initial applicable discipline below and cross out and initial non-applicable items within the discipline.)

______ **ARCHITECTURAL**

1.1 Fire resisting assemblies
1.2 *Fire separations* and their continuity
1.3 *Closures*, including tightness and operation
1.4 Interior and exterior finishes
1.5 Egress systems, including *access to exit* within *suites* and *floor areas*
1.6 Performance and physical safety features (guardrails, handrails, etc.)
1.7 Structural capacity of architectural components, including anchorage and seismic restraint
1.8 Roofing and flashings
1.9 Wall cladding systems
1.10 Dampproofing and/or waterproofing of walls and slabs below *grade*
1.11 Thermal insulation systems, including condensation control and cavity ventilation
1.12 Sound control
1.13 Landscaping, screening and site grading
1.14 Provisions for fire fighting access
1.15 *Access* requirements for persons with disabilities
1.16 Elevating devices
1.17 Coordination of testing of fire emergency systems and maintenance programs
1.18 Development Permit and conditions therein
1.19 Exterior glazing
1.20 Interior signage, including acceptable materials, dimensions and locations
1.21 Review of all applicable shop drawings

JL **STRUCTURAL**

2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
~~2.2 Structural aspects of *deep foundations*~~
2.3 Review of all applicable shop drawings

______ **MECHANICAL**

3.1 HVAC systems and devices, including high *building* requirements where applicable
3.2 *Fire dampers* at required *fire separations*
3.3 Continuity of *fire separations* at HVAC penetrations
3.4 Functional testing of mechanically related fire emergency systems and devices
3.5 Maintenance manuals for mechanical systems
3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
3.7 Review of all applicable shop drawings

1 of 2

Schedule B-2 — *Continued*

_______ **PLUMBING**

4.1 Roof *drainage systems*
4.2 Site and *foundation drainage systems*
4.3 *Plumbing systems* and devices
4.4 Continuity of *fire separations* at plumbing penetrations
4.5 Functional testing of plumbing related fire emergency systems and devices
4.6 Maintenance manuals for *plumbing systems*
4.7 Structural capacity of plumbing components, including anchorage and seismic restraint
4.8 Review of all applicable shop drawings

_______ **FIRE SUPPRESSION SYSTEMS**

5.1 Suppression system classification for type of *occupancy*
5.2 Design coverage, including concealed or special areas
5.3 Compatibility and location of electrical supervision, ancillary alarm and control devices
5.4 Evaluation of the capacity of city (municipal) water supply versus system demands and domestic demand, including pumping devices where necessary
5.5 Qualification of welder, quality of welds and material
5.6 Review of all applicable shop drawings
5.7 Acceptance testing for "Contractor's Material and Test Certificate" as per NFPA Standards
5.8 Maintenance program and manual for suppression systems
5.9 Structural capacity of sprinkler components, including anchorage and seismic restraint
5.10 For partial systems — confirm sprinklers are installed in all areas where required
5.11 Fire Department connections and hydrant locations
5.12 Fire hose standpipes
5.13 Functional testing of fire suppression systems and devices

_______ **ELECTRICAL**

6.1 Electrical systems and devices, including high *building* systems where applicable
6.2 Continuity of *fire separations* at electrical penetrations
6.3 Functional testing of electrical related fire emergency systems and devices
6.4 Electrical systems and devices maintenance manuals
6.5 Structural capacity of electrical components, including anchorage and seismic restraint
6.6 Clearances from *buildings* of all electrical utility equipment
6.7 Fire protection of wiring for emergency systems
6.8 Review of all applicable shop drawings

_______ **GEOTECHNICAL — Temporary**

7.1 *Excavation*
7.2 Shoring
7.3 Underpinning
7.4 Temporary construction dewatering

_______ **GEOTECHNICAL — Permanent**

8.1 Bearing capacity of the *soil*
8.2 Geotechnical aspects of *deep foundations*
8.3 Compaction of engineered fill
8.4 Structural considerations of *soil*, including slope stability and seismic loading
8.5 Backfill
8.6 Permanent dewatering
8.7 Permanent underpinning

2 of 2

SCHEDULE B-1

Forming Part of Section 2.6 of the
British Columbia Building Code

ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW

Note:
1. This letter must be submitted along with Schedule B-2 before issuance of a *building* permit. A separate letter must be submitted by each *registered professional*.
2. This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Building Inspectors Association of B.C., and Union of B.C. Municipalities.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

To: The Building Inspector Date: July 10/97

ALBERNI - CLAYQUOT REGIONAL DISTRICT

Address (Print)

3008 FIFTH AVE.

PORT ALBERNI, B.C

Dear Sir:

Re: McLEAN MILL NATIONAL HISTORIC SITE 5633 Smith Rd

Address of Project (Print)

LOT A, PLAN VIP7991 ALBERNI [illegible] DISTRICT

Legal Description of Project (Print)

The undersigned hereby gives assurance that the design of the
(Initial those of the items listed below that apply to this *registered professional*.
All the disciplines will not necessarily be employed on every project.)

_________ ARCHITECTURAL

_________ STRUCTURAL

[illegible] MECHANICAL

[illegible] PLUMBING

[illegible] FIRE SUPPRESSION SYSTEMS

_________ ELECTRICAL

_________ GEOTECHNICAL — temporary

_________ GEOTECHNICAL — permanent

components of the plans and supporting documents prepared by this *registered professional* in support of the application for the *building* permit substantially comply with the B.C. Building Code and other applicable enactments respecting safety except for construction safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during construction as indicated on the attached "SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS" (SCHEDULE B-2).

1 of 2

Schedule B-1 — *Continued*

The undersigned also undertakes to notify the *authority having jurisdiction* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during construction.

I certify that I am a *registered professional* as defined in the British Columbia Building Code.

Tom Wilson
Name (Print)

[signature]
Signed

July 10/97
Date

Keen Engineering Co. Ltd.
Address (Print)
1010 Langley Street
Victoria, B.C.
V8W 1V8

(250) 382-2177
Phone

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA T. W. WILSON

(Affix PROFESSIONAL SEAL here)

(If the *Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm Keen Engineering Co. Ltd. (Print name of firm)
and I sign this letter on behalf of the firm.

NOTE: The above letter must be signed by a *registered professional*. The British Columbia Building Code defines a "*registered professional*" to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or
(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

For the following structures:
A-05 Visitor Reception Centre
C-05 R.B. McLean House
F-10 Caretaker Residence
D-08 Sawdust Fuel Bin
D-01 Mill Building

2 of 2

SCHEDULE B-2

Forming Part of Section 2.6 of the
British Columbia Building Code

SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS

Note: 1. This form must be submitted with Schedule B-1 before issuance of a *building* permit.
2. This form is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Union of B.C. Municipalities and Building Inspectors Association of B.C.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

Date: July 10/97

(Initial applicable discipline below and cross out and initial non-applicable items within the discipline.)

______ ARCHITECTURAL

1.1 Fire resisting assemblies
1.2 *Fire separations* and their continuity
1.3 *Closures*, including tightness and operation
1.4 Interior and exterior finishes
1.5 Egress systems, including *access to exit* within *suites* and *floor areas*
1.6 Performance and physical safety features (guardrails, handrails, etc.)
1.7 Structural capacity of architectural components, including anchorage and seismic restraint
1.8 Roofing and flashings
1.9 Wall cladding systems
1.10 Dampproofing and/or waterproofing of walls and slabs below *grade*
1.11 Thermal insulation systems, including condensation control and cavity ventilation
1.12 Sound control
1.13 Landscaping, screening and site grading
1.14 Provisions for fire fighting access
1.15 *Access* requirements for persons with disabilities
1.16 Elevating devices
1.17 Coordination of testing of fire emergency systems and maintenance programs
1.18 Development Permit and conditions therein
1.19 Exterior glazing
1.20 Interior signage, including acceptable materials, dimensions and locations
1.21 Review of all applicable shop drawings

______ STRUCTURAL

2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
2.2 Structural aspects of *deep foundations*
2.3 Review of all applicable shop drawings

______ MECHANICAL

3.1 HVAC systems and devices, ~~including high *building* requirements where applicable~~
3.2 *Fire dampers* at required *fire separations*
3.3 Continuity of *fire separations* at HVAC penetrations
3.4 Functional testing of mechanically related fire emergency systems and devices
3.5 Maintenance manuals for mechanical systems
3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
3.7 Review of all applicable shop drawings

Schedule B-2 — *Continued*

PLUMBING

4.1 Roof *drainage systems*
~~4.2 Site and *foundation drainage systems*~~
4.3 *Plumbing systems* and devices
4.4 Continuity of *fire separations* at plumbing penetrations
4.5 Functional testing of plumbing related fire emergency systems and devices
4.6 Maintenance manuals for *plumbing systems*
4.7 Structural capacity of plumbing components, including anchorage and seismic restraint
4.8 Review of all applicable shop drawings

FIRE SUPPRESSION SYSTEMS

5.1 Suppression system classification for type of *occupancy*
5.2 Design coverage, including concealed or special areas
5.3 Compatibility and location of electrical supervision, ancillary alarm and control devices
~~5.4 Evaluation of the capacity of city (municipal) water supply versus system demands and domestic demand, including pumping devices where necessary~~
5.5 Qualification of welder, quality of welds and material
5.6 Review of all applicable shop drawings
5.7 Acceptance testing for "Contractor's Material and Test Certificate" as per NFPA Standards
5.8 Maintenance program and manual for suppression systems
5.9 Structural capacity of sprinkler components, including anchorage and seismic restraint
5.10 For partial systems — confirm sprinklers are installed in all areas where required
5.11 Fire Department connections and hydrant locations
~~5.12 Fire hose standpipes~~
5.13 Functional testing of fire suppression systems and devices

ELECTRICAL

6.1 Electrical systems and devices, including high *building* systems where applicable
6.2 Continuity of *fire separations* at electrical penetrations
6.3 Functional testing of electrical related fire emergency systems and devices
6.4 Electrical systems and devices maintenance manuals
6.5 Structural capacity of electrical components, including anchorage and seismic restraint
6.6 Clearances from *buildings* of all electrical utility equipment
6.7 Fire protection of wiring for emergency systems
6.8 Review of all applicable shop drawings

GEOTECHNICAL — Temporary

7.1 *Excavation*
7.2 Shoring
7.3 Underpinning
7.4 Temporary construction dewatering

GEOTECHNICAL — Permanent

8.1 Bearing capacity of the *soil*
8.2 Geotechnical aspects of *deep foundations*
8.3 Compaction of engineered fill
8.4 Structural considerations of *soil*, including slope stability and seismic loading
8.5 Backfill
8.6 Permanent dewatering
8.7 Permanent underpinning

2 of 2

96-126

SCHEDULE B-1

Forming Part of Section 2.6 of the
British Columbia Building Code

ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW

Note:
1. This letter must be submitted along with Schedule B-2 before issuance of a *building* permit. A separate letter must be submitted by each *registered professional*.
2. This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Building Inspectors Association of B.C., and Union of B.C. Municipalities.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

To: The Building Inspector

Date: July 12, 1997

Alberni-Clayaquot Regional District

Address (Print)

3008 Fifth Avenue

Port Alberni, B.C.

Dear Sir:

Re: McLean Mill National Historic Site - [illegible]633 Smith Road

Address of Project (Print)

Lot A, Plan VIP 57991 Alberni Land Distrrict

Legal Description of Project (Print)

The undersigned hereby gives assurance that the design of the
(Initial those of the items listed below that apply to this *registered professional*. All the disciplines will not necessarily be employed on every project.)

N/A ARCHITECTURAL

N/A STRUCTURAL

N/A MECHANICAL

N/A PLUMBING

N/A FIRE SUPPRESSION SYSTEMS

[illegible] ELECTRICAL

N/A GEOTECHNICAL — temporary

N/A GEOTECHNICAL — permanent

For the following structures

[illegible]01 Mill Building
D[illegible]2 Observation Deck
D08 Sawdust Fuel Bin
C05 R.B. McLean House
F10 Caretaker Residence
A05 Visitor Reception Centre
C03A Woodshed
D04 Lubricant Shed
A09 Well Head Building

components of the plans and supporting documents prepared by this *registered professional* in support of the application for the *building* permit substantially comply with the B.C. Building Code and other applicable enactments respecting safety except for construction safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during construction as indicated on the attached "SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS" (SCHEDULE B-2).

1 of 2

Schedule B-1 — *Continued*

The undersigned also undertakes to notify the *authority having jurisdiction* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during construction.

I certify that I am a *registered professional* as defined in the British Columbia Building Code.

F.N. FENGER, P.ENG.

Name (Print)

Signed

July 12, 1997

Date

Address (Print)

838 Pandora Avenue

Victoria, B.C.

(250) 381 6121

Phone

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA F. N. FENGER

(Affix PROFESSIONAL SEAL here)

(If the *Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm F.N. FENGER & ASSOCIATES LTD.
and I sign this letter on behalf of the firm. (Print name of firm)

NOTE: The above letter must be signed by a *registered professional.* The British Columbia Building Code defines a "*registered professional*" to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or

(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

2 of 2

SCHEDULE B-2

Forming Part of Section 2.6 of the
British Columbia Building Code

SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS

Note: 1. This form must be submitted with Schedule B-1 before issuance of a *building* permit.
2. This form is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Union of B.C. Municipalities and Building Inspectors Association of B.C.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

Date: July 12, 1997

(Initial applicable discipline below and cross out and initial non-applicable items within the discipline.)

N/A **ARCHITECTURAL**

1.1 Fire resisting assemblies
1.2 *Fire separations* and their continuity
1.3 *Closures*, including tightness and operation
1.4 Interior and exterior finishes
1.5 Egress systems, including *access to exit* within *suites* and *floor areas*
1.6 Performance and physical safety features (guardrails, handrails, etc.)
1.7 Structural capacity of architectural components, including anchorage and seismic restraint
1.8 Roofing and flashings
1.9 Wall cladding systems
1.10 Dampproofing and/or waterproofing of walls and slabs below *grade*
1.11 Thermal insulation systems, including condensation control and cavity ventilation
1.12 Sound control
1.13 Landscaping, screening and site grading
1.14 Provisions for fire fighting access
1.15 *Access* requirements for persons with disabilities
1.16 Elevating devices
1.17 Coordination of testing of fire emergency systems and maintenance programs
1.18 Development Permit and conditions therein
1.19 Exterior glazing
1.20 Interior signage, including acceptable materials, dimensions and locations
1.21 Review of all applicable shop drawings

N/A **STRUCTURAL**

2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
2.2 Structural aspects of *deep foundations*
2.3 Review of all applicable shop drawings

N/A **MECHANICAL**

3.1 HVAC systems and devices, including high *building* requirements where applicable
3.2 *Fire dampers* at required *fire separations*
3.3 Continuity of *fire separations* at HVAC penetrations
3.4 Functional testing of mechanically related fire emergency systems and devices
3.5 Maintenance manuals for mechanical systems
3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
3.7 Review of all applicable shop drawings

1 of 2

Schedule B-2 — *Continued*

N/A **PLUMBING**

4.1 Roof *drainage systems*
4.2 Site and *foundation drainage systems*
4.3 *Plumbing systems* and devices
4.4 Continuity of *fire separations* at plumbing penetrations
4.5 Functional testing of plumbing related fire emergency systems and devices
4.6 Maintenance manuals for *plumbing systems*
4.7 Structural capacity of plumbing components, including anchorage and seismic restraint
4.8 Review of all applicable shop drawings

N/A **FIRE SUPPRESSION SYSTEMS**

5.1 Suppression system classification for type of *occupancy*
5.2 Design coverage, including concealed or special areas
5.3 Compatibility and location of electrical supervision, ancillary alarm and control devices
5.4 Evaluation of the capacity of city (municipal) water supply versus system demands and domestic demand, including pumping devices where necessary
5.5 Qualification of welder, quality of welds and material
5.6 Review of all applicable shop drawings
5.7 Acceptance testing for "Contractor's Material and Test Certificate" as per NFPA Standards
5.8 Maintenance program and manual for suppression systems
5.9 Structural capacity of sprinkler components, including anchorage and seismic restraint
5.10 For partial systems — confirm sprinklers are installed in all areas where required
5.11 Fire Department connections and hydrant locations
5.12 Fire hose standpipes
5.13 Functional testing of fire suppression systems and devices

ELECTRICAL

6.1 Electrical systems and devices, including high *building* systems where applicable
6.2 Continuity of *fire separations* at electrical penetrations
6.3 Functional testing of electrical related fire emergency systems and devices
6.4 Electrical systems and devices maintenance manuals
6.5 Structural capacity of electrical components, including anchorage and seismic restraint
6.6 Clearances from *buildings* of all electrical utility equipment
6.7 Fire protection of wiring for emergency systems
6.8 Review of all applicable shop drawings

N/A **GEOTECHNICAL — Temporary**

7.1 *Excavation*
7.2 Shoring
7.3 Underpinning
7.4 Temporary construction dewatering

N/A **GEOTECHNICAL — Permanent**

8.1 Bearing capacity of the *soil*
8.2 Geotechnical aspects of *deep foundations*
8.3 Compaction of engineered fill
8.4 Structural considerations of *soil*, including slope stability and seismic loading
8.5 Backfill
8.6 Permanent dewatering
8.7 Permanent underpinning

2 of 2

SCHEDULE B-1

Forming Part of Section 2.6 of the
British Columbia Building Code

ASSURANCE OF PROFESSIONAL DESIGN AND COMMITMENT FOR FIELD REVIEW

Note:
1. This letter must be submitted along with Schedule B-2 before issuance of a *building* permit. A separate letter must be submitted by each *registered professional.*
2. This letter is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Building Inspectors Association of B.C., and Union of B.C. Municipalities.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

To: The Building Inspector   Date: JULY 14, 1997

ALBERNI·CLAYOQUOT REGIONAL DISTRICT
Address (Print)
3008 FIFTH AVE.

PORT ALBERNI, B.C.

Dear Sir:

Re: McLEAN MILL
Address of Project (Print)
LOT A PLAN VIP 57991 ALBERNI LAND DISTRICT.
Legal Description of Project (Print)

The undersigned hereby gives assurance that the design of the
(Initial those of the items listed below that apply to this *registered professional.*
All the disciplines will not necessarily be employed on every project.)

________ ARCHITECTURAL

________ STRUCTURAL

________ MECHANICAL

________ PLUMBING

[illegible] FIRE SUPPRESSION SYSTEMS → B-2 - Item 5.4

________ ELECTRICAL

________ GEOTECHNICAL — temporary

________ GEOTECHNICAL — permanent

components of the plans and supporting documents prepared by this *registered professional* in support of the application for the *building* permit substantially comply with the B.C. Building Code and other applicable enactments respecting safety except for construction safety aspects.

The undersigned hereby undertakes to be responsible for *field reviews* of the above referenced components during construction as indicated on the attached "SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS" (SCHEDULE B-2).

Schedule B-1 — *Continued*

The undersigned also undertakes to notify the *authority having jurisdiction* in writing as soon as possible if the undersigned's contract for *field review* is terminated at any time during construction.

I certify that I am a *registered professional* as defined in the British Columbia Building Code.

ANDREW J. RUSHFORTH
Name (Print)

Signed

11 July 1997
Date

Address (Print)

GRAEME & MURRAY CONSULTANTS LTD.
~~1137 YATES STREET~~
VICTORIA, B. C.

Phone

PROFESSIONAL PROVINCE OF A. J. RUSHFORTH BRITISH COLUMBIA ENGINEER

(Affix PROFESSIONAL SEAL here)

(If the *Registered Professional* is a member of a firm, complete the following.)

I am a member of the firm GRAEME & MURRAY CONSULTANTS LTD.
(Print name of firm)
and I sign this letter on behalf of the firm.

NOTE: The above letter must be signed by a *registered professional*. The British Columbia Building Code defines a "*registered professional*" to mean

(a) a person who is registered or licensed to practise as an architect under the Architects Act, or

(b) a person who is registered or licensed to practise as a professional engineer under the Engineers and Geoscientists Act.

2 of 2

SCHEDULE B-2

Forming Part of Section 2.6 of the
British Columbia Building Code

SUMMARY OF DESIGN AND FIELD REVIEW REQUIREMENTS

Note: 1. This form must be submitted with Schedule B-1 before issuance of a *building* permit.
2. This form is endorsed by: Architectural Institute of B.C., Association of Professional Engineers and Geoscientists of B.C., Union of B.C. Municipalities and Building Inspectors Association of B.C.
3. In this letter the words in italics have the same meaning as in the British Columbia Building Code.

Date: JULY 11, 1997

(Initial applicable discipline below and cross out and initial non-applicable items within the discipline.)

________ **ARCHITECTURAL**

1.1 Fire resisting assemblies
1.2 *Fire separations* and their continuity
1.3 *Closures*, including tightness and operation
1.4 Interior and exterior finishes
1.5 Egress systems, including *access to exit* within *suites* and *floor areas*
1.6 Performance and physical safety features (guardrails, handrails, etc.)
1.7 Structural capacity of architectural components, including anchorage and seismic restraint
1.8 Roofing and flashings
1.9 Wall cladding systems
1.10 Dampproofing and/or waterproofing of walls and slabs below *grade*
1.11 Thermal insulation systems, including condensation control and cavity ventilation
1.12 Sound control
1.13 Landscaping, screening and site grading
1.14 Provisions for fire fighting access
1.15 *Access* requirements for persons with disabilities
1.16 Elevating devices
1.17 Coordination of testing of fire emergency systems and maintenance programs
1.18 Development Permit and conditions therein
1.19 Exterior glazing
1.20 Interior signage, including acceptable materials, dimensions and locations
1.21 Review of all applicable shop drawings

________ **STRUCTURAL**

2.1 Structural capacity of structural components of the *building*, including anchorage and seismic restraint
2.2 Structural aspects of *deep foundations*
2.3 Review of all applicable shop drawings

________ **MECHANICAL**

3.1 HVAC systems and devices, including high *building* requirements where applicable
3.2 *Fire dampers* at required *fire separations*
3.3 Continuity of *fire separations* at HVAC penetrations
3.4 Functional testing of mechanically related fire emergency systems and devices
3.5 Maintenance manuals for mechanical systems
3.6 Structural capacity of mechanical components, including anchorage and seismic restraint
3.7 Review of all applicable shop drawings

Schedule B-2 — *Continued*

PLUMBING

4.1 Roof *drainage systems*
4.2 Site and *foundation drainage systems*
4.3 *Plumbing systems* and devices
4.4 Continuity of *fire separations* at plumbing penetrations
4.5 Functional testing of plumbing related fire emergency systems and devices
4.6 Maintenance manuals for *plumbing systems*
4.7 Structural capacity of plumbing components, including anchorage and seismic restraint
4.8 Review of all applicable shop drawings

FIRE SUPPRESSION SYSTEMS

5.1 ~~Suppression system classification for type of *occupancy*~~
5.2 ~~Design coverage, including concealed or special areas~~
5.3 ~~Compatibility and location of electrical supervision, ancillary alarm and control devices~~
5.4 Evaluation of the capacity of city (municipal) water supply versus system demands and domestic demand, including pumping devices where necessary
5.5 ~~Qualification of welder, quality of welds and material~~
5.6 ~~Review of all applicable shop drawings~~
5.7 ~~Acceptance testing for "Contractor's Material and Test Certificate" as per NFPA Standards~~
5.8 ~~Maintenance program and manual for suppression systems~~
5.9 ~~Structural capacity of sprinkler components, including anchorage and seismic restraint~~
5.10 ~~For partial systems — confirm sprinklers are installed in all areas where required~~
5.11 Fire Department connections and hydrant locations
5.12 ~~Fire hose standpipes~~
5.13 ~~Functional testing of fire suppression systems and devices~~

ELECTRICAL

6.1 Electrical systems and devices, including high *building* systems where applicable
6.2 Continuity of *fire separations* at electrical penetrations
6.3 Functional testing of electrical related fire emergency systems and devices
6.4 Electrical systems and devices maintenance manuals
6.5 Structural capacity of electrical components, including anchorage and seismic restraint
6.6 Clearances from *buildings* of all electrical utility equipment
6.7 Fire protection of wiring for emergency systems
6.8 Review of all applicable shop drawings

GEOTECHNICAL — Temporary

7.1 *Excavation*
7.2 Shoring
7.3 Underpinning
7.4 Temporary construction dewatering

GEOTECHNICAL — Permanent

8.1 Bearing capacity of the *soil*
8.2 Geotechnical aspects of *deep foundations*
8.3 Compaction of engineered fill
8.4 Structural considerations of *soil*, including slope stability and seismic loading
8.5 Backfill
8.6 Permanent dewatering
8.7 Permanent underpinning

2 of 2

McGINN
Engineering &
Preservation Ltd.

#9 - 868 Cassiar Street
Vancouver, B.C. V5K 4N6
Tel: (604) 473-9866
Fax: (604) 473-9877
E-mail: bmcginn@mcginneng.dwg.com

Mr. Harold Graboski,
Building Inspector,
Alberni-Clayoquot Regional District,
3008 Fifth Avenue,
Port Alberni, B.C.
V9Y 2E3

Dear Mr. Graboski;

RE: McLEAN MILL NHS BUILDING PERMIT APPLICATION

Please find attached our building permit application for the above project, complete with signed Letters of Assurance.

A master project schedule is attached for your reference. We intend to undertake let the following contracts or complete with our own forces the following work within the present building season(end of year):

Site Services - to include waste water disposal, potable water distribution, fire suppression, electrical site services(underground ducting without conductors) and some road upgrades around the mill.

Potable Water Supply Well - on site well.

Work By Own Forces - Mill Building Structural Upgrade, Reconstruction of Log Deck, Log Haul and Log Dump. Upgrade to Filer Shed and miscellaneous site clearance.

Packaged Steam Boiler Installation - installation of 150 h.p. boiler to supply steam to the steam engine, carriage engine and two steam cylinders.

Miscellaneous Wood Structures - construction of half of the Observation Deck, the Sawdust Fuel Bin to house the boiler, the Electrical Woodshed to house the electrical service entry, the Lubricant Shed to house the fire pump and the Wellhead Building to house the well.

Mill Electrical - electrical services to the mill building and sawdust fuel bin.

Barry J. McGinn, P.Eng., C.P., MAIBC, M.Sc. Historic Preservation
Deborah Rink, Certified Arborist, M. Landscape Arch., M. Urban and Regional Planning

Mill Roof - new antiqued roof surface on existing roof, complete with trim and drainage.

We will keep you informed of progress and arrange a site meeting once construction is underway. We look forward to working with you on this exciting project.

Thank you.

Sincerely;

Barry McGinn, P.Eng., MAIBC
McGinn Engineering & Preservation Ltd.
McLean Mill NHS Construction Manager

NO. BC97-24

REGIONAL DISTRICT OF ALBERNI-CLAYOQUOT

APPLICATION FOR PERMIT TO BUILD

A Building Permit will not be issued prior to the expiry of the mandatory 30 day appeal period on sewage disposal permits as per subsection 5 (3) of the Health Act.

Port Alberni, BC Aug 8 1997

TO THE BUILDING INSPECTOR:

The undersigned hereby applies for a permit to build according to the attached specifications (and accompanying plans):

1	Street Address McLean Mill N.H.S., 5633 Smith Road, Port Alberni, B.C. V9Y 7L5			
	Lot A	D.L. 106	Plan No. VIP 57991	
2	Name of Owner City of Port Alberni	Address 4255 Wallace Street Port Alberni, B.C. V9Y 3Y6		
	Name of Contractor McGinn Engineering & Preservation Ltd.	Address #9-868 Cassiar St. Vancouver, B.C. V5K 4N6		
	Name of Architect Paul Merrick Architects Ltd.	Address One Gaolers Mews Vancouver, B.C V6B 4K7		
3	Purpose of Building(s) Industrial Museum			
4	Dimensions of Building (Mill Bldg.)	No. of Sq. Ft. 20,960	Front 236'	Depth 64'
5	No. of stories in height 2	Height from grade to highest point 37' ft.		
6	Material foundation:	Walls open heavy timber	Footings concrete pier/cedar block	
7	Depth of basement floor from average lot level: approx. 4'6"			
8	Footings size 24 inches	Foundation walls thickness — inches		
	External wall thickness:	1st Floor	2nd Floor	3rd Floor
9	Surface materials on front walls:	weathered cladding boards		
10	Will roof be flat, peaked circular or mansard?	gable		
11	What will be the materials of roofing?	'antiqued' corrugated sheet metal		
12	Size of joists:	1st Floor 4" X 10"	2nd Floor	3rd Floor
13	Length of joists between bearings 14 ft.	Spacing c to c 1'-6 inches		
14	Wall height: Basement 6'-0"	1st Floor 11'-0"	2nd Floor	3rd Floor
15	Size of girders under main floor:	10" X 10"		
16	Interior finish:	Walls open heavy timber	Ceilings open	
17	How many chimneys? 1 (mill bldg.)	Flue dimensions 20" Ø		
18	What type of heating apparatus?	Gas-fired Steam Boiler		
19	Estimated total value (exclusive of land)			
	PERMIT FEE			
20	If repairs to existing building, minor alterations or small addition, give full details:			
	Drawings / letters attached			

I/we agree that the information contained in this application or gathered by the Regional District in connection with a building permit may be used by the Regional District for any purpose connected with the exercise of its powers or the performance of its duties including enforcement of Regional District bylaws. In consideration of the granting of a building permit, I/we agree to release and indemnify the Regional District of Alberni-Clayoquot, its Board members, employees and agents from and against all liability, demands, claims of action, suits, judgements, losses, damages, costs, expenses of whatever kind which I/we or any other person, partnership or corporation or my/our respective heirs, successors, administrators or assignees may have or incur in consequence of or incidental to the granting of this permit or any inspection, failure to inspect, certification, approval, enforcement or failure to enforce the Regional District of Alberni-Clayoquot Building Bylaw or the British Columbia Building Code and I/we agree that the Regional District of Alberni-Clayoquot owes me/us no duty of care in respect of these matters.

I/we have read the above agreement, release and indemnity and understand it.

Signature of owner(s) Eric McCormick

Address c/o 4255 WALLACE STREET, Port Alberni, B.C. V9Y 3Y6

APPENDIX D.

BC WATER RESOURCE ATLAS

AQUIFER CLASSIFICATION WORK SHEET

DATE: November 15, 2004

AQUIFER LOCATION: Alberni Valley east

REFERENCE NUMBER: 697

LAND DISTRICT: Alberni LD

DESCRIPTIVE LOCATION: Extends along east side of Alberni Valley

NTS MAP SHEETS: 92F/7

BCGS MAP SHEETS: 092F.17, 092F.026, 092F.027 and 092F.036

CLASSIFICATION: IIB **RANKING: 12**

Aquifer Size:
Area of aquifer is approximately 42 km^2.

Aquifer Boundaries:
The aquifer boundary has been delineated using water well records information (area of development). It likely extends beyond these boundaries in a northwest to southeasterly trend.

Geologic Formation (overlying): Pleistocene and Holocene deposits, till, clay, sand, gravel and boulders.

Unconsolidated/Bedrock: Bedrock

Geologic Formation (aquifer): Mainly Cretaceous sandstone and shale underlain by granite, limestone and basalt of Karmutsen Formation of Triassic age. Inliers of the Karmutsen Formation may be found locally in the northern portion of the aquifer and Late Eocene intrusive rocks may be found locally near the southern terminus of the aquifer.

Confined/Unconfined/: Confined. One flowing well reported.

Vulnerability:
Moderate. The geometric mean (geomean) depth to static water level is 3.9 metres (12.7 feet). The geometric mean thickness of the confining layer is 9.5 metres (31 feet) and the mean thickness of the confining layer is 15 metres (49 feet). The range of thickness of the confining layer is from 0 to 41 metres (0 to 133 feet). The bulk hydraulic conductivity of the fractured bedrock is likely low but water may move quickly through fracture zones.

Productivity:
Low to moderate. Well yields reported in the well records range up to 0.002 to 1.3 L/s (0.03 to 20 gpm). The geometric mean of reported well yields is 0.15 L/s (2.4 gpm) and the mean well yield is 0.3 L/s (4.7 gpm). Higher well yields appear asscociated with underlying volcanic rocks.

Depth to Water Table:
The geometric mean static water level is 3.9 metres (12.7 feet). The mean static water level is 8.6 metres (28 feet) and the range of static water levels is flowing to 46 metres (flowing to 150 feet).

Direction of Flow:
Groundwater likely moves from east to west and southerly towards Somass River and Alberni Inlet. Further analysis need to be conducted to confirm the direction of flow.

Recharge:
Precipitation and infiltration from surface sources to the east and north. Further studies need to be conducted to determine all sources of recharge to the aquifer.

Well Density:
Low. Approximately 2 wells/km^2, wells however are clustered locally.

Users/Level of Use:
Mainly domestic and occasional commercial.

Reliance on Source:
Appears variable.

Conflicts Between Users:
None documented.

Quantity Concerns (type, source, level of concern):
Low yielding wells locally.

Quality Concerns (type, source, level of concern):
Several well owners report high hardness, sulphury taste and odour, mineralized and salty water, very high iron in some cases, causes staining of clothes and presence of hydrogen sulphide and methane gas.

Notes:
The geometric mean depth of water wells in this aquifer is 68 metres (222 feet). The mean depth of wells is 79 metres (260 feet) and the range of well depths is from 15 to 201 metres (50 to 660 feet).

The statistics quoted for this aquifer are based on 17 to 32 water well records.

References:

Berardinucci, J. and K. Ronneseth. 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. Water, Air and Climate Change Branch. BC Ministry of Water, Land and Air Protection. Victoria, B.C. 54 pp.

Brown, W.L. and R.B. Erdman. 1976. *Groundwater Investigation Arrowsmith Heights Area Port Alberni District Lot 139,* Piteau Gadsby Macleod Ltd., Vancouver, B.C. File 76-002.

Massey, N.W.D., Friday, J.S., Riddell, J.M. and S.E. Dumais. 1991. *Geology of the Port Alberni-Nanaimo Lakes Area, NNTS 92F/1W, 92F/2E and part of 92F/7E*, Geological Survey Branch, Geoscience Map 1991-1. Ministry of Energy, Mines and Petroleum Resources, Victoria, B.C.

Massey, N.W.D., Friday, J.S., Riddell, J.M. and S.E. Dumais. 1989. *Geology of the Port Alberni-Nanaimo Lakes Area, NNTS 92F/1W, 92F/2E and part of 92F/7E*, Geological Survey Branch, Open File Map 1989-6, Sheet 5 of 9. Ministry of Energy, Mines and Petroleum Resources, Victoria, B.C.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Alberni Valley east

AQUIFER REFERENCE NUMBER: 697

CLASSIFICATION: IIB RANKING VALUE: 12

Classification Component:

Level of development: Moderate - ***Moderate*** level of demand in relationship to ***moderate*** level of aquifer productivity.

Level of Vulnerability: Moderate: ***Moderate to low*** level of vulnerability to surface contamination.

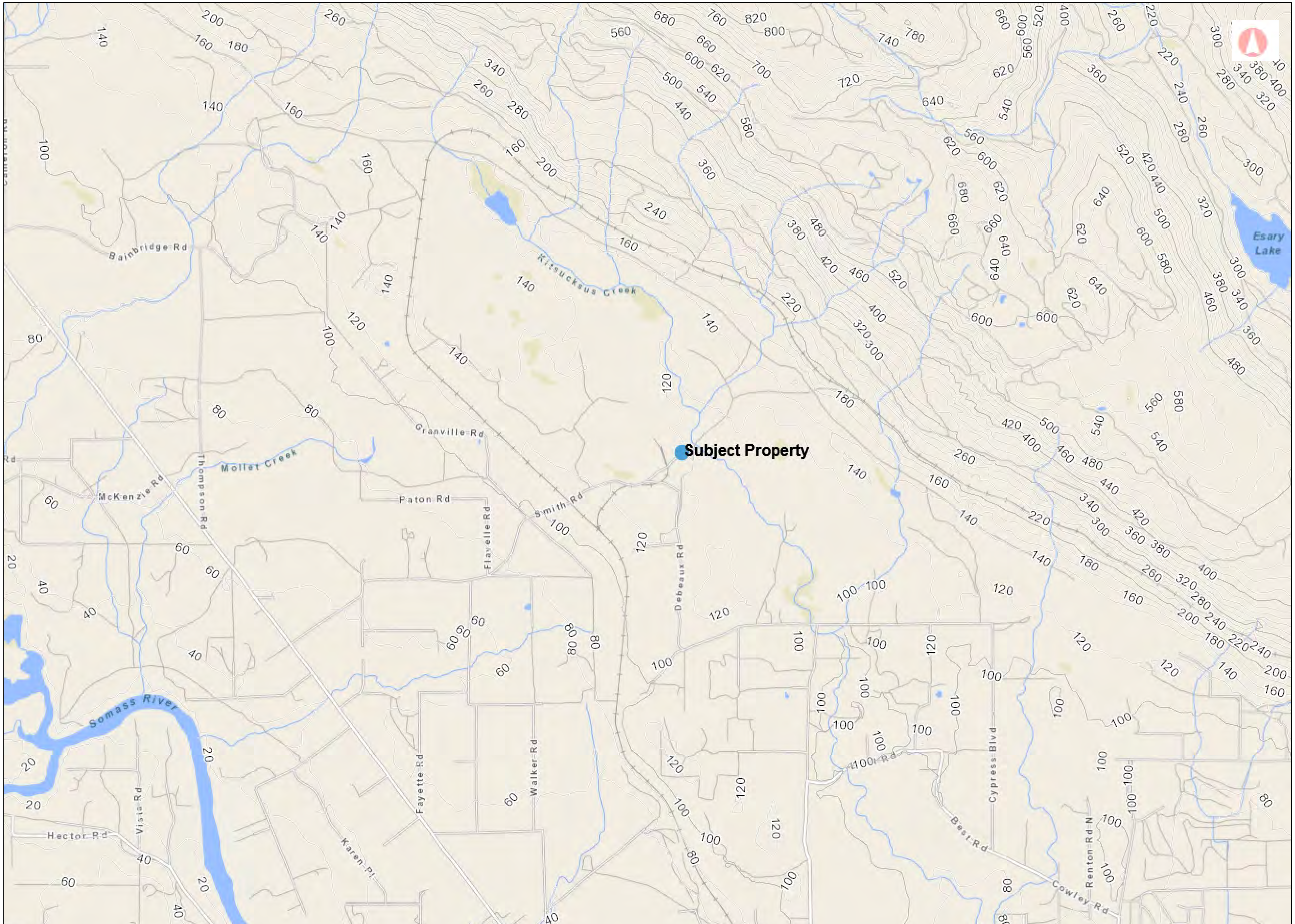
Ranking Component:

	Value
Productivity:	**1**
Vulnerability:	**2**
Size:	**3**
Demand:	**1**
Type of Use:	**2**
Quality Concerns:	**3**
Quantity Concerns:	**0**
Total	**12**

Statistical Analysis of Well Data

Aquifer 697					
	Well Depth (ft)	***Depth to Water (ft)***	***Depth to Bedrock (ft)***	***Reported Well Yield (gpm)***	***Estimated Thickness of Confining Materials (ft)***
Number of Wells	32	17	31	30	31
Maximum	660	150	112	20	112
Minimum	50	flowing	0	0.03	0
Mean	260	28	49	4.7	49
Geometric Mean	222	13	31	2.4	31

Contours Map



Legend

Contours - Labels (1:20,000
Contours - (1:20,000)

FCODE
- Contour - Index
- Contour - Index Indefinite
- Contour - Index Depression
- Contour - Index Depression Ind
- Contour - Intermediate
- Contour - Intermediate Indefinite
- Contour - Intermediate Depressi
- Contour - Intermediate Depressi

0 0.73 1.5 km

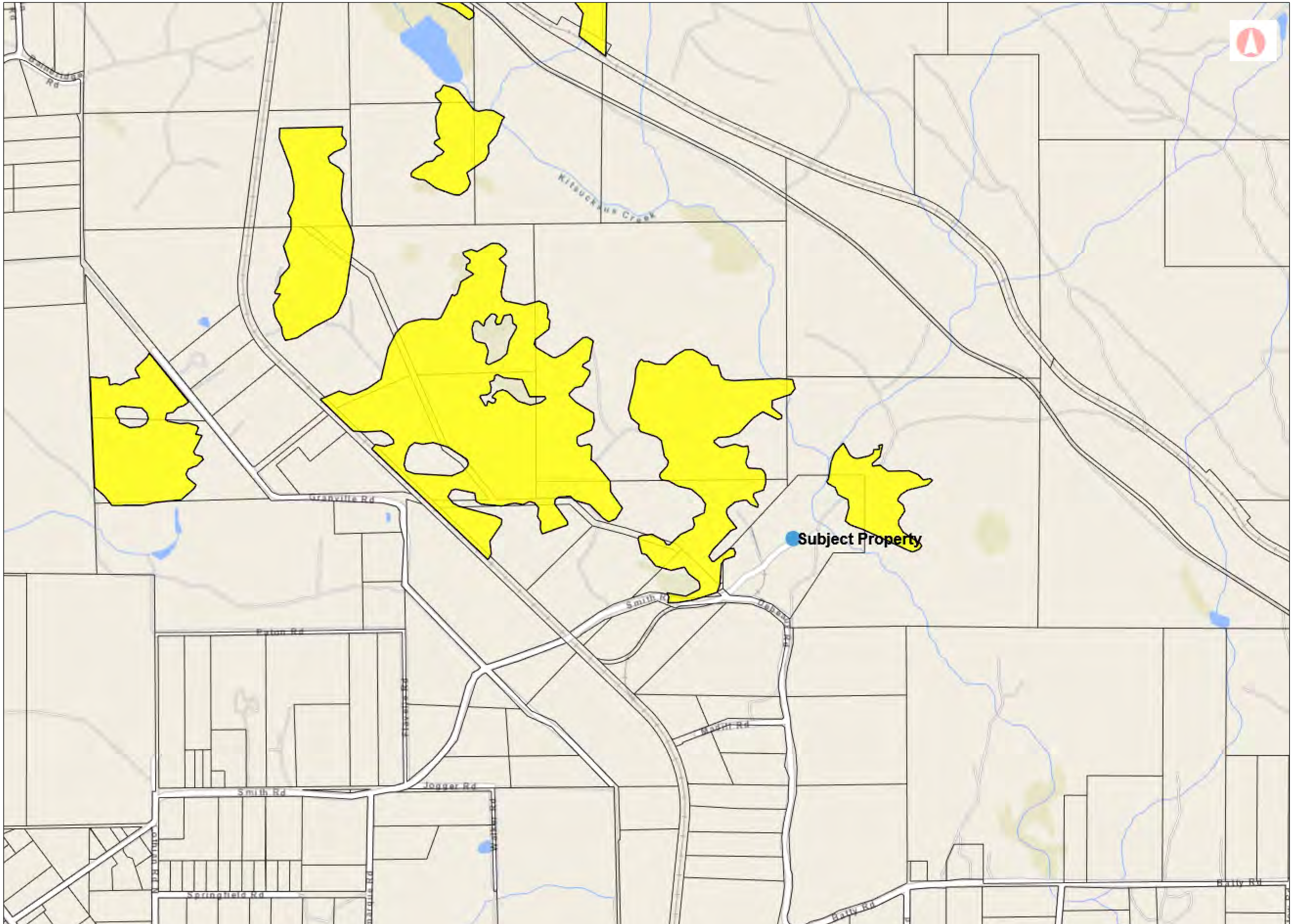
1: 36,112

Copyright/Disclaimer

CAUTION: Maps obtained using this site are not designed to assist in navigation. These maps may be generalized and may not reflect current conditions. Uncharted hazards may exist. DO NOT USE THESE MAPS FOR NAVIGATIONAL PURPOSES.

Datum:	NAD83
Projection:	WGS_1984_Web_Mercator_Auxiliary_Sphere

Key Map of British Columbia



BRITISH COLUMBIA

Critical Habitat Map

Legend

Ecosystem Enhancement - I
Colour Themed

HABITAT_ENHANCEMENT_TY

- Burn
- Slash
- Slash and Pile burn

Fisheries Sensitive Watersh
Colour Filled

Critical Habitat for Federally
Risk - Posted - Colour Them

CRITICAL_HABITAT_STATUS

- Final
- Proposed

Integrated Cadastral Fabric

Fisheries Sensitive Watersh
Outlined

Species and Ecosystems at
Available Occurrences - CD

Ecosystem Enhancement - I
Outlined

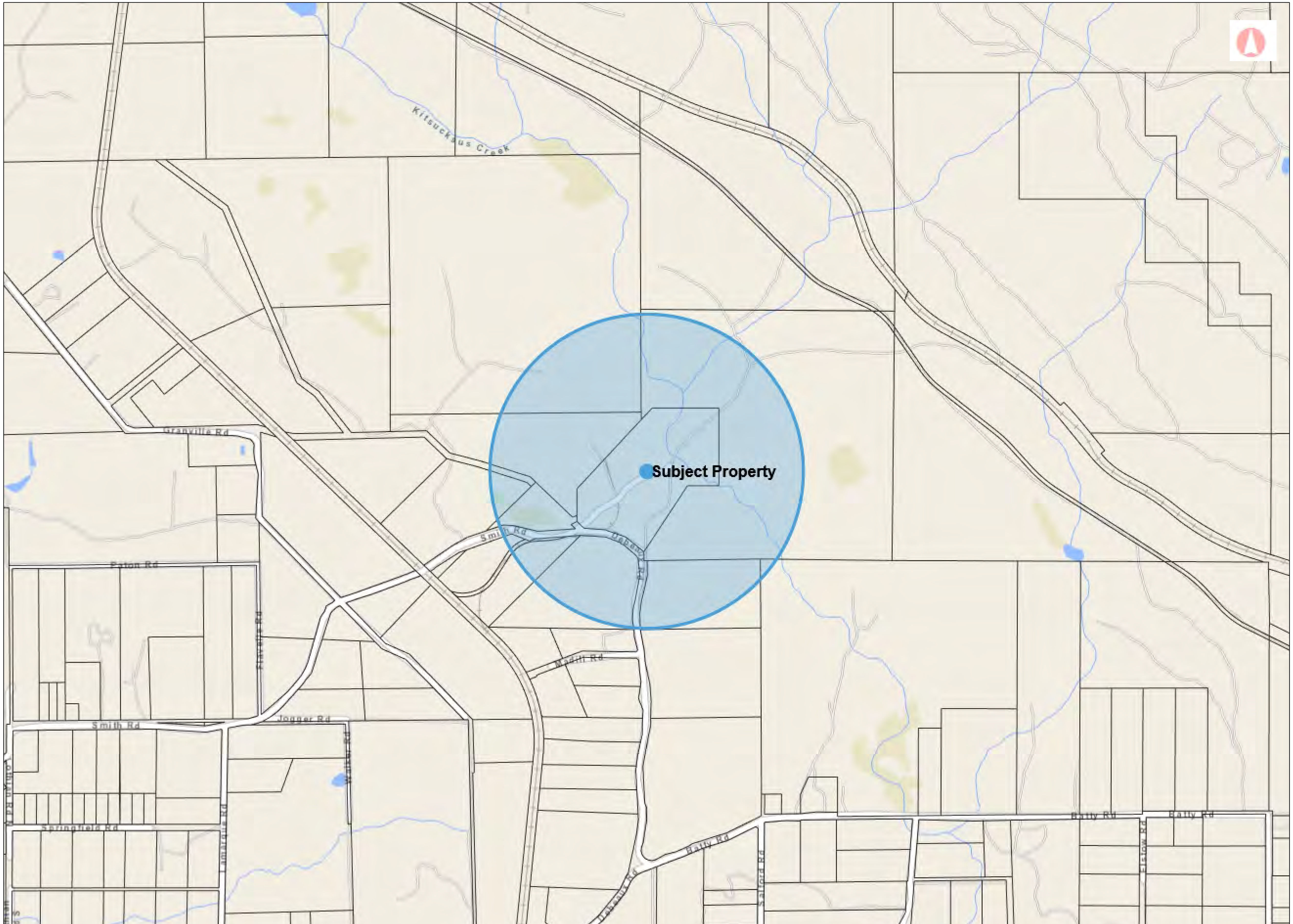
Critical Habitat for Federally
Risk - Posted - Outlined

0 0.37 0.7 km

1: 18,056

Datum:	NAD83
Projection:	WGS_1984_Web_Mercator_Auxiliary_Sphere

Key Map of British Columbia



BRITISH COLUMBIA

Monitoring Map

Legend

- EMS - All Stations
- EMS - Water Sites (Spring)
- EMS - Water Sites (Observa
- EMS - Water Sites (Well)
- EMS - Water Sites (Water P
- EMS - Water Sites (Water M
- EMS - Air Monitoring (Air Pe
- EMS - Air Monitoring (Ambie
- EMS Groups - Meteorologic
- EMS Groups - Federal Provi Stations
- Integrated Cadastral Fabric

0 0.37 0.7 km

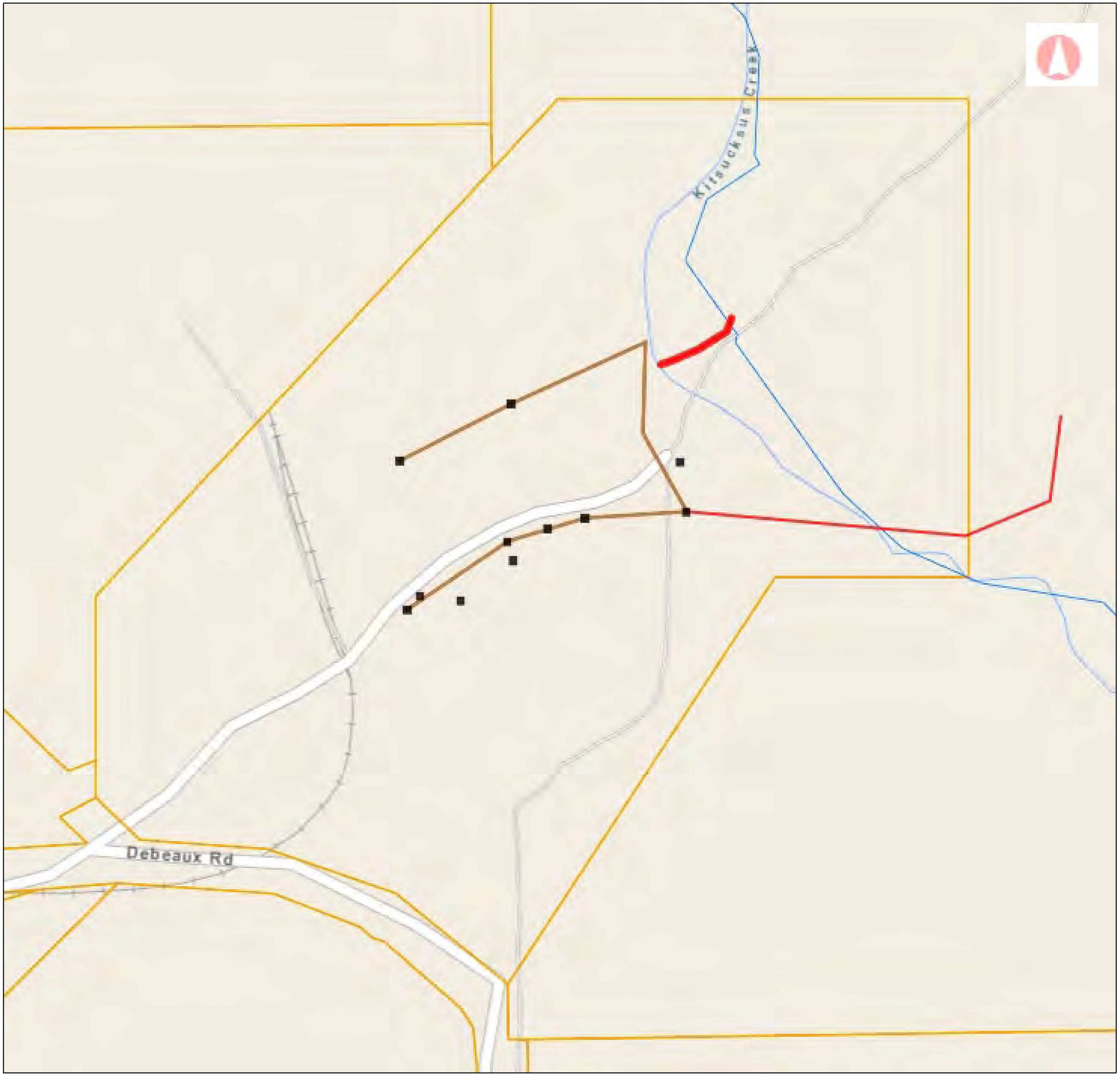
1: 18,056

Copyright/Disclaimer

Datum: NAD83

Projection: WGS_1984_Web_Mercator_Auxiliary_Sphere

Key Map of British Columbia



BRITISH COLUMBIA

Surface Water- Map

Legend

Flood Protection Appurtenar

POINT_TYPE

- Access
- Alignment
- Culvert
- Drop
- Fence
- Fence Gate
- Floodbox
- Foot Bridge
- GAUGE
- Groyne
- Manhole
- Monument

0 0.09 0.18 km

1: 4,514

Copyright/Disclaimer

CAUTION: Maps obtained using this site are not designed to assist in navigation. These maps may be generalized and may not reflect current conditions. Uncharted hazards may exist. DO NOT USE THESE MAPS FOR NAVIGATIONAL PURPOSES.

Datum: NAD83

Projection: WGS_1984_Web_Mercator_Auxiliary_Sphere

Key Map of British Columbia

Ministry of Environment

HABITAT WIZARD STREAMS REPORT

Feb. 1, 2019

WATERBODY INFORMATION	
Name:	KITSUCKSUS CREEK
Alias:	KITSUCKSIS CREEK
Alias (2):	KITSUKSIS CREEK
UTM Co-ordinate (Stream Mouth):	UTM: 10 367953, 5457785
Primary Mapsheet:	092F07
Primary Region:	Vancouver Island
Watershed Code:	930-137400-17300
Waterbody Identifier:	00000ALBN
Stream Length (m):	13.58
Stream Order:	3
Stream Magnitude:	11

SPECIES PRESENT

FISH SPECIES	LAST KNOWN OBSERVATION DATE
Chinook Salmon	01-DEC-97
Chum Salmon	01-JAN-89
Coastal Cutthroat Trout	19-AUG-15
Coho Salmon	19-AUG-15
Cutthroat Trout	01-JAN-95
Cutthroat Trout (Anadromous)	01-JAN-95
Rainbow Trout	01-JAN-70
Steelhead	01-JAN-00

STOCKING INFORMATION

DATE	SPECIES	RELEASED	STOCK	LIFE STAGE	HATCHERY

OBSTRUCTIONS

DESCRIPTION	HEIGHT	LENGTH	COMMENTS
Dam	5	0	BYPASSED BY FISHWAY, IS AN OLD LOGGING DAM.
Log jam	0	0	(NUMEROUS LOG JAMS THROUGHOUT. REF# = HQ0645)

ONLINE WATER LEVELS

REFERENCE URL

This water body has online water level information available from Environment Canada and the Province of BC. Use the link(s) above to go directly to the station information on the BC River Levels website.

WATER QUANTITY INFORMATION

The most current water survey information is available from the following Water Survey of Canada wel
http://scitech.pyr.ec.gc.ca/waterweb/selectProvin provides access to real-time water station in
http://www.wsc.ec.gc.ca/hydat/H2 provides access to archived water station information

REFERENCES

REFERENCE ID	REFERENCE TITLE
23-14	1:50,000 NTS INVENTORY MAPS BASED ON 1970'S FIELD SURVEYS.
23-15	SOMASS RIVER INVENTORY, 1976.
23-8	FISHERY OFFICER, PORT ALBERNI (1975 - PRESENT). PERSONAL INFORMATION. INTERVIEWED JAN 18 - 19, 1989
24-27	Personal communication with Biological Consultant, D.R. Clough Consulting, April 1995
DFO063	WEST COAST VANCOUVER ISLAND CHINOOK SURVEYS
DFP001	Addition of zones & points re: FISS maps for fish distribution for G.I.S. display purposes
DFV0001	OWHATCHET CREEK AND ROGER CREEK RESTORATION
HQ0645	STREAM INVENTORY FORMS
HQ2695	Stream Survey Form: Kitsuksus Creek (1969-72)
STLHD-SUM	STEELHEAD Database

TRIBUTARY STREAMS

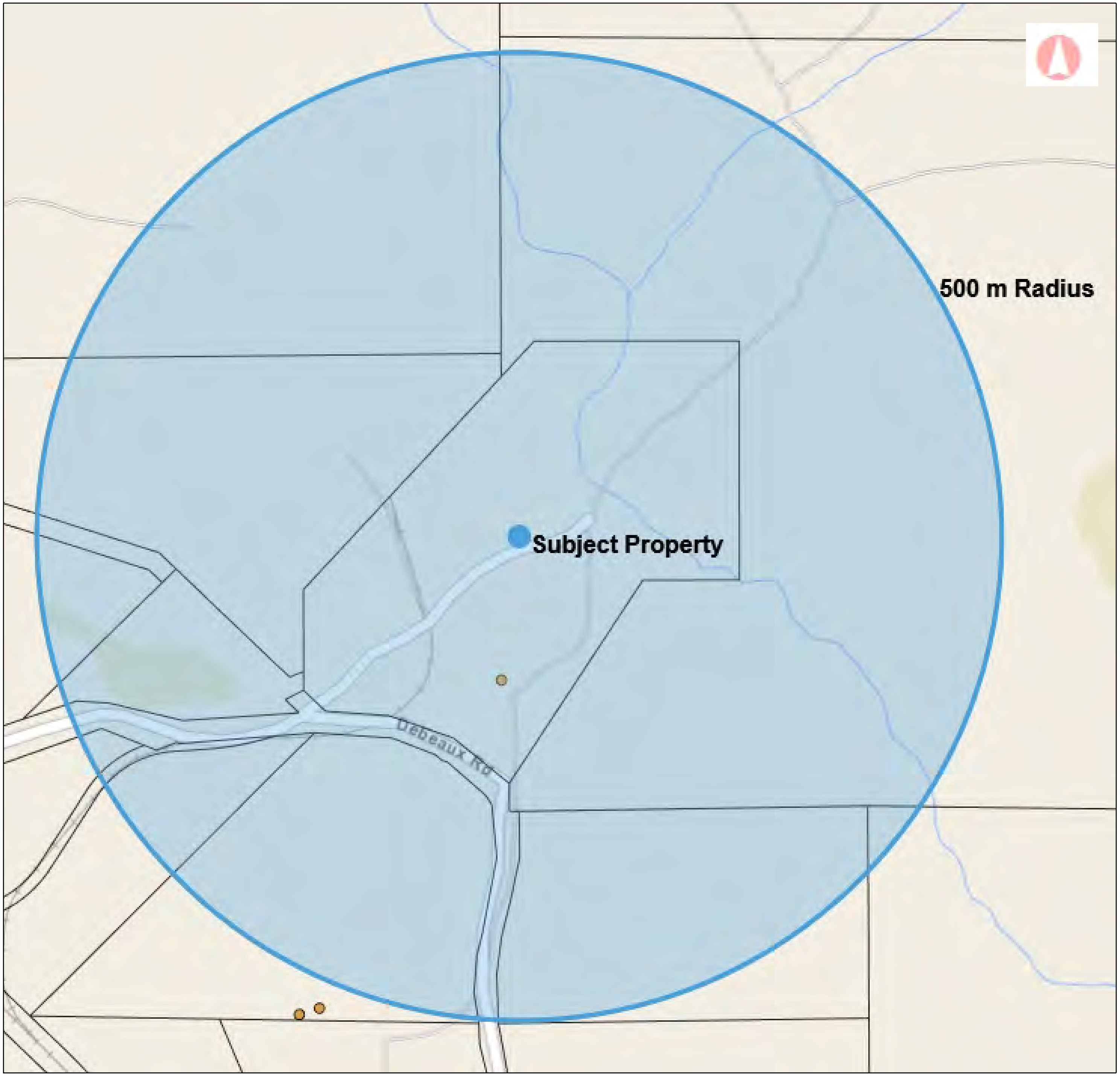
1:50,000 WATERSHED CODE	GAZETTED NAME	UTM	EASTING	NORTHING
930-137400-17300-04500	LUGRIN CREEK	10	367753	5458375
930-137400-17300-23000	CHERRY CREEK	10	369109	5459582
930-137400-17300-31400	Unnamed tributary - 00000ALBN - 317787	10	369028	5460549
930-137400-17300-77000	Unnamed tributary - 00000ALBN - 317788	10	366367	5464865

STREAM SURVEY DATA

ADDITIONAL INFORMATION

Please see the Fisheries Information Data Queries (FIDQ) for additional and more detailed queries of fish and fish habitat information: **http://www.env.gov.bc.ca/fish/fidq/index**

Please check the Ecological Reports Catalogue (EcoCat) for reference material and data that is available for online distribution: **http://www.env.gov.bc.ca/ecocat/**



BRITISH COLUMBIA

Water Well Map- 500m Radius

Legend

Water Wells - Licensed/Unli

WELL_LICENCE_GENERAL_S

Licensed

Unlicensed

Water Rights Licences - Wa

Water Wells - Private Dome

Integrated Cadastral Fabric

0 0.18 0.37 km

1: 9,028

Copyright/Disclaimer

CAUTION: Maps obtained using this site are not designed to assist in navigation. These maps may be generalized and may not reflect current conditions. Uncharted hazards may exist. DO NOT USE THESE MAPS FOR NAVIGATIONAL PURPOSES.

Datum: NAD83

Projection: WGS_1984_Web_Mercator_Auxiliary_Sphere

Key Map of British Columbia

BRITISH COLUMBIA Groundwater Wells and Aquifers

Log in

Well Summary

Well Tag Number: 94833
Well Identification Plate Number:
Owner Name: BARRY MCGINN MCGINN ENGINEERING
MCLEAN MILL NATIONAL HISTORIC SITE
Licenced Status: UNLICENSED

Well Status: ALTERATION
Well Class: Water Supply
Well Subclass: Non Domestic
Intended Water Use: Test

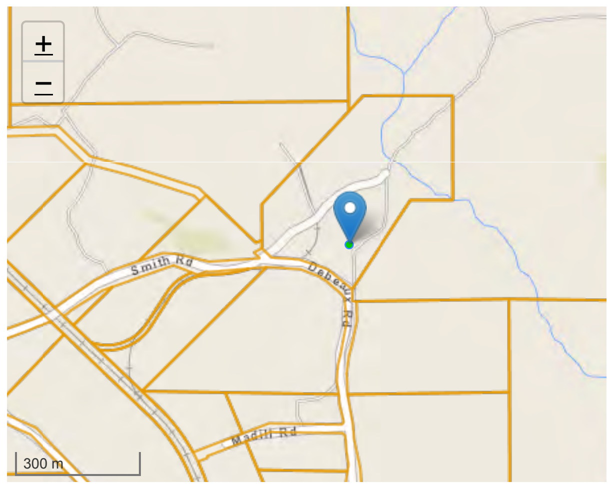
Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Aquifer Number:
Alternative specs submitted (if required): No

Location Information

Street Address: 5633 SMITH ROAD
Town/City: PORT ALBERNI
Legal Description:

Lot	
Plan	
District Lot	106
Block	
Section	
Township	
Range	
Land District	01 ALBERNI
Property Identification Description (PID)	

Description of Well Location: AT THE MCLEAN MILL NATIONAL HISTORIC SITE.
BCGS Mapsheet Number: 092F036221



Leaflet | Powered by Esri | Government of British Columbia, DataBC, GeoBC

Geographic Coordinates - North American Datum of 1983 (NAD 83)

Latitude: 49.309048
UTM Northing: 5463419
Zone: 10

Longitude: -124.827711
UTM Easting: 367149
Location Accuracy Code: (10 m accuracy) ICF cadastre and good location sketch

Well Activity

Construction Date (YYYY-MM-DD)	Alteration Date (YYYY-MM-DD)	Decommission Date (YYYY-MM-DD)	Drilling Company
	1997-08-22		Fyfe's Well Drilling

Well Completion Data

Total Depth Drilled: 540 feet
Finished Well Depth: 540 feet
Final Casing Stick Up:
Depth to Bedrock: 100 feet
Ground Elevation:
Elevation Determined By:

Static Water Level (BTOC): 30 feet
Estimated Well Yield: 20 GPM
Artesian Flow:
Artesian Pressure:

Well Cap:
Well Disinfected: No
Drilling Method: AIR_ROTARY
Orientation of Well: vertical

Lithology

From (feet)	To (feet)	Lithology Raw Data	Description	Material Description	Relative Hardness	Colour	Water-Bearing Estimated Flow	Observations
0	10		stony	till		brown		
10	20	TILL WITH COBBLES	stony			grey		
20	35		stony	till		grey		
35	40			till	Soft	brown		
40	60	TILL WITH BOULDERS				grey		
60	100		stony	till		grey		
100	230	SHALE INTERBEDS		sandstone		grey		MEDIUM/HARD
230	240						4 USGPM	WB FRACTURE APPROX. 4 USPGM
240	300			shale	Soft	grey		
300	400			shale	Soft	grey		BOREHOLE APPEARS TO BE STABLE
440	450			shale	Soft	grey		
450	470			shale	Medium	grey		
470	500			shale		grey		WITH GREENISH INCLUSIONS (CALCITE?)
500	530			shale	Very Soft	grey		
530	535	LIGHT COLOURED IGNEOUS ROCK						WATER BEARING
535	540	IGNEOUS ROCK			Very Hard			BOREHOLE APPEARS STABLE.

Casing Details

From (feet)	To (feet)	Diameter (inches)	Casing Material	Wall Thickness (inches)	Drive Shoe
0	22	10		0.350	Yes
0	105	6		0.250	No

Surface Seal and Backfill Details

Surface Seal Material: Bentonite clay
Surface Seal Installation Method:
Surface Seal Thickness: 2 inches
Surface Seal Length:

Backfill Material Above Surface Seal:
Backfill Depth:

Screen Details

No screen assembly information available.

Intake Method:
Type:
Material:
Opening:
Bottom:

Well Development

Developed By: Air lifting
Development Total Duration: 2 hours

Well Yield

Estimation Method:
Estimation Rate:
Estimation Duration:

Well Decommissioning

Reason for Decommission:
Method of Decommission:
Decommission Details:

Sealant Material:
Backfill Material:

Comments

Disclaimer

APPENDIX E.

ARCHAEOLOGY SEARCH

Kate Gilbert

From: Cooper, Diana FLNR:EX <Diana.Cooper@gov.bc.ca>
Sent: Tuesday, January 8, 2019 9:53 AM
To: Kate Gilbert
Subject: RE: Data Request: Kate Gilbert - TerraWest Environmental

Hello Kate, Happy New Year!

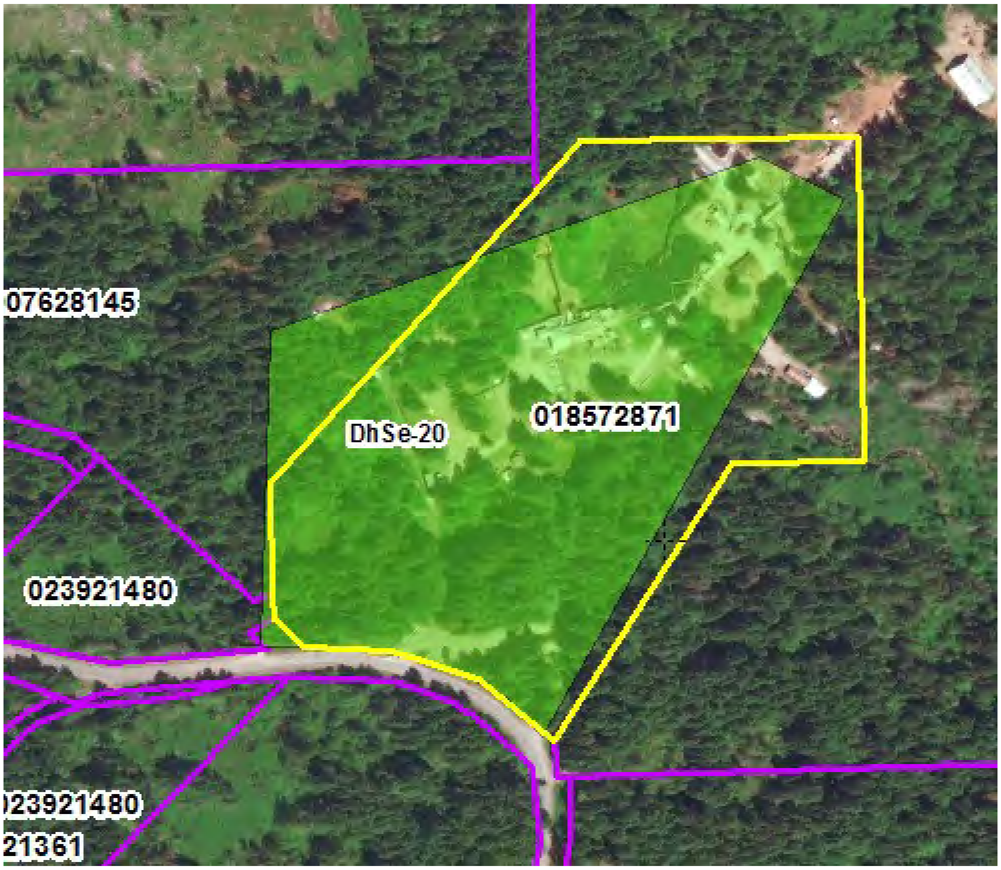
Thank you for your data request regarding 5633 Smith Road, Port Alberni, PID 018572871, LOT A, LOOP FARMS AND DISTRICT LOT 106, ALBERNI DISTRICT, PLAN VIP57991 EXCEPT THAT PART IN PLAN VIP65071. Provincial records indicate that historic place DhSe-20, the McLean Lumber Mill, is recorded on the property. The McLean Mill is a lumber mill complex with buildings and equipment, built in 1926-1927. It was designated a National Historic site in 1989 and plaqued in 2001. Administration is cost-shared by Parks Canada. Please contact the planning department at the City of Port Alberni for more information.

According to Provincial records there are no known archaeological sites recorded on the subject property. There is always a possibility for unknown archaeological sites to exist on the property. Archaeological sites (both recorded and unrecorded) are protected under the *Heritage Conservation Act* and must not be altered or damaged without a permit from the Archaeology Branch. If any land-altering development is planned for the property, owners and operators should be notified that if an archaeological site is encountered during development, activities must be halted and the Archaeology Branch contacted at 250-953-3334 for direction.

Please review the screenshot of the property below (outlined in yellow). If this does not represent the property listed in the data request, please contact me. The green area is the heritage property boundary.

Kind regards,

Diana



Diana Cooper | Archaeologist/Archaeological Site Inventory Information and Data Administrator

Archaeology Branch|Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Unit 3 – 1250 Quadra Street, Victoria, BC V8W2K7| PO Box 9816 Stn Prov Govt, Victoria BC V8W9W3
Phone: 250-953-3343 | Fax: 250-953-3340 | Website: http://www.for.gov.bc.ca/archaeology/

From: kgilbert@terrawest.ca <kgilbert@terrawest.ca> **On Behalf Of** ArchDataRequest@gov.bc.ca
Sent: January 7, 2019 2:39 PM
To: Arch Data Request FLNR:EX <ArchDataRequest@gov.bc.ca>
Subject: Data Request: Kate Gilbert - TerraWest Environmental

Terms and Conditions Accepted	Yes
Name	Kate Gilbert
Email	kgilbert@terrawest.ca
I am a	Contractor for Private Property (e.g., engineer, architect)
Affiliation	TerraWest Environmental
Address	TerraWest Environmental 3148 F Barons Rd.
City	NANAIMO
Province	British Columbia
Postal Code	V9T 4B5
Phone Number	250-618-3918
Information Requested	I request information and advice about archaeological sites on the parcel(s) described below (include civic address, PID, legal description; attach maps below if available):

	DhSe 5633 Smith Road, Port Alberni, BC PID: 018-572-871 Lot A Plan VIP57991, Distict Lot 106, Land District 01, Except Plan VIP 65071 Loop Farms.
Why Site Information is Required	Other (describe below):
	Potential intrusive environmental investigations into the soil and groundwater within the Subject Property.
Third Party Access	The following person(s) may have access to this information:
	D.G. Clough Consulting (David Clough)
Format Required	PDF
Who Prompted	I am a regular business user of this information request service

File Attachment#1

File Attachment#2

File Attachment#3

File Attachment#4

File Attachment#5

APPENDIX F.

PREVIOUS REPORTS AND LETTERS

APPENDIX F.

3.2.1 The Physical History of the R.B. McLean Lumber Company, National Historic Site. 1992. C.J. Taylor (Taylor)

The Physical History

of the

R.B. McLean Lumber Company National Historic Site

C.J. Taylor
January 1992

INTRODUCTION

This report was prepared to assist in the planning of the conservation and interpretation of the R.B. McLean Lumber Company National Historic Site. In writing this report, I was fortunate in having access to a a wealth of evidence relating to the site's history. Besides the old mill and other buildings, the McLeans left behind a very complete set of business records dating from the first years of the firm's operation. These have been carefully conserved in the Alberni Valley Museum. Over the past few years, Jean McIntosh, director of the Alberni Valley Museum, has undertaken an oral history program, interviewing people associated with the McLean operation, principally Kermit Green who worked in the mill from 1936 through 1965, and Muriel McLean, widow of Arnold, who lived at the site in the 1920s and 1930s. Jean McIntosh and her colleagues at the museum have supplemented these documentary and oral sources with a very fine photographic collection relating to the early history of the site.

The documents cannot tell the whole picture. A degree of imagination is necessary to picture the whole site as it evolved through time. Here, I was assisted by a very fine degree of local knowledge, and was able to draw on the opinions of Jean McIntosh, John Mitchell, Dave Lowe and others. My colleague, restoration architect David Whiting, was another resource with whom I could discuss possibilities and probabilities. Much of the main outline of the site's history already existed in these people's heads before I started researching it and I was soon drawn into esoteric discussions about the location of roads, tracks and buildings and the workings of things like doggers, planers and jill poles (sometimes also called the gin pole). A lot of these discussions concerned what could be termed site modeling, conjectures on how the mill and surrounding operation worked at various points in time. The configurations detailed below are really the fruits of these discussions reinforced by my documentary research.

Despite all of this excellent support there was still not enough evidence to accurately reproduce a detailed evolution of the site, especially given the time constraints of the exercise. It is quite likely, too, that some will disagree with how I have presented aspects of the site's history. Much of the modeling exercise involved subjective judgment and it is also quite possible that I have gotten the odd detail wrong. No doubt during the development phase over the next couple of years details will be added to this history and corrections made. I am confident, however, thanks to the help mentioned above, that the broad outline of the history given here is substantially correct and that it will assist those approaching the planning and development of the site.

The history of the site begins with the construction of the mill in 1927 and runs through 1965 when the mill finally closed. The period after that forms an epilogue during which the mill and surrounding buildings gradually deteriorated and began to crumble, followed by the recent initiatives to stabilize the buildings and arrest the process of decay, but it is reasonable to state that the working history of the site under the direction of the R.B. McLean Lumber Company began in 1926 and ended in 1965. Throughout this period there was an almost steady process of change, especially at the mill itself as the fabric of the building was constantly being modified or repaired. Within this constant change, however, there occurred some significant milestones which make it possible to delineate three main phases of development: the construction of the mill and principal camp buildings in 1927-28, the introduction of motor transport in 1934, and the introduction of hydroelectric power in 1949. These innovations influenced three distinct configurations to the site. The first, obviously, brought the mill and the establishment of the site; but it also centred on rail transport, both to bring the logs to the mill and to ship out the milled lumber and the site was organized around the rail spur running through the site. The second milestone introduced the mixed use of rail and roads through the site while the third milestone brought about the removal of the rail spur from the middle of the site, the changed location of the planer and the introduction of the green chain, all of which combined to further change the orientation of the site. While interpreting the history of the site through these three configurations may mask the sense of continuing change, they shape and give meaning to the myriad of minor changes that occurred through the site, many of which cannot be precisely dated.

First Configuration: 1927-34

The R.B. McLean Lumber Company, comprised of Robert B. McLean and his three sons, Walter, Philip and Arnold, moved to the Alberni area in 1926. The first land for the mill site and camp, along with surrounding timber, was obtained from the De Beaux estate and included 56 acres from Lot 261, 160 acres from Lot 161, and 160 acres from Lot 106.[1] The mill site comprises part of lots 27, 106 and 161. Not all of the De Beaux land land was purchased outright; on some of the property surrounding the mill site the McLeans merely had the timber rights. The extent of these limits was increased in the subsequent years and the McLeans obtained timber rights to much of the Loop Farm area and up the slopes of the Beaufort Range.

During 1926-27 the McLeans built a small but fairly typical sawmill beside Kitsuksis Creek. It was unusual in that it was not located on tidewater but this handicap was overcome by the damming of the creek to make a pond for the booming of logs and the construction of half a mile of railway spur to connect the mill to the Esquimalt and Nanaimo Railway. Initially the McLeans either sold locally or shipped all their lumber east by rail so the lack of water access was not a problem.

The mill itself was a ramshackle affair made of logs, sawn timbers, lumber and corrugated iron. It consisted of three levels: a main floor for the saws and related machinery, an understory containing the steam engine, and an attic for the drive shaft and pulley wheels. Related to the mill building proper was the boiler house on the south and hopper buildings for sawdust and scrap wood attached to the north side. A large open burner was situated about 150 feet north, originally somewhat closer than the present burner site.

The lumber was produced then much as it was later. Logs were brought in by rail to the pond and unloaded at a slide located beside the dam. The logs were sorted in the pond and cut to specific lengths by the boom man who had a floating shed on the water. Logs were brought up the ramp by a winch driven cable and kept ready on the log deck. On the log deck the log would be manhandled by two or three men on to the log carriage. Originally the log deck was exposed at the extreme east end of the deck and the log carriage, originally purchased in 1923[2] and probably brought from the McLean's old Cloverdale mill, ran out to the end of the deck. The carriage was mounted on v-shaped wheels that ran along iron rails fastened to the floor of the deck and pulled by a steam powered winch. Two men, a setter and a dogger, would ride with the log through the carriage. The log would be adjusted or set on the carriage by steam operated levers that would position the log laterally and by a cable which would rotate the log. These adjustments would determine the way in which the log would be cut as it passed through the main saws called the head rig. The head rig consisted of two circular saws -a bottom one 54 inches in diameter and a top saw 50 inches in diameter- positioned so that they overlapped slightly. A log would be carried back and forth through the head rig, its setting changed slightly after each cut.[3]

From the head rig the timbers could go in one of two ways through the mill. If dimension timbers were being made then they would be cut to size by the head rig and then carried by steam powered rollers down the length of the mill to a large cut off or trim saw situated at the north west end. Once cut to length, the timbers would be rolled off a transfer case at the west end and piled on the lumber deck there, probably on the southwest corner.

If lumber was being manufactured, then the timbers would go down the middle of the mill from the head rig. A transfer chain with live or steam powered rollers would move the timbers to the south side of the mill to the edger. The timbers would be fed through the edger from the east, coming out the west side as boards. From there the board would be fed further west along a conveyer to a smaller trim saw and passed out the transfer case to the lumber deck on the west side. The original Woods planer was located beside the edger on the south side of the mill. If lumber was to be planed then it would be fed through the planer from west to east and stacked along the deck which extended along the south side of the mill (Figure 1). In this first configuration, before the advent of the motorized lumber carrier, the lumber yard was probably not very extensive so as much lumber and timbers as possible would have been allowed to accumulate on the extensive lumber deck. The piles would have been shifted around by hand with the aid of carts called Hindus. From 1927 until 1934 the lumber was shipped out by rail. Boxcars were loaded from the deck along the south side (Fig. 3) or backed into an inset at the west lumber deck and loaded from the rear (Fig. 4). Lumber was also piled along the south side of the track so that the cars could be loaded from both sides (Fig. 5).

The defining characteristic of this period was the almost total dependence on rail transport to bring logs to the mill, ship out lumber and bring in supplies. This dependence on rail transport was a strong determinant on the early configuration of the site. The rail line ran from east to west across the south side of the log pond and mill close to the lumber deck (Fig. 3). The rail spur was modified slightly to provide a small spur leading directly into the southwest end of the lumber deck. This would have allowed rear loading box cars to be loaded more easily from the deck (Fig. 4). There was a plank road entering the site from the south but in the early days of the McLean establishment motor transport was not very evident. Most supplies and people came to the mill site by way of the McLean rail spur (see Fig.2).

The Budda gasoline powered locomotive, bought in 1928, was a key piece of machinery in the transportation system of this first period. It could pull two flat cars of logs to the pond or move a loaded box car to the main line. The use of a single locomotive for both logging and lumbering operations meant that there had to be a connecting rail network throughout the McLean operation. Soon after the purchase of the Budda, the McLeans experienced trouble with premature wear of the reverse gear. The cause, it seems, was the locomotive having to do too much pulling in reverse and the manager of the Westminster Machine Works suggested a track configuration that would permit the locie to turn around between the lumber deck and the log dump: "a Y coming up the road from the pond to the mill siding." The provincial government inspector of railways also made suggestions about the grade of the track bed and the gauge of the rails and through 1928 the McLeans made steady improvements to the track. That year they also bought two log cars complete with bunks.

In 1930 H.E. Beyer, the firm's accountant, wrote a testimonial for the Budda in which he said:

> The locomotive hauls easily two logging cars up a five per cent grade, and we have handled as big load as a 40 foot car loaded with 32,000 board feet lumber up a three per cent curved grade.
>
> . . .
>
> It has reduced our cost of logging and shipping considerably and has no trouble keeping up with the work of two departments.[6]

Kermit Green, who worked at the mill from 1936, remembers it differently. "You know what the old timers used to say about that? They should have built another one just exactly like it then junked them both! A gutless wonder!"[7] (Fig. 6)

Because of the mill's initial isolation, accommodation was erected on the site at an early date. The first houses to be erected were those for the three McLean sons, and, although R.B. McLean maintained his home in Cloverdale, a house was apparently put up for him as well. The cook house was also among the first buildings to be put up along with two bunkhouses, a blacksmith's shop, and a storage building, called the barn, located nearby. These buildings displayed a variety of finishes: Walter's appears to have had shingle siding while Philip's appears to have had shiplap (Figs. 7 and 8) and the barn (Fig. 9) had board and batten siding. Other houses would have joined this grouping by the early 1930s including those of the PLIB inspector, another mill employee, and the bookkeeper. There may also have been a house on the south side of the dam but of this we have only the slightest of evidence (Fig. 10). Initially all of this houses would have lacked indoor plumbing and so have had outhouses in the back.

By the early 1930s there were two other groupings of houses on the site. Japanese workers, who were employed at the mill in its early phases built at least two houses south down the west side of Kiksuksis Creek. Muriel McLean, Arnold's widow, said in an interview that the Japanese houses were built from lumber manufactured by the mill and that they resembled the other houses. There was a foot bridge, gardens, and a large brick bath associated with these buildings.[8] Another cluster of buildings was located to the west of the mill and included a house occupied by an engineer at the mill and perhaps one also for a teacher although it is possible that the teacher, who at one time was the engineer's daughter, lived in the engineer's house.[9] An office building was also located in this sector of the site.

There were probably few buildings located east of the mill in the first phase. The large building between the mill and the pond probably housed the steam generator. The Clegg Studios photograph of the mill pond taken about 1930 shows a lean-to and shed attached to the Power House (Fig. 11).

It is likely that the small parts shed and another fuel building existed at this time across the pond and for a while the locie shed was located in this sector. An early photograph shows the fuel storage building with the board and batten siding typical of the buildings erected in the first phase of the site's history (Fig. 12). The garage and machinery shop building, associated with motor transport, probably did not exist at this time.

Second Configuration: 1934-48

From 1929 until about 1933 the R.B. McLean Lumber Company endured three or four hard years as the North American lumber markets collapsed and the lumber industry experienced the full brunt of the economic depression. Yet by 1934 the McLeans were once again doing good business as the firm participated in the general revival of west coast lumbering and the isolated prosperity of Port Alberni. The reason for this anomaly lay in the ability of the west coast lumbermen to adapt to new overseas markets such as Japan, China and Great Britain and free themselves from dependence on rail markets in North America. The key to this success lay in the formation of large trading cartels such as Associated Timber Exporters (ASTEXO) and Seaboard These were lumber cooperatives which obtained and filled overseas orders by coordinating the output from a number of individual suppliers. The cargo trade, as it came to be called, was also helped by good ports and in Port Alberni by the construction there of a lumber assembly wharf which facilitated the amassing of the large shipments.[10] The R.B. McLean Lumber Company reaped many of the benefits of these initiatives and was thus able to include its comparatively puny output in larger shipments destined overseas and kept its mill at near full capacity through the later 1930s and 1940s.

This activity affected the fortunes of the mill. First, the profits earned by the company allowed it to recapitalize and reinvest in the operation. This spending was directed toward acquiring new innovations such as lumber carriers and logging trucks. Another affect of the cargo trade was that it placed greater emphasis on the manufacture of dimension timber.

The first indication of the firm's recapitalization is a memorandum of agreement of January 1934 between R.B. McLean, as vendor, and his three sons, as purchasers. This document described how R.B. McLean "advanced on behalf of the Company, for the purchase of certain equipment, including the Yates Planer, the sum of $2,500 and has agreed to convey, assign and transfer to the Company the machinery plant and equipment of the old mill at Cloverdale." In addition the old man agreed "to advance to the Company a further sum of $4,000."[11]

This financial restructuring was followed by a number of significant additions through 1934. The old planer, which was broken and ultimately sold for scrap, was replaced by the new Yates planer mentioned above. This was installed in the place left by the original planer beside the edger. The planer had its own power source, an old steam powered tractor situated just below. The tractor was probably salvaged from the old Cowley mill which was one of many small mills which failed to survive the depression.[12] This engine also powered the cyclone extractor which blew wood shavings from the planer through a pipe to fuel the main boiler and a new metal extractor may have been added at this time.

At the end of 1933 or the beginning of 1934 the McLeans purchased a turbine generator to provide a better source of electricity for lights in the mill and the houses than the old steam powered generator. An undated memo written about this time from the president of Swan Hydroelectric, informing the McLeans that their turbine was about to be shipped, concluded with: "Hope you are getting along with the building of the Power House and Tail Race and that you will have complete plant ready soon."[13] This may have referred to a second building situated beside the already existing one. The power plant was augmented in 1941 by the purchase of a larger water turbine and D.C. generator capable of lighting six to eight 100 watt lamps.[14] A 250 watt gasoline electric light plant was purchased in 1947.[15] By 1949 when the firm converted to bring in electricity from the B.C. Power Commission, it had one 10 kilowatt generator and three smaller ones capable of generating from three to four kilowatts.[16]

Another significant purchase in 1934 was an eight cylinder Ford truck with a Hayes trailer for hauling logs. At the same time the firm contracted with an independent trucker to haul logs so that they had two trucks hauling logs to the pond.[17] In this period the McLeans logging operation was described as having two sides. One crew remained logging along the rail line but a second crew began truck logging. This created the need for a second log dump at the east end of the pond and explains the other boom located there.[18] The original dump remained for the logs brought in by rail while the second one was for the trucks. The equipment sheds and garage were probably erected soon after this time and the development of the east end of the pond as a hub for logging equipment may have occurred in this period.

Yet another significant purchase in 1934 was the Ross Carrier, a motorized belly loading vehicle capable of transporting lumber piles.[19] The Ross Carrier facilitated the movement of lumber piles around the yard so that large orders could be accumulated, dried and sorted according to size. This innovation affected the mill operation in two ways. It removed pressure from the lumber deck and encouraged the expansion of the lumber yard. The appearance of the fields for stacking lumber to the west probably post dates the appearance of the Ross Carrier. Green lumber could be stacked out in the yard before being brought back to the mill to be run through the planer. According to Kermit Green, who worked at the mill from 1936 on, "They always accumulated several thousand feet before it would go to the planer and it would go in the yard and as it accumulated or we got orders, we shipped that or we ran the planer."[20] The lumber deck may have been modified to allow the Ross carrier to drive straight on to the deck up an earth ramp on the west side. The introduction of the Ross Carrier was followed in 1936 by the purchase of an 18 foot Packard truck as an alternate method for transporting lumber to Port Alberni.[21]

The handling of large orders of dimension timber created special problems on the lumber deck all of which the Ross Carrier could not solve. One solution to the problem of shifting the heavy timbers around was to have an overhead crane, that likely appeared in the mid 1930s, for moving the heavy timbers around (Fig. 4). There is no concrete evidence to date the appearance of this piece of machinery, however, and its date must remain a conjecture.[22] The overhead crane does not appear in the aerial photograph taken in the late 1930s and it is likely that its function was replaced by the portable crane (Fig. 14).

The introduction of motorized transport wrought a number of changes to the mill site during the 1930s. The increase in the size of the mill yard made buildings in that sector a hindrance and the office and engineer's residence were probably removed in this period. A loading platform built south of the mill and the railway spur probably facilitated the loading of lumber trucks. As well, a log dump was built for logging trucks on the east side of the pond. The main dump was on the dam and was serviced by an A frame. The secondary dump, by the machinery shop, was serviced by a gin pole. The lumber trucks entered the mill site from the south, along the old plank road, then looped around to approach the mill just to the south of the railway siding. The logging trucks would have entered the site the same way as the lumber trucks but continued through the camp along the plank road and across the dam to dump their logs on the east side of the pond (Fig. 15).[23] Figure 16 shows the plank road crossing the railway in this period while Figure 17 shows the plank road running across the rail line and the dam. The locie shed is shown in its second location at the east end of the dam. The garage was re-built in this period, enlarging its capacity from that of its earliest manifestation (Fig. 18).

The growing use of motor vehicles changed the site in indirect ways as well. By 1940 more people lived away from the site and commuted in each morning than lived in the camp. By this time a crummy brought workers back and forth between Port Alberni. During the 1940s the Philip McLeans moved to Cumberland, the Arnold McLeans moved to Port Alberni and the Walter McLeans moved away and ceased to be involved in the business. The Japanese workers were interned for the duration of the war and their houses vacated. Sometime later in the decade these buildings were bulldozed flat to clear a field for agricultural use. One addition in this period was the cold storage building across from the cook house which Kermit Green remembers as having been built by his father in 1937.[24]

A rare inventory of the camp's buildings was provided in response to a provincial government questionnaire in 1949. The McLeans listed their buildings as follows:

Dwellings	- five
Cookhouse	- one
Bunkhouses	- two
Blacksmith shop	- one
Garage	- one
Pumphouse	- one
Sawmill	- one[25]

Unfortunately, it does not appear that the McLeans were especially rigorous in their response as there is no mention of some of the smaller buildings, such as equipment sheds, that should have been standing at this time. Nevertheless the details that are provided are probably accurate so this provides definite evidence of five houses and two bunkhouses still existing at this time. The five dwellings referred to were likely those of Walter, Philip and Arnold Mclean, a worker's house lived in by Kermit Green, and grandma's house, formerly the R.B. McLan cabin. The bookeeper's house may have functioned as an office although such a function is not mentioned in the survey response. Certainly, though, by this time the bookeeper was living in Port Alberni.

Third Configuration: 1950-65

The greatest changes to the mill since its construction took place during 1949-50 when the mill was hooked up to hydroelectric service from the British Columbia Power Commission. The mill had always been underpowered and the prosperity of the postwar years finally stimulated the McLeans to consider a major investment in the plant. The opinion of a number of experts was sought, including a sales engineer for Canadian General Electric. He argued that electricity could solve a number of the mill's chronic problems.

> In the case of this particular mill the steam engineer estimated during our visit that they were developing about 200 horsepower. You will recall, though, that the Planer was not operating anywhere near its top speed, and the whole mill slows down every time the Head Saw hits a heavy cut. In using the electric drive, if all the machines are properly motored, the machines would operate at peak efficiency and the output of the mill would show a marked increase.[26]

The McLeans were largely persuaded by this argument and made a number of changes proposed by CGE. Electric motors were installed to power the trim saws, slashers, edger, planer and conveyers, as well as a new green chain. Electric motors meant the elimination of many of the inefficient belts that had run off the drive shaft running down the upper story and allowed the planer to be removed to its own building off the west end of the mill. This involved an extraordinary outlay of cash for the McLeans. Labour charges alone for the four month period from January through May were over $11,000.[27] The cost of converting the mill to electric power, including transformers, motors, and related equipment is estimated to have been in the neighbourhood of $20,000. An estimate prepared by Houle Electric shows the range of electric machinery being considered at this time and is attached as an appendix.

In the mill, the system of manufacturing lumber and timbers was not drastically changed. The McLeans resisted suggestions that they install more efficient gang saws and fully wean themselves from steam power. The mill was renovated rather than rebuilt. Although the head rig and carriage remained steam driven, the carriage was partly automated by having the setting mechanism -the niggers and doggers- steam driven. After this modification, Kermit Green, who was head sawyer at the time, said: "I could push a button and work the dogs individually or collectively by pushing the main button."[28] The walls of the log deck would have been built up and the roof extended at this time to offer greater protection from the weather (Fig. 19). Electric motors allowed greater flexibility of the placement of machinery and the planer was removed from its awkward position on the south side to a separate building off the northwest corner of the mill. A resaw was installed in the space left by the planer but according to Kermit Green this was not used much.[29] South of the lumber deck a green chain was built, also powered by electricity, that facilitated the sorting and piling of lumber (Fig. 20). A shed for the PLIB inspector was built at the head of this chain. The houses of both Walter and Philip McLean would have been removed to make way for this innovation. Outside the mill, twin utility poles and an enclosure for the transformers were built to the south of the boiler house (Figure 22).

With the relocation of the planer and the construction of the green chain, the lumber piling became concentrated at the west end instead of along the south side as before. Green lumber moved through the mill from east to west and then south down the green chain. Piled according to size, the lumber would then have been moved to the yard further west. Green lumber for planing would be brought back to the lumber deck and fed to the planer from the west. From the planer the lumber could have been moved out to the yard or piled back on the deck.

With the rationalization of lumber piling at the west end of the mill, and the cessation of rail logging, the railway spur could be relocated in a north south configuration to the west of the lumber yard. The deck and rail siding on the south side of the mill were removed. The siding would have had to be removed to make way for the transformers and green chain but this relocation also meant that the shippers and yard men could load the railway cars and trucks without getting tangled up in the operation of the mill. The new spur was accompanied by a new locie shed as well as a dip tank and loading platform (Fig. 21). In this period the locie was used exclusively for pulling lumber cars to the main line; logs were no longer brought to the pond by rail. Logging roads were pushed east along the old rail line and up the slopes of the Beaufort Range. Logging trucks therefore would have entered the mill site from the east instead of from the south, off Creamery Road as before.

The camp really declined in use in this third phase. Howard McLean and family lived in the former residence of Arnold McLean from 1948 to 51. During this time they added the deck and large front window.[30] But they too joined everyone else living in town and following that the house was used solely as an office. According to Kermit Green, one bunkhouse was demolished about 1950.[31] The bunkhouse and cookhouse would have been used intermittently through the 1950s and, judging by their condition, the other buildings not at all. The hub of activity beside the office and mill would have been the machinery buildings and garage at the east end of the mill.

In December 1965 Howard McLean suddenly announced that he was shutting down the mill and the employees were laid off. The logging operations continued for a number of more years, however, as did the farm. McLean sold the head rig and carriage to a small saw mill in Squamish, otherwise the mill and the camp buildings were left as they were. The McLean property was acquired by Macmillan Bloedel in 1983. Shortly after this event the Alberni Valley Museum became involved in trying to preserve the historic buildings. The rate of deterioration of the buildings quickened through the 1980s and the museum became increasingly concerned with their preservation. Its first intention was to dismantle the mill and move it off site and the pieces that made up the mill were carefully inventoried. The museum was concerned, however, that flooding under the lumber deck was causing the rest of the mill foundation to rot, threatening the stability of the mill before it could be moved, and to this end it removed the lumber deck which had already deteriorated beyond saving (Fig. 23). The Alberni Valley Museum acquired ownership of the McLean mill site in 1990 and began efforts to preserve the buildings _in situ_.

ENDNOTES

1 R.B. McLean Archives, Alberni Valley Museum [hereafter MA], Box M 341, "original purchases made about 1927," n.d.

2 MA, Box M 451, blueprint showing assembly of No. "A" steel carriage, 54" opening, from E. Long Mfg. Co. Ltd. 1923.

3 Interview with Kermit Green, 20 November 1987. Manuscript on file, Alberni Valley Museum.

4 MA, Box M 345, William Reid, manager, Westminster Iron Works, to R.B. McLean Lumber Co., 21 Nov. 1928.

5 MA, Box M 345, William Rae, Chief Inspector of Equipment, B.C. Department of Railways, to R.B. McLean Lumber Co., 12 March 1928.

6 MA, Box M 332, H.E. Beyer to Westminster Iron Co., 23 Jan. 1930.

7 Jean McIntosh, "Notes from conversation with Kermit Green re final identification of Squamish carriage," 19 Feb. 1988.

8 Jean McIntosh, "Interview with Muriel McLean," 8 May 1989; "Notes from meeting and visit to mill with Muriel McLean," 26 April 1989; "Visit with Muriel McLean," 24 Oct. 1989. Transcripts on file, Alberni Valley Museum.

9 Interview with Kermit Green, 24 Oct. 1991. Transcript on file, Alberni Valley Museum.

10 MA, Box M 338, R.B. McLean to Canadian Pacific Railway, 7 Jan. 1929."The opening of the Assembly Dock at Port Alberni gave the smaller mills in this section of the Island the hope of being able to participate in shipments for export."

11 MA, Box M 378, "Memorandum of Agreement made the 25th January 1934 between Robert B. McLean, vendor, and Walter S. McLean, Philip A. McLean and Arnold G. McLean, purchasers."

12 MA, Box M 333, R.B. McLean to Burrard Iron Works, 12 March 1937, "We have purchased from Cowley Brothers the stationary upright engine that was in the mill." Interview with Kermit Green, 24 Oct. 1991.

13 MA, M 335, James B. Swan to R.B. McLean Lumber Co., n.d.

14 MA, M 342, R.B. McLean Lumber Co. to Swan Hydro Electric, 4 Feb. 1941.

15 MA, M 119, Marshall Wells Invoice, 8 May 1947.

16 MA, M 347, R.B. McLean Lumber Company to Galbraith and Sulley, 24 Feb. 1949.

17 MA, M 378, Motor vehicle licenses, 1936; M 326, P.A. McLean to Hayes Anderson Motor Trucks, 18 April 1934.

18 Interview with Kermit Green, 24 Oct. 1991.

19 MA, M 326, R.R. Page to R.B. McLean Lumber Co., 10 July 1934.

20 Interview with Kermit Green, 24 Oct. 1991.

21 MA, M378, Motor vehicle licenses, 1938.

22 MA, M 429, Westminster Iron Works, blueprint, "Proposed Storage Crane for McLean Lumber Company," possible date 1936. The design, however, does not match the crane in the photograph.

23 Interview with Kermit Green, 24 Oct. 1991.

24 Interview with Kermit Green, 24 Oct. 1991.

25 MA, M 347, H.A. McLean to Government Assessor, 5 July 1949.

26 MA, M 387,C.W. Bradfield, Canadian General Electric, Victoria, to Lionel Houle, 24 Oct. 1949.

27 MA, M 28, Souther Construction Ltd., Invoices, Jan.-May, 1950.

28 Interview with Kermit Green, 24 Oct. 1991.

29 Interview with Kermit Green, 24 Oct. 1991.

30 Jean McIntosh, "Notes from an interview with Lolly McLean," 30 March 1990, Manuscript on file, Alberni Valley Museum.

31 Interview with Kermit Green, 24 October 1991.

FIGURES

19 East view of mill in 1988 showing enclosed log deck. Source: Alberni valley Museum, John Mitchell photograph.

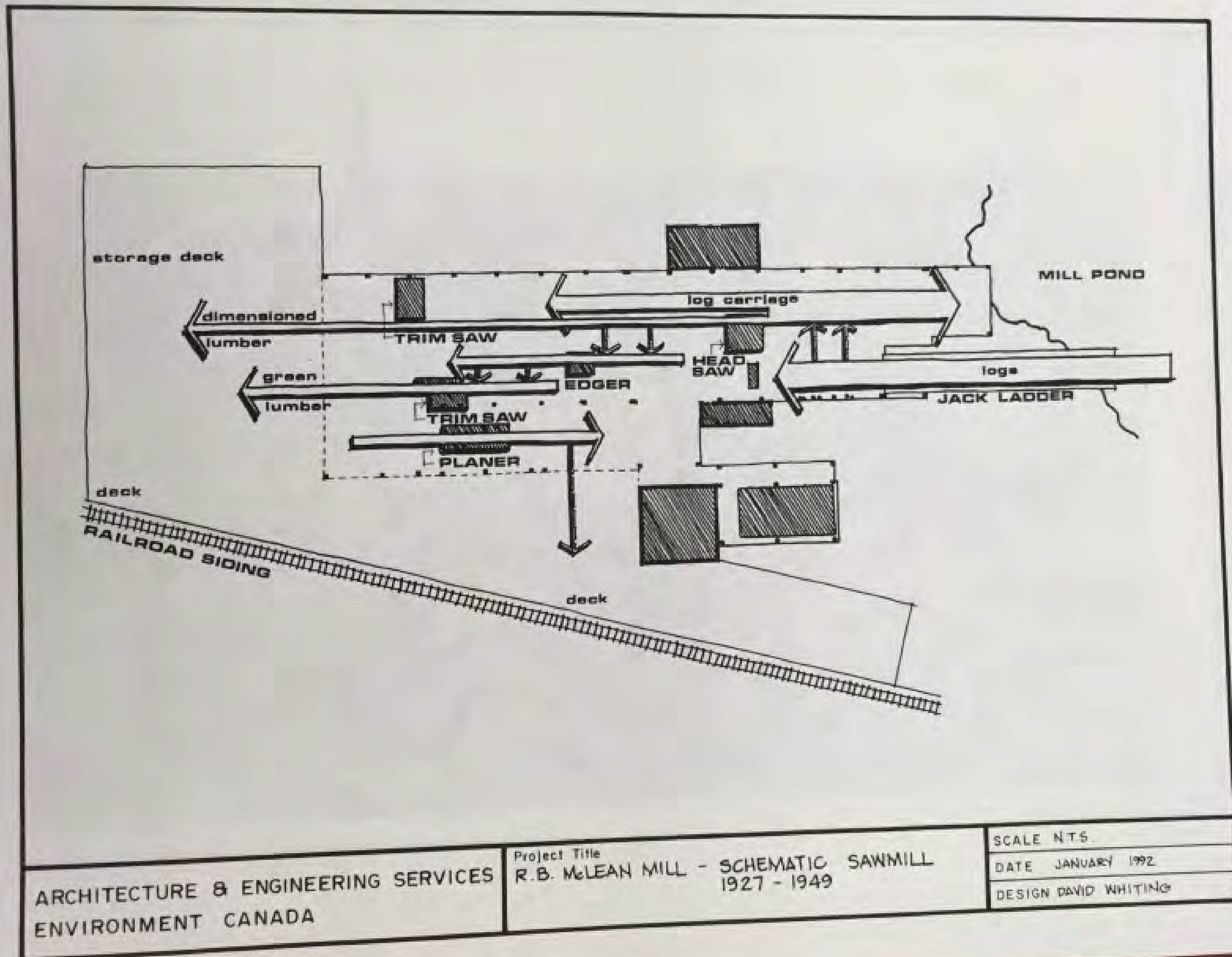
20 Mill Plan, 1950-64.

21 Site Plan - Third Configuration, 1950-65.

22 South elevation of mill in 1988 showing twin utility poles and transformer enclosure. Source: Alberni Valley Museum, neg. no. PN 11468, John Mitchell photograph.

23 Lumber deck, 1988. Source: Alberni Valley Museum, John Mitchell photograph.

FIGURE 1. Mill Plan 1927-49.



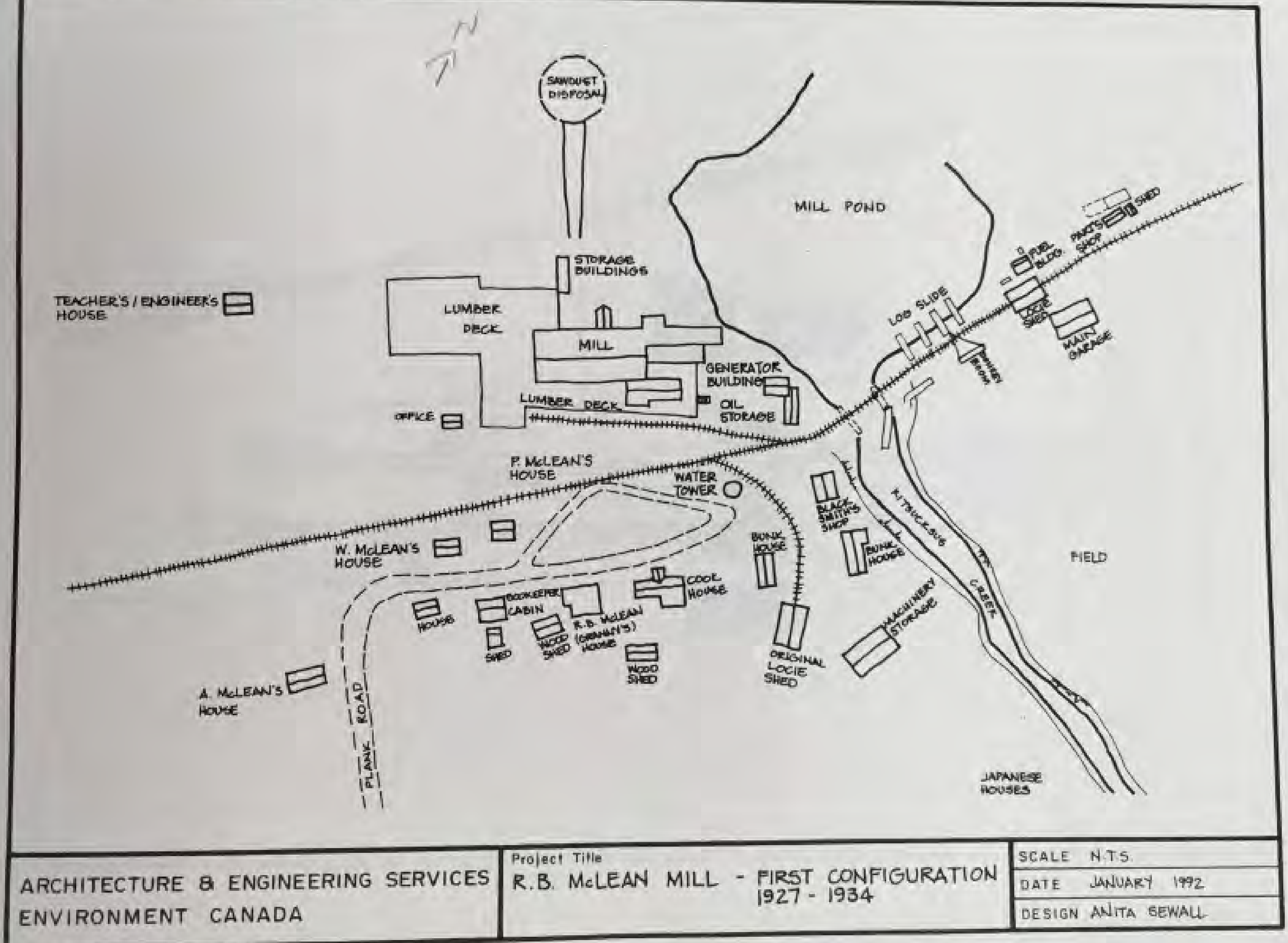


FIGURE 2. Site Plan - First Configuration, 1927-34.

FIGURE 3. Lumber Deck and Railway Spur before 1934. Note square wooden cyclone extractor on mill roof, dimension timber piled for loading along south side of mill.

FIGURE 9. Barn (Machinery Storage Building), 1988.

FIGURE 11. Mill from log pond ca. 1930. Note exposed log deck.

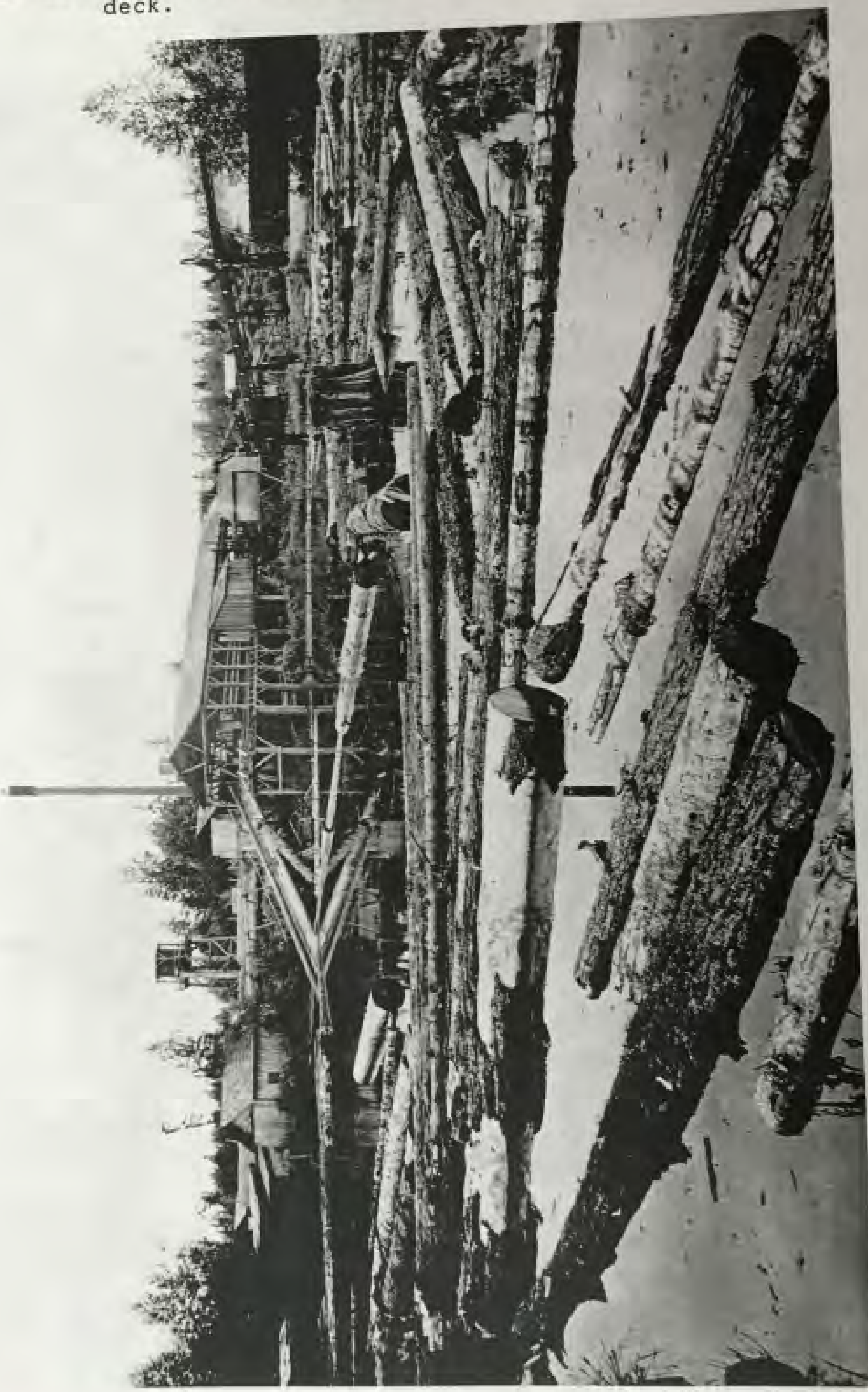


FIGURE 12. 1926 Model T Ford in front of Fuel Storage Building. Note board and batten siding, wood shingle roof. Machinery shop not evident in background.

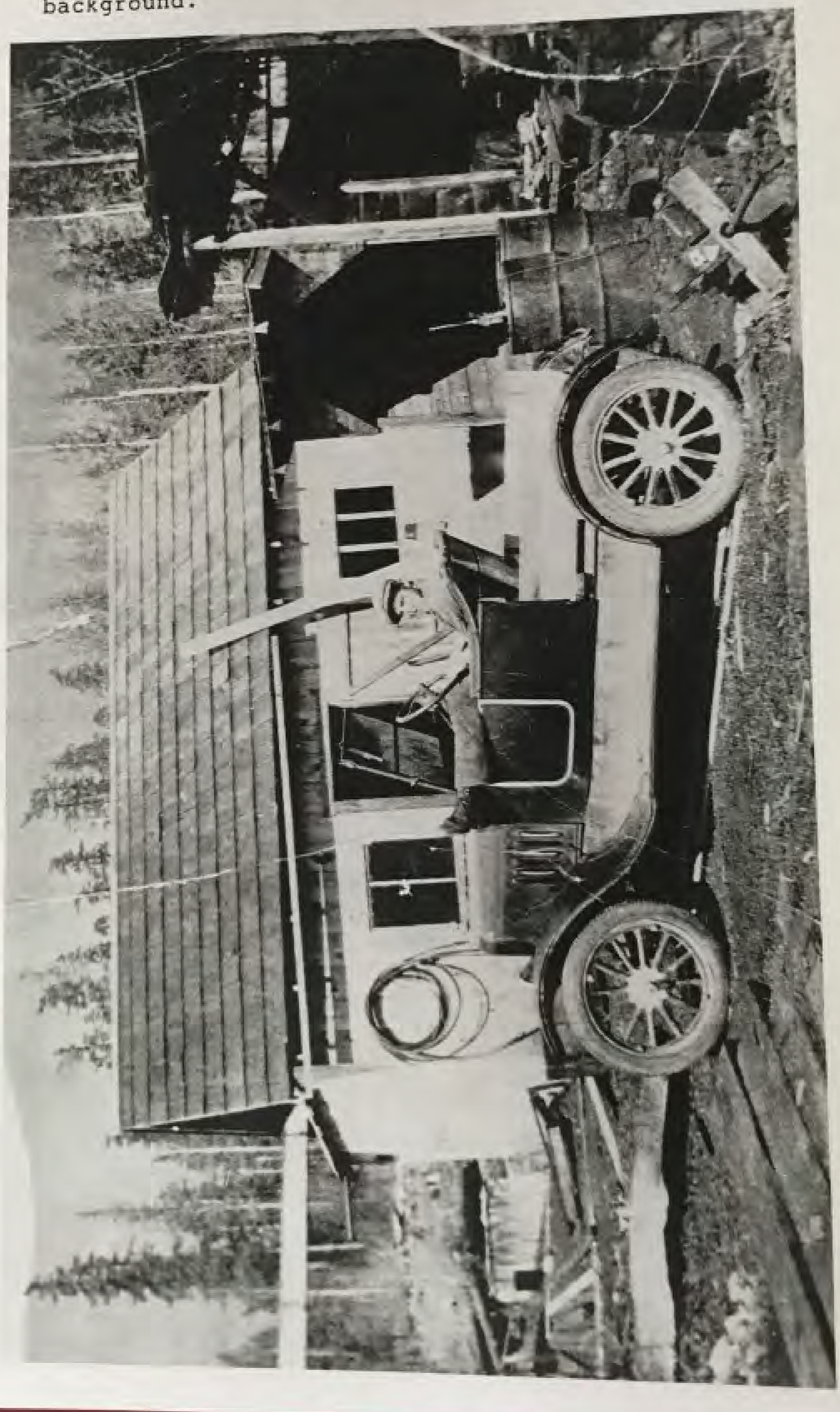


FIGURE 14. Aerial view of McLean site, probably 1937. Note configuration of lumber deck, loading ramp, and lumber yards. Portable crane is off west end of deck.

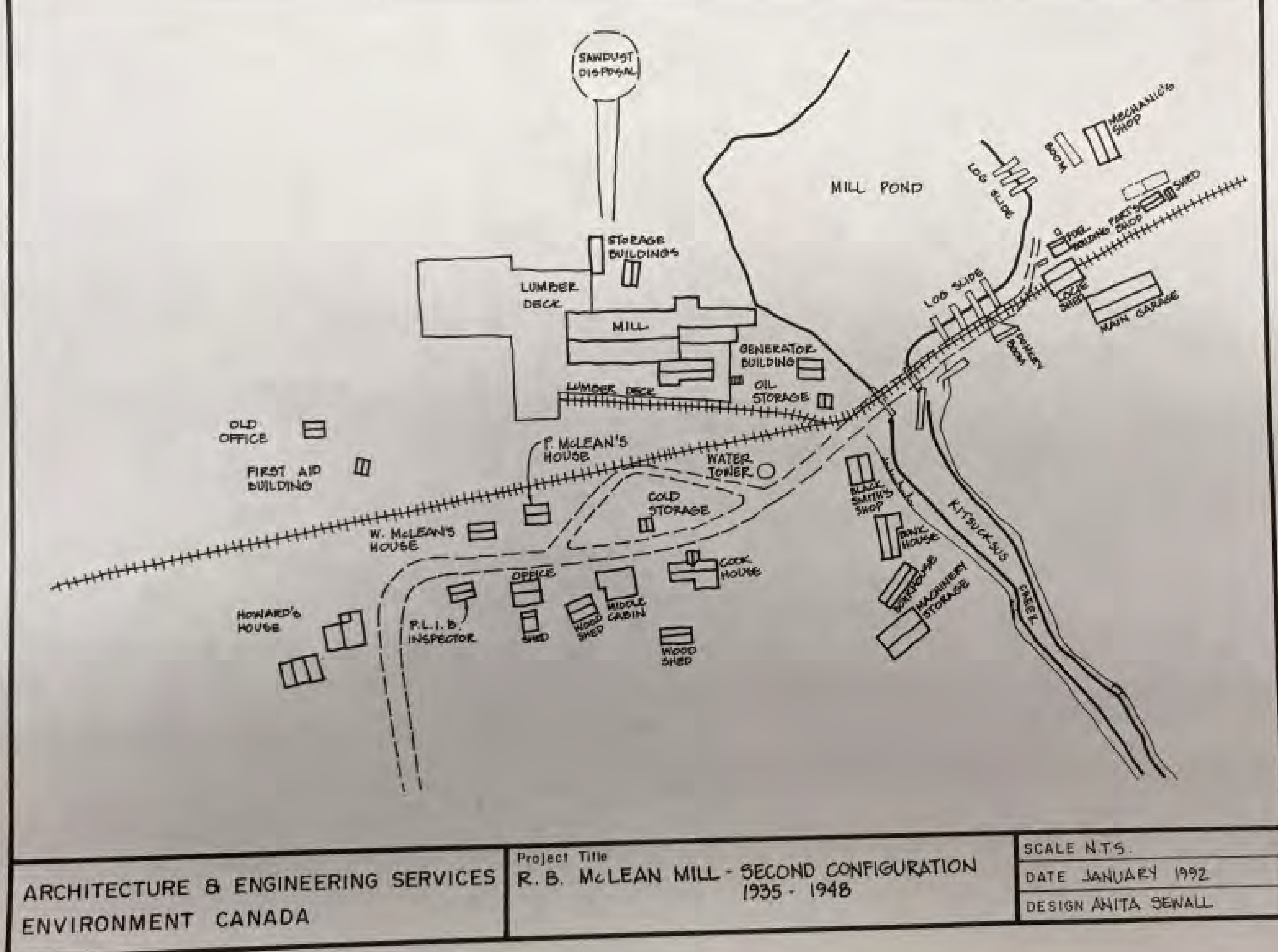


FIGURE 15. Site Plan - Second Configuration, 1934-49.

FIGURE 16. 1937 White truck with 1934 Hayes trailer ca. 1937-41. Detail shows plank road crossing railway spur near southeast corner of the mill.

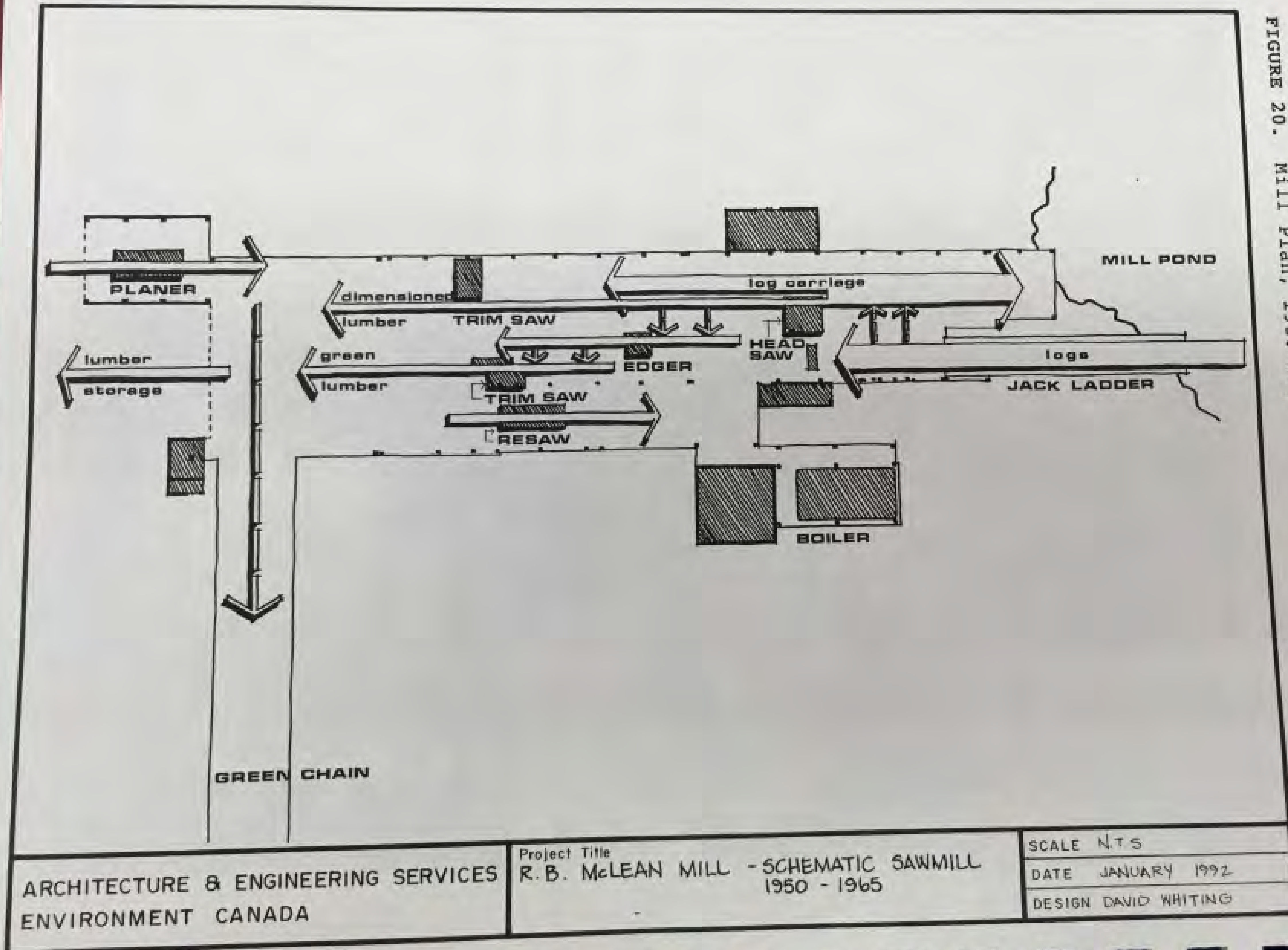


FIGURE 20. Mill Plan, 1950-65.

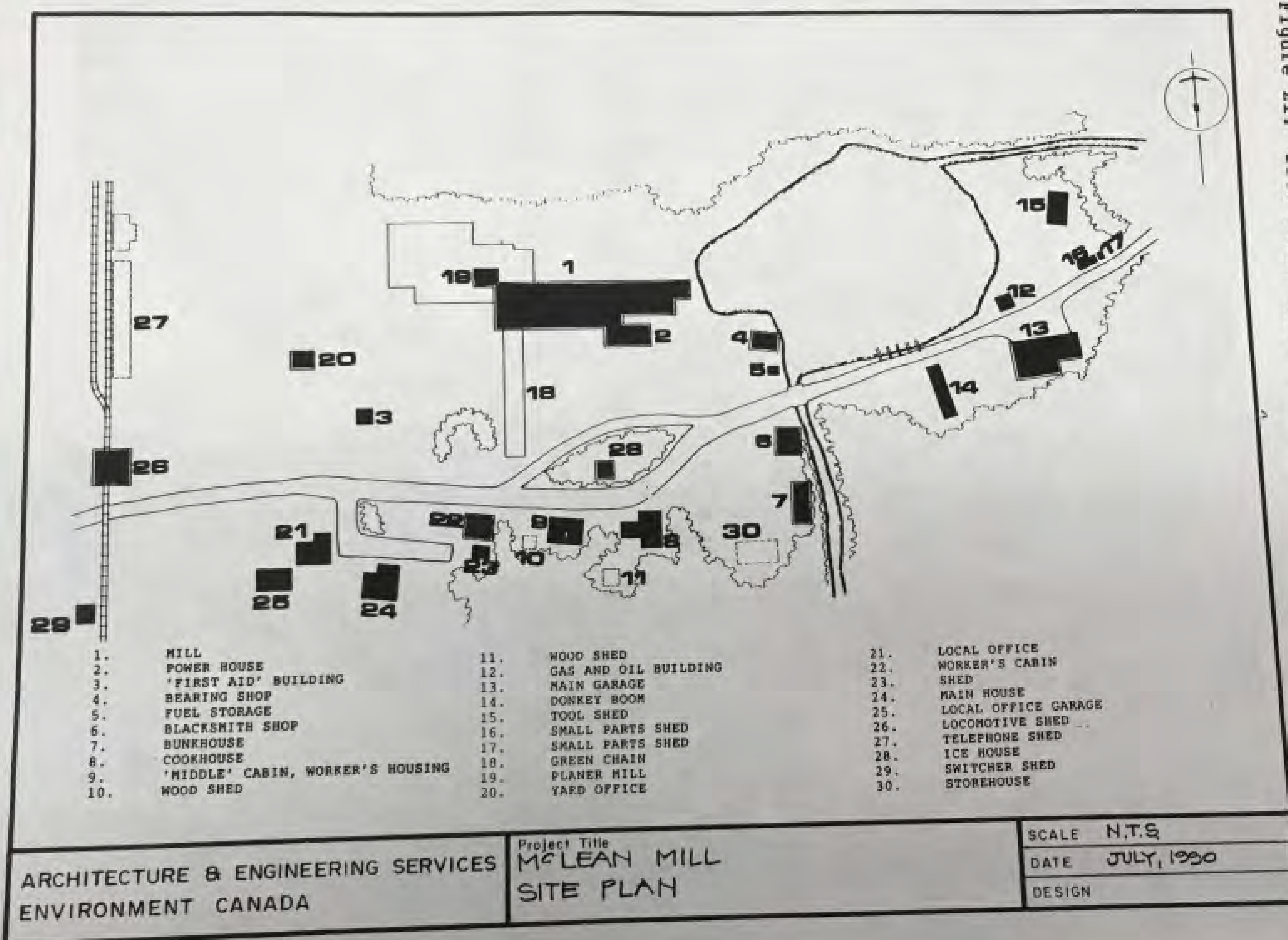


Figure 21. Site Plan, Third Configuration, 1950-65.

FIGURE 23. Lumber deck, 1988.

APPENDIX F.

3.2.2 Investigation of Potential Site Contamination at McLean Mill, Port Alberni, B.C. May 1992. Brian Weller, CPS Ottawa, and Liz Baker PWC, Calgary

INVESTIGATION OF POTENTIAL SITE CONTAMINATION AT MCLEAN MILL, PORT ALBERNI, B.C.

Date of Investigation: 4 May, 1992

Investigators: Brian Weller, CPS, Ottawa
Liz Baker, PWC, Calgary

Background

The McLean Saw Mill operated from the 1920's until the 1950's and is representative of the logging industry in this time period. The mill structure is in reasonable condition and a consortium consisting of the Municipality of Port Alberni, the Province of B.C. and the Canadian Parks Service has been formed to co-plan and fund the restoration of the mill.

The mill site consists of a saw mill facility, a logging operation maintenance yard and a dip tank and storage yard which was used to chemically treat wood for rot resistance. At this time, it is not known what chemical was used, although it is likely that pentachlorophenol was the chemical in question.

Site Description

Saw Mill Component

This area is characterized by a complex of wood frame structures and a steam generating power plant. An empty mill pond, approximately 2 ha in size, lies adjacent to the mill structure. A number of old buildings which served as offices, personal residences, bunkhouses, etc. are scattered about the 12.8 ha property.

It is not known if there is serious contamination on the site associated with the mill facility itself although it is apparent that over the lifetime of the facility large quantities of lubricants were used. Surplus lubricants would not have been contained in the building but would have easily moved to the ground beneath. As a consequence, significant quantities of hydrocarbons may have accumulated beneath the buildings; or in the sediments of the mill pond.

Two small garbage dumps were found on property.

Logging Maintenance Area

This area (approximately 1 ha) contains two buildings: a 5 bay maintenance building and a small oil shed with two adjacent gas pumps. Two 500 gal underground storage tanks (estimated), one 1000 gal underground storage tank (estimated) and one 500 gal above ground diesel fuel storage tank (estimated) (apparently empty) are also present. Certain of the tanks are known to have contained gasoline.

The maintenance shed contains an oil change pit and four additional bays which would have been used to repair or store equipment used in the logging operations. Twelve wet cell batteries were found inside the maintenance building.

It is not known if large quantities of oil have spilled or been dumped on the site. There is evidence of spillage in the oil pit and in the vicinity of the gas pumps and diesel fuel tank.

Wood Treatment Facility

All that remains of this operation are the dip tank, still in tact, and two wood storage yards (.5 ha and 1 ha in size). Drainage from the dip tank is apparently south-east towards the mill and mill pond. The tank bords on a low swampy area to the north west. The swampland is probably underlain by clay.

Discussion

If this site is developed, it will be used by large numbers of visitors and will undergo major reconstruction. The stream that passes through the mill pond is an important salmon stream.

Serious site contamination may exist on site due to the spillage of wood treating chemicals, hydrocarbons leaking from mill machinery and hydrocarbons leaking from storage tanks or spilled during refuelling or maintenance operations.

The potential presence of wood preservation chemicals and hydrocarbons may pose a significant risk to site visitors, site workers and salmon and may therefore be in violation of CEPA or the Fisheries Act.

Western Region should be aware that involvement with the Municipality of Alberni and the Province of B.C. in the development of this site may bestow liability on CPS, if the land is found to be contaminated.

Recommendations

1. A legal opinion must be obtained on the liability associated with CPS involvement in the development of this site.

2. A requirement of CPS involvement in the development of this site is that a preliminary site assessment be conducted to determine if contaminants are present in the ground or in the ground and surface waters. If the presence of contamination is detected, a more detailed site assessment will be required.

APPENDIX F.

3.2.3 General Comments from a site inspection conducted by Barry Campbell EARP/Cultural Resource Warden in July 1992. With draft memo attached

GENERAL COMMENTS

R.B. MCLEAN SAWMILL NATIONAL HISTORIC SITE

1. Site was visited by Barry Campbell, EARP/Cultural Resources Warden in early July 1992. Site visit was arranged with David Lowe, Project Manager, R. B. McLean Mill N.H.S. Campbell toured site for 2-3 hours with site caretaker and with some old-time residents familiar with the mill who happened to be present at the time of the visit. Some of the facilities were viewed from the exterior only as they were locked or were too unstable to enter. Some portions of the site were not visited by Campbell, however he toured the facilities centered around the mill complex. Site classification done by Campbell in October-November 1992, based on site visit, information from David Lowe, and phone calls with various experts in government and private enterprise.

   As a result of this brief site visit there may be a number of errors/ommissions which will affect the overall assessment score upward or downward. Additional testing or information, particularly regarding the chemicals used for lumber preservatives and the amount of hydrocarbons in the ground around various components of the site, could make some difference in the scoring. However, this information is unlikely to affect the overall site ranking.

2. Brian Weller from Headquarters, Natural Resource Conservation, also visited the site and submitted a report which is also attached.

3. A detailed site map, annoted with information on hazardous materials is also appended. This information is based mostly on the relatively short site visit and therefore may contain errors or ommissions.

4. Information from B.C. Ministry of Environment, Water Management Branch in Nanaimo, on known water wells nearby is appended. It is not comprehensive as wells do have to be registered in B.C. David Lowe thinks that much of the drinking water for the area comes from Kitsucksus Creek upstream from the mill site. However the appended information indicates that there may be a well on lot 9 across the road from the entrance of the mill site (reference Wayne Sadzak well)

5. Soil information from the B.C. Ministry of Agriculture office in Courtenay (334-1239) is appended. There is no information on soil depth or confining layers from this Ministry; however the well records from the Water Management Branch indicates a continuation of almost impervious pebbly-stoney clay to bedrock about 20m down.

Information from informants states that there is a "real hard clay 3 to 3.5 feet down and that swamps in the area stay wet all year."

The soil map indicates that the Stamp soils underlie the main mill area. This soil is described in the appended information. Another nearby soil type comprises the Dashwood soils. This latter soil is similar and has a concreted layer averaging 1m deep (range 75-125cm).

6. DIP TANK AND LUMBER DRYING/STORAGE AREA

According to informants the dip tank was not in operation for a very long period of time. It would probably relate to the later period of the mill's operation (perhaps the 1960's), when export standards demanded wood treatment. David Lowe stated that the dip tank ceased operation in 1965. Informants at the site stated to Barry Campbell that the liquid was red in colour and smelled strongly. However, both Barry Campbell and David Lowe were unable to find anyone who had specific knowledge of this operation. Barry Campbell called Forinteck, a research corporation in the field of wood technology and wood products. He talked to Paul Morris (224-3221) of the wood preservatives section. After hearing the description of the liquid and the period of the mill operation Paul thought that the chemical(s) were: primarily Disodium octoborite with secondarily, a minor quantity of Pentachlorophenol. Paul said that in the 1960's some lumber preserving was done with a 30% concentration of heated disodium octoborite. According to Paul "it was a low risk preservative that is again returning to 'fashion'. It is also used for eye washes, washing powders in low concentration. In high concentration it is used as a herbicide. It has a low mammal toxicity and as a fish toxin it is 'not too bad'. It can cause temporary testicular atrophy. Disodium octoborite does not attach to clay, is soluable and readily leaches out of soils. The pentachlorophenol was used as a sapstain in a comparitively low concentration for export shipments to Europe. Penetration of the wood was by simple diffusion." Paul referred me to Don Chapotelle for further information.

Don Chapotelle (684-0211) works with the Council of Forest Industries and has worked in the industry for many years. This was why Paul Morris referred his name to me. Don felt that the chemicals were penta- and tetra-chlorophenols used as anti-stains. Or he thought that the chemical could have been PQ-8, a copper preservative. Don said that the chlorophenols were almost colourless so could not explain why the liquid was red. However he said that these two former chemicals dominated the preservative business in the 1960's. He referred me to Roger Smith of Forinteck for specialized information on preservatives. (Note Roger Smith has not been contacted). He also referred me to Art McCordick (245-7543) of Duncan, who had a business of supplying preservatives to mills for anti-stain treatment during the 1960's). McCordick is now retired. (NOTE:

McCordick was not contacted. However Chapotelle does not wish McCordick to know who referred his name. Apparently Chapotelle and McCordick were involved in litigation some years ago).

CONCLUSION
Substance used unknown, however pentachlorophenol is mentioned. Scoring in the Contaminants section of the assessment is based on the possible presence of chlorophenol preservatives (high risk compounds). Quantity of preservative reaching the ground could be high due to splash or overflow from the tank and drippage from the piles of drying lumber.
Recommend searching mill records for invoices or records of chemicals used.
Recommend contacting old employees of the mill to see if they have further information.
Recommend contacting Roger Smith at Forinteck for his opinion.
Recommend drilling and testing soil for chemical evidence in the vicinity of the dip tank and the lumber drying area, **or** drilling a sample of wood from the sides of the dip tank and testing the interior portion of the wood for chemical evidence.

7. RESIDENCES
No information sought on the garbage or sewage disposal methods. Some small garbage dumps were noted by Brian Weller. These two items not assessed or scored.

8. MAIN SAWMILL
Sawmill was tentatively examined by B. Campbell. Most of mill was inaccessible due to structural instability. Campbell looked underneath half of mill towards the Mill Pond. Soil surface is predominately moist clay. Some oil staining was visible on the surface and most of the timber foundation posts or boards lying on the ground were stained with hydrocarbons.

The plant was steam powered. The steam lines on the ground were associated with hydrocarbon stained soil.

According to David Lowe there were 3 steam cylinders which were lubricated with 2-3 drops of oil a minute or about 1 pint per day per cylinder. This occurred in the 1927-65 period. Over this time period amount of oil used was considerable.

Other moving machinery was lubricated with oil or grease on a daily basis.

The dip of the terrain under the sawmill is towards the mill pond. Therefore hydrocarbons might slowly move through the soil towards the pond. High pond levels might have flushed much of the oil downstream by now.

CONCLUSION
Recommend sub-surface soil testing under the building for presence of hydrocarbons.

9. TRANSFORMERS

Three electrical transformers were located on open ground in front of the mill. They were still hooked together and fastened to a pair of power pole "arms". There was no cover over the transformers. Rumours existed that the transformers contained PCB contaminated oils. B. Campbell contacted B. C. Hydro and B. C. Ministry of Environment which confirmed transformers had not been previously tested. B.C. Hydro (Bruce Adams, Keith Williams 724-2711) immediately offered to test the transformers. Appended results indicates the transformers were "negative". This means that no levels of PCB above 50 ppm were detected. It does not mean that the transformers are free of PCB's. Results were sent to B.C. Ministry of Environment (758-3951, Margaret).

Ministry of Environment recommended that the oils in the transformers be sent out for disposal, to avoid possible accidental spill. They thought that B.C. Hydro might take the oil or the transformers. Each transformer should contain approx 42 gallons of oil (likely Imperial measure). However the group sponsoring the mill restoration wishes to consider the re-use of the transformers. Apparently they were used operationally until relatively recent times.

CONCLUSION

Recommend the transformers be surrounded by a weather resistant cover to reduce their deterioration.

Recommend the transformers be placed in a trough that would contain any potential spillage of the oils.

10. MILL POND

Mill pond is now a grassy depression about 2ha in area. Kitsucksus Creek flows through the pond area. It supports a run of coho salmon and cutthroat trout. The Coho salmon have been "enhanced" by the installation of a fish ladder and by other management efforts.

Barry Campbell did not examine the mill pond closely. It probably contains a large amount of woody, waterlogged debris, ranging from logs, to wood fragments to sawdust. These materials would be subject to slow decay under more recent silts and the grassy surface. Generation of leachate and gas (hydrogen sulphide, carbon dioxide, methane etc.) are possible. In addition hydrocarbons or other chemicals from buildings near the pond (mill, fuel building, garage, parts shop etc) may have seeped into the pond sediments.

CONCLUSION

Recommend coring pond sediments for possible toxic leachates or other chemicals.

Find out potential flood frequency of Kitsucksus Creek through discussion with informants.

11. SAWDUST DISPOSAL

This area near the mill and the mill pond was not examined by B.

Campbell. There is the possibility that sawdust decomposition has produced leachates that would enter the mill pond area.

12. FUEL BUILDING
Four tanks were located by or underneath this structure. Two 500-1000 gallon tanks were buried under the building. One has about 1.5 inches of gas still in it. The other contains gravel, dirt and sludge. The buried tank behind the building contains about 1.5 inches of gasoline. There were a number of 45 gallon metal barrels inside and outside the building. The building was locked so B. Campbell does not know how many of these barrels were full, nor their contents. Also there were a number of 5 or 10 gallon pails of possible greases inside the building. Again it is not known how many contained chemicals and what these chemicals were.

The fuel tanks under the building were leaking when the mill was operational so they were not used further (Source: informants to Dave Lowe).

The floor boards, foundation and adjacent soil was heavily stained with black hydrocarbon residue.

CONCLUSION
Recommend a more comprehensive inventory of potentially hazardous chemicals associated with this building, followed by removal of chemicals to an approved disposal site. All containers, emptied and steam cleaned, would be subsequently returned to site as part of the site history.
Recommend soil probing to determine at depth oil penetration.

13. MECHANICS SHOP
This building was locked and the view through windows to the inside was obscured by dust on the panes. Nothing potentially hazardous was noticed.

CONCLUSION
Recommend an inventory of building contents for potentially hazardous materials. The floor should be examined for potential staining.

14. WOOD DECK
Engine, transmission and transaxle oils on a variety of industrial vehicles were changed here. The ground between the ramps was stained with hydrocarbons.

Dave Lowe inquired about the fate of the engine oils following a change. Informants stated that the oil was used for burning bush or junk or was simply burned off. B. Campbell does not know where this happened.

15. PARTS SHOP
A number of probably empty anti-freeze containers were found

under the building. The building was locked so the interior could not be examined.

CONCLUSION
Recommend a detailed building contents inventory for hazardous chemicals.

16. MAIN GARAGE
Dry and wet cell batteries were found in this structure, along with pails of greases. There was an oil change pit in this building that had a gravel floor.

17. ALONG ROAD TOWARDS BARN
B. Campbell did not walk along this road beyond the main garage. Large numbers of old logging trucks and machinery may be located in the bush off this road.

CONCLUSION
Recommend the bushy areas surrounding the mill site be examined for the presence of potentially hazardous materials, such as barrels of oils, greases, preservatives, batteries, paints etc.

18. BARN
This building was not examined.

FINAL COMMENTS

The next stages of assessment and remediation of this National Historic Site should be undertaken co-operatively by the parties to the original agreement, including Environment Canada, the City of Port Alberni and the Province of British Columbia. Recommend quick action in commencing detailed assessment and remediation to take advantage of funds in the NCSR Program, a joint federal-provincial initiative, before they lapse in approximately 2 years time. More detailed site assessment should be completed prior to rehabilitation of site gets underway. Site remediation should be done before public opening and operation.

McLean Mill, Port Alberni, B.C.

Background

The McLean Saw Mill operated from the 1920's until the 1950's and is representative of the logging industry in this time period. The mill is also in reasonable condition and a .... consisting of the Municipality of Port Alberni, the Province of B.C. and the Canadian Parks Service has been formed to co-plan and fund the restoration of the mill.

The mill site consists of a saw mill facility, a logging operation maintenance yard and a dip tank and storage yard which was used to chemically treat wood for not resistance. At this time, it is not known what chemical was used, although it is likely that pentachlophenol was the chemical in question.

Site Description

Saw Mill Component

This area is characterized by a complex work of wood frame structures and a steam generating power plant. An empty mill pond (2ha) lies adjacent to the mill structure. A number of old building which served as personal residences and bunkhouses are scattered about the 12.8 ha property.

It is not likely that there is serious contamination on the site anociated with the mill facility itself although it is apparent that over the lifetime of the facility large quantities of lubricants were used on the many moving parts of the machinery. As a consequence, significant quantities of hydrocarbon may have accumulated beneath the buildings; or in the sediments of the mill pond.

Two small garbage dumps were found on property.

Logging Maintenance Area

This area (1ha) contains two buildings: a 5 bay maintenance building and a small oil shed with adjacent two gas pumps, 2 500 gal underground storage tanks .... 1 1000 gal underground storage tank (estimated) and 1 500 gal above ground diesel fuel storage tank (estimated size) (apparently empty). It is not known whether or not the underground tanks are full, empty or leaking.

The maintenance shed contains an oil change pit and four additional bays which would have been used to repair or store equipment used in the logging operations. 12 batteries were found inside the maintenance building.

It is not known if large quantities of oil have spilled or been dumped on the site. There is considerable evidence of spillage in the oil pit used in the vicinity of the gas pumps and diesel fuel tank.

Wood Treatment Facility

All that remains of this operation are the dip tank, still in fact, and two wood storage yards (1 ha and 2 ha in size). Drainage from the dip tank is apparently south-east towards the mill and mill pond. The tank boarders on a low swampy area to the north west. The swampland is probably underlain by clay.

Recommendations

Serious site contamination may exist on site due to the spillage of wood treating, chemical hydrocarbons leaking from mill machinery and hydrocarbons leaking from storage tanks or spilled during refuelling or maintenance operations.

If this site is developed, it will be used by large numbers of visitors and will undergo major reconstruction. The stream that passes through the mill pond is an important salmon stream.

The potential presence of wood preservation chemicals and hydrocarbons may pose a significant risk to site visitors, site workers and salmon. The site should therefore be thoroughly investigated for the presence and concentration of these contaminants.

What to recommend re level of investigations.

Province of British Columbia

Ministry of Tourism and Ministry Responsible for Culture

MEMORANDUM

Date: August 25, 1993

To: Bob Davis, Environment Safety Officer, Environmental Protection
Ministry of Environment, Lands and Parks

Re: **Site contamination study- McLean Mill National Historic Site, Port Alberni**

Further to our telephone conversation of August 24, 1993 regarding the above, I am enclosing a package of information on the site. I have given your name to Jim Hartley of Canadian Parks Service and he will be in touch.

Thanks for your consideration of this matter and I look forward to working with you on this project.

Mark Bawtinheimer
Preservation Architect

MB/re

Enclosure

Province of British Columbia
Ministry of Touris[illegible] nd Ministry Responsible for Culture
HERITAGE CONSERVATION BRANCH

Mark Bawtinheimer
M.A.I.B.C.
Preservation Architect

Phone: (604) 356-1198
Fax: (604) 356-7796

Mailing address:
5th Floor - 800 Johnson Street
Victoria
British Columbia
V8V 1X4

APPENDIX F.

3.2.4 MacMillan Bloedel Limited Memo-R.B. McLean Mill Site, Preliminary Site Assessment. 1993. John Pillsbury to D. Blake, Alberni Pacific Division

MacMillan Bloedel Limited — INTER-OFFICE MEMO

File: BM-200.

TO: D. Blake Alberni Pacific Division

FROM: Jon Pillsbury AT: Environmental Services-H.O. DATE: 18NOV93

SUBJECT: R.B. McLean Mill Site
-- Preliminary Site Assessment

COPIES TO: E. McCormick

Dave,

I have received the lab results for analysis of some samples I took when I visited the site on 30SEP93 with Eric McCormick, Director of Parks and Recreation, City of Port Alberni. I was in the area Wednesday, 17NOV93, and briefly discussed the attached data with Eric. He took photocopies of the lab results (Attachment I) which have my notes re sample sites and criteria levels on the report sheet.

The quick answer is that there is some contamination and more investigation is required to determine the extent of this. There is some contamination of soil with PCP anti-stain below the drain bung in the old dip-tank, and some in the area where I understand lumber used to be stored. (Present site of a satellite dish). There is oil and grease below the mill steam engine, below the fuel building (around the buried tank), under the garage grease racks, and behind the fuel shed (under a raised fuel tank set on a steel frame). There is also metal contamination of the soil in the blacksmith shop. These preliminary observations indicate the presence of contaminants in concentrations above the industrial (level C) levels.

To determine the <u>extent</u> of contamination, and the condition of the mill pond (more on this later), will require some further examination. I suggest employing a professional such as Envirochem; TRI; Karwandy, Wilmer, Wise; or Golder & Assoc. to perform this evaluation. I can supply contacts and telephone numbers if you wish to pursue this. I suggest requesting proposals from several of these people and then look at both the proposed strategy and the price. I could review the proposals with you and offer comments, when you get to that stage.

<u>Mill pond</u> This is a problematic situation. In order to say it is clean, one would have to set up a fairly fine sampling grid and take many samples, then composite them in some manner to reduce the lab costs (which could be quite high -- several hundred dollars each sample if we are unsure what we are looking for). The trouble is, we don't know what some "creative" individual may have dumped in there to dispose of it in the past; nor do we know where he may have dumped it. The actual risk is a function of what may leach out when the pond is filled, and what may be accessible to visitors to the site. This would be something to discuss with the consultants.

Please call me at 661-8264 if you wish to discuss.

Jon.

RECEIVED

Attachment

E:\ALBERNI\APD\SMPLTST2.DOC

MacMillan Bloedel Limited INTER-OFFICE MEMO

BM-206

TO Jon Pillsbury

P-6019

NOV -3 1993

FROM A.C. Garby AT MB Research DATE November 2, 1993

SUBJECT **APD SOIL SAMPLES** COPIES TO E.E. Chao

Testing of the soil samples submitted on October 1st has now been completed. Results, reported on an oven dry basis, are as follows:

DIP TANK BY RAIL LINE — STORAGE AREA - BY SATELLITE DISH

ABOVE C (5ppm)

	MS-1	MS-2	
Pentachlorophenol	26	0.11	ppm
Tetrachlorophenols	1.4	0.014	ppm
Trichlorophenols	<1	<0.01	ppm
Total Chlorinated Phenols	27.4	0.124	ppm
Creosote	<0.1	<0.2	ppm

ABOVE A (0.1 ppm)

ABOVE C (10 ppm)

SOIL BELOW DRUMS BY MILL STEAM BOILER

	MS-4	MS-5	
Phosphate	1240	1280	ppm
Sulfur	240	290	ppm

BELOW LEVEL A (500 ppm)

	MS-3	MS-7	MS-8	MS-9	MS-10	MS-11
	STEAM ENGINE	MILL POND	U.G. TANK BELOW OIL SHED	ABOVE GROUND TANK IN FRONT OF OIL SHED	GREASE RACKS	RAISED TANK ON FRAME BEHIND OIL SHED
Oil and Grease	62.8%	<0.025%	10.2%	0.078%	10.0%	2.8%
	ABOVE C	ABOVE A	ABOVE C	ABOVE A	ABOVE C	ABOVE C

A = 0.01 %
B = 0.1 %
C = 0.5 %

NOTES

LEVELS A, B, & C ARE THOSE ESTABLISHED FOR B.C. PLACE AND REPRESENT MAXIMUM CONCENTRATIONS FOR RESIDENTIAL, PARKLAND AND INDUSTRIAL USE RESPECTIVELY.

	A	B	C	BLACKSMITH SHOP MS-6		MILL POND MS-7		
Arsenic	5	30	50	116	C+	6.65	A+	ppm
Barium	200	500	2000	312	A+	71.5		ppm
Cadmium	1.0	5	20	19.0	B+	<0.25		ppm
Chromium	20	250	500	79.4	A+	85.6	A+	ppm
Cobalt	15	50	300	19.2	A+	27.6	A+	ppm
Copper	30	100	500	846	C+	80.0	A+	ppm
Lead	50	500	1000	8030	C+	<1.5		ppm
Mercury	0.1	2	10	0.19	A+	0.11	A+	ppm
Molybdenum	4	10	40	<4		<4		ppm
Nickel	20	100	500	109	B+	50.4	A+	ppm
Selenium	2	3	10	<0.5		<0.5		ppm
Silver	2	20	40	<1.5		<1.5		ppm
Tin	5	50	300	2730	C+	4.1		ppm
Zinc	80	500	1500	16000	C+	86.3	A+	ppm
Aluminum				13500		25500		ppm
Antimony				248		<8		ppm
Beryllium				<1.5		<1.5		ppm
Boron				88.9		23.9		ppm
Calcium				47600		6450		ppm
Iron				135000		58600		ppm
Magnesium				6700		14500		ppm
Manganese				2520		1270		ppm
Phosphorous (as phosphate)				6100		1180		ppm
Potassium				4650		293		ppm
Sodium				695		109		ppm
Strontium				287		107		ppm
Titanium				412		538		ppm
Vanadium				35.4		117		ppm

A. C. Garby

A.C. Garby
ACG/jdh

APPENDIX F.

3.2.5 A Management Plan for the McLean Mill National Historic Site, Port Alberni, British Columbia. 1993. Commonwealth Historic Resource Management Limited

A MANAGEMENT PLAN FOR THE

McLEAN MILL NATIONAL HISTORIC SITE

PORT ALBERNI, BRITISH COLUMBIA

COMMONWEALTH HISTORIC RESOURCE MANAGEMENT LIMITED

IN ASSOCIATION WITH

BAWLF KEAY ASSOCIATES, ARCHITECTS LTD.

THE ARA CONSULTING GROUP INC.

QUOIN PROJECT AND COST MANAGEMENT LTD.

LORD CULTURAL RESOURCES PLANNING AND MANAGEMENT INC.

MILLENNIA RESEARCH

TERA PLANNING LTD.

HISTORICA RESEARCH LIMITED

NOVEMBER 1993

COMMONWEALTH HISTORIC RESOURCE MANAGEMENT LIMITED

220 - 1333 Johnston Street
Vancouver, B.C.
V6H 3R9
Tel: (604) 688-7995
Fax: (604) 688-7991

53 Herriott Street
Perth, Ontario
K7H 1T5
Tel: (613) 267-7040
Fax: (613) 267-1635

D390

EXECUTIVE SUMMARY

Background and Planning Framework

The McLean Mill National Historic Site, located on 32 acres (13 hectares) near Port Alberni, British Columbia, contains more than 35 extant structures, including a steam-powered sawmill. The site operated between 1926 and 1965, and has been donated to the City of Port Alberni by MacMillan Bloedel Limited. The mill and artifacts were donated by the McLean family. It is intended that the site be developed under a three-party agreement among the City of Port Alberni, the British Columbia Heritage Trust, and Parks Canada.

The McLean Mill has been commemorated as a National Historic Site for its close association with the history of the British Columbia Forest Industry. The collective value of the cultural landscape and the individual site resources are both significant. Parks Canada has identified four principal themes (logging, sawmilling, labour / people, and transportation / marketing); and four related themes (technology, camp life, agriculture, and forest). A series of management objectives have been developed by the three partner agencies and the consultants; and a number of policies, including Parks Canada's Cultural Resource Management Policy, will guide development.

Development Concept

The development concept was selected by the partner agencies after having considered three alternatives prepared by the consultants. The three had been analyzed for their impact on the conservation of historic resources; the opportunities they would provide for presentation and operation; and projected capital costs, visitor forecasts, and operating budgets.

The McLean Mill will be developed as a high-quality heritage tourism attraction that will draw visitors and serve as a community amenity. The site's resources will be preserved through careful management and presented to the public by means of a variety of exhibits, activities, and programs. The site will be presented as a working sawmill community, with a moderate degree of animation (including the operation of historical equipment) and a high level of preservation. The presentation will draw on all periods of the McLean operation, and all of the identified themes will be interpreted on the site and in a new Visitor Reception Centre.

Visitors will go first to the Visitor Reception Centre, where they encounter a multi-media presentation, exhibits, and services. The site tour passes through the logging zone, the milling zone, and the camp zone, which offer a variety of active demonstrations (many using historical machinery), hands-on activities, and static interpretive displays in the open air and within some structures. Costumed interpreters, operators, and uniformed guides will aid in the presentation, their and the activities' numbers depending on the time of year. Opportunities are provided to explore the site beyond the three core zones, including the site of the Japanese-Canadian community near Kitsuksis Creek and paths through the surrounding forest.

Preservation of Resources

The site contains several categories of resources: buildings and structures, archaeological resources, large artifacts, small artifacts, landscape resources, and natural resources. For each category, the Management Plan describes the present situation, states the relevant levels of intervention, and makes recommendations for the appropriate management actions. The following are some of the salient recommendations:

- The program of stabilizing *in-situ* resources should continue.
- A long-term plan for preservation, maintenance, and protection of buildings and structures should be prepared and implemented.
- A structural analysis should be made of all buildings and structures that will be subjected to active use by people and/or operating machinery.
- Work crews should continue to recover and record any archaeological remains found on the site.
- Additional archaeological survey work should be undertaken on the site, particularly in the vicinity of the former Japanese-Canadian community and the mill pond.
- All vehicles, railway equipment, and moveable large machinery should be managed and cared for in a manner that produces the most effective and efficient protection.

- A decision should be made with respect to whether or not operable equipment may be used, on an artifact-by-artifact basis, by assessing the importance of preserving the historical technology *vs.* preserving the historical fabric.
- Safety considerations with respect to operating machinery should be addressed.
- A joint management strategy should be developed for the McLean Lumber Co. collection of artifacts and the Alberni Valley Museum's Forest Industrial Collection.
- The surrounding forest and the configuration of the forest edge should be retained as a key element in the site's landscape character.
- The mill pond, dam, fish ladder, and bridge should all be replaced, in consultation with the Water Management Branch of the Ministry of Environment, Lands and Parks.
- Refilling the mill pond should be done with the intent of enhancing its habitat potential.
- Any excavation within the mill pond or along Kitsuksis Creek should be subject to a hydrological / fisheries study.
- Initiate the Environmental Assessment and Review Process (EARP) to determine the acceptability of the environmental impacts of site development.

A schedule of interventions for all buildings and structures have been provided.

Visitor Services and Use of Resources

A fully developed communications strategy will determine the manner in which the site's themes and resources are presented to the public, both on and off the site. It will determine what the site will interpret and which markets will be reached, and should be developed in tandem with the preservation strategy. It is intended that the personal interpretation program be extensive, and that there also be a parallel program of non-personal interpretation. The presentation of themes and marketing initiatives should be linked to other visitor and educational opportunities in the region, including other visitor attractions in the Port Alberni Heritage Network and the school curricula.

A preliminary schedule of recommended uses for the principal buildings and structures has been provided.

Site development will include the construction of a Visitor Reception Centre (about 5,000 square feet) and a facility for collections maintenance and storage (about 7,500 square feet). Other facilities will include a parking lot, ticket booth, washrooms, and food services. As well, the site will require water supply, waste water disposal, electrical power, and steam power. Visitors with disabilities should be given the opportunity for liberal access to the site and its interpretive services.

Based on visitor projections, the site should be designed for a capacity of 400 people on the site at one time. Planning and programming will ensure that the visitor load is distributed evenly across the site. If deterioration occurs to site resources, or if visitation rises above projections, either the site design will have to be altered to increase capacity or else visitation will have to be discouraged.

Markets and Marketing Strategies

The McLean Mill site will appeal to all visitor segments. Based on an analysis of current markets and comparable attractions, and assigning capture rates to each segment, it is estimated that 116,000 people will visit the site in the first year of full operation, and that attendance will climb steadily thereafter, to 143,000 in Year 10. An active program of marketing and promotion are essential and should be maintained, as should a high level of community and regional support.

Economic diversification forms a key municipal objective for the development. Consideration should be given to doing an economic impact study of the development, to quantify the benefits of the project to the region.

Local and Regional Integration

Planning for development requires co-ordination among the three partner agencies (the City of Port Alberni, the British Columbia Heritage Trust, and Parks Canada) and the Regional District of Alberni-Clayoquot. Land use falls within the jurisdiction of the Regional District, which is also responsible for the road network around the site. Planning for roads should consider the proposed 'Three Valleys Highway', which will link the Alberni Valley with the Comox and Cowichan Valleys.

Access will be by road, by rail, and by trail. It is suggested that the route to the site be along Beaver Creek and Smith Roads, and that the return to Port Alberni should be along either Kitsuksis Road or Cowley and Cherry Creek Roads. Rail access, along the E&N tracks, does not form part of the McLean Mill development, but McLean Mill management should encourage the achievement of this objective. The site will also be linked to the Log Train Trail and other trails along the Beaufort Range.

The McLean Mill will be one of many heritage attractions in the Port Alberni Heritage Network. The City should co-ordinate (or manage) joint promotion of these attractions. It should also continue to encourage the interest and support of the community and volunteers.

Administration, Capital Costs, and Operation

It is proposed that the McLean Mill be administered by an autonomous not-for-profit society, operating at arm's length from he City of Port Alberni. It would seek to achieve status as a registered charity with Revenue Canada. Five staff departments will be required, and a preliminary staffing plan recommends about 15 positions at a total annual budget of about $500,000 for salaries and benefits.

It is estimated that the capital cost of development will be approximately $7.4 million (in 1993 dollars), inclusive of planning, design, and project management, but exclusive of GST and off-site railway work.

Cash flow projections have been prepared, taking into consideration both capital and operating cash flow. It is estimated that, in addition to revenues earned on the site, the operation will require core funding commitments of $250,000 per year. If the core funding is maintained at this level, the site will operate with a positive cash flow that would be available for ongoing capital improvements. The cash flow projections allow three years for planning, design, and construction. The construction schedule may be extended, with the main impact being the delay in the flow of revenues.

TABLE OF CONTENTS

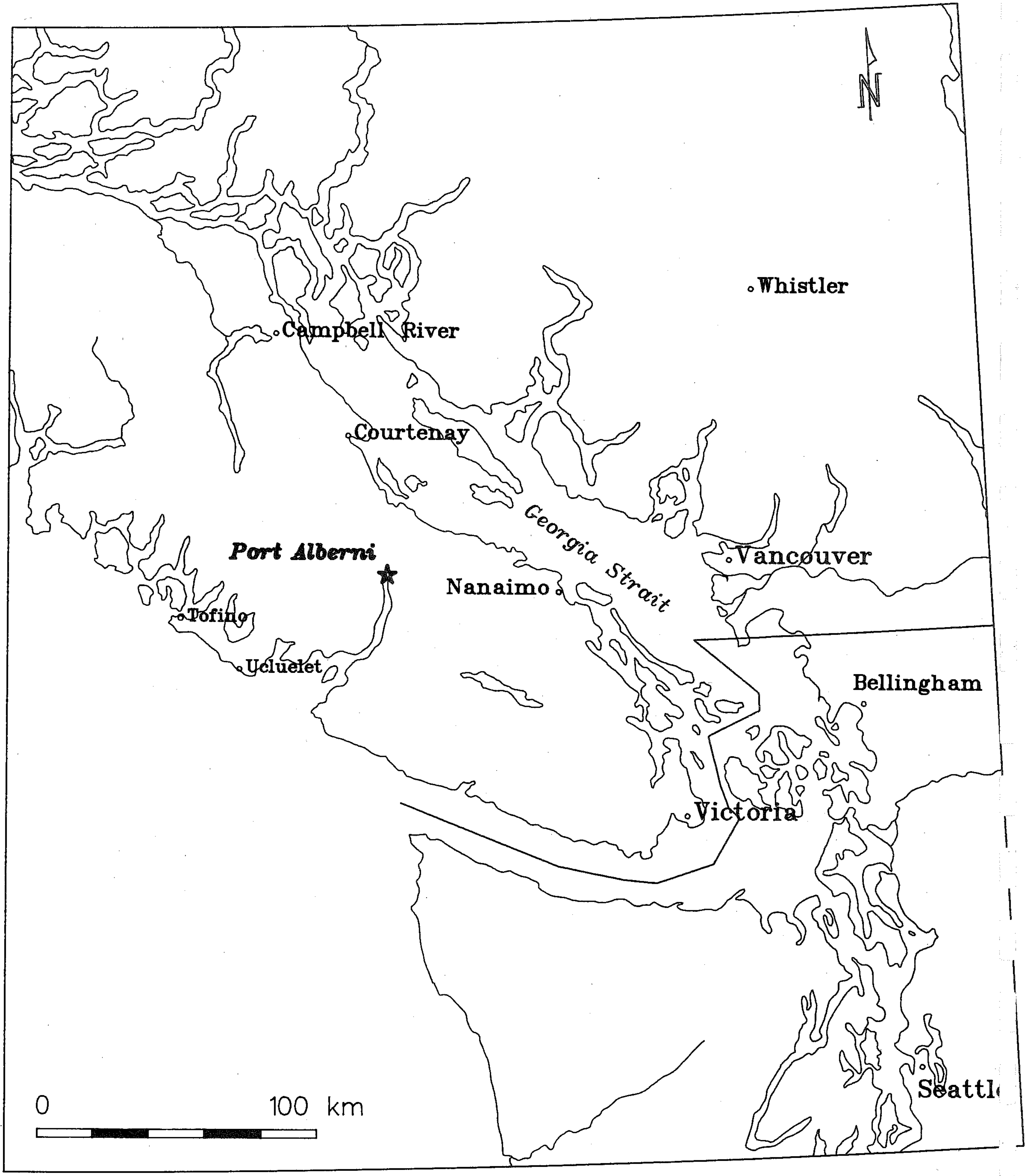
1. INTRODUCTION

1.1 Background

The McLean Mill National Historic Site is a former sawmill camp complex, operated by the R.B. McLean Lumber Co., located on 32 acres (13 hectares) of land, about 6 miles (10 km) from downtown Port Alberni, British Columbia. The site contains more than 35 extant buildings and structures, including a steam-driven sawmill, residential buildings that accommodated the owners, employees, and their families, structures used for servicing equipment, and a drained mill pond. Logging operations occurred near the mill, on the adjacent Beaufort Range. The lumber company was a family-run business whose working history began in 1926 and ended in 1965. The site was donated to the City of Port Alberni by MacMillan Bloedel Limited, and the mill and artifacts were donated by the McLean family.

The Historic Sites and Monuments Board of Canada has recognized the historical significance of the site with respect to both logging and sawmilling on the West Coast. The Minister of the Environment approved the recommendation of the Board in August 1989 and declared it a national historic site. It is intended that the site be developed as a partnership involving the City of Port Alberni (through its Parks and Recreation Department and the Alberni Valley Museum), the Government of British Columbia (through the British Columbia Heritage Trust), and Department of the Secretary of State (through the Parks Canada). The development will come about as a three-party agreement, the details of which are not yet fully defined.

A number of important studies of the site been made over the last five years by the three partners. These address its history, the structures, the archaeological remains, the mechanical equipment, and proposals for development of the site as part of a larger heritage interpretive system in the Alberni Valley. These studies are listed in Appendix A. In addition to this written material, considerable construction work has been undertaken on the site to stabilize the physical resources. The site is currently open to visitors in its pre-development condition during weekdays, with guided tours available two afternoons weekly. The City of Port Alberni has retained a full-time Site Manager since 1991.



Port Alberni in the context of southwestern British Columbia.

1.2 The Planning Process

In November 1991 the City of Port Alberni commissioned Commonwealth Historic Resource Management Limited to undertake a Management Plan for the McLean Mill National Historic Site. (At that time the site was being called the R.B. McLean Lumber Co. National Historic Site.) The planning process began with a planning session in Port Alberni on 21-23 January 1992, attended by ten members of the consulting team and eight members of the three development partners. Subsequent investigation, interviews, analysis, and plan proposals have led to Commonwealth's producing three previous reports:

- *A Management Plan for the R.B. McLean Lumber Co. National Historic Site: Discussion Paper*, March 1992
- *A Management Plan for the R.B. McLean Lumber Co. National Historic Site: Interim Report*, July 1992
- 'A Management Plan for the R.B. McLean Lumber Co. National Historic Site: Options Analysis,' January 1993

These reports are referred to repeatedly in the present *Management Plan*, and the material in them includes relevant background information. Their tables of contents are reproduced in Appendix B, and the Options Analysis is reproduced as Appendix C. The four reports together comprise the products of the work by Commonwealth Historic Resource Management Limited and its study team.

The *Discussion Paper* described the process of investigation to date, then provided a management approach for each of the resource types. Those management approaches form the framework for many of the discussions and recommendations in this plan.

The *Interim Report* presented three alternative management options for site development, providing capital cost and visitor projections for each. The three options were presented in a stakeholders' meeting and at public open houses held on 14-15 October 1992, at the McLean Mill site and the Alberni Valley Museum. Participants were introduced to the plan concepts and asked to respond to questionnaires, the results of which are tabulated in Appendix D. Public opinion

Planning session held January 1992 (top) and public open house at Alberni Valley Museum, October 1992 (bottom).

was also solicited in a large number of interviews held between February and May 1992. The opinions expressed in the interviews and the public open houses have been considered in the selection of the option, and throughout the *Management Plan*.

The 'Options Analysis' summarized the relative advantages and disadvantages of each option with respect to preservation and presentation. It provided an analysis of the impact that each option would have on the conservation of the historic resources, and also the opportunities that each would provide for presentation and operation. It helped the three partner agencies in their selection of a management option. In January 1993 the Client Group announced its selection of an option and instructed the Study Team to begin preparation of the *Management Plan*. Drafts were circulated in April and May 1993. The final *Management Plan* reflects the Client Group's comments to the two drafts.

View of the sawmill, January 1992. The remains of the green chain are in the foreground.

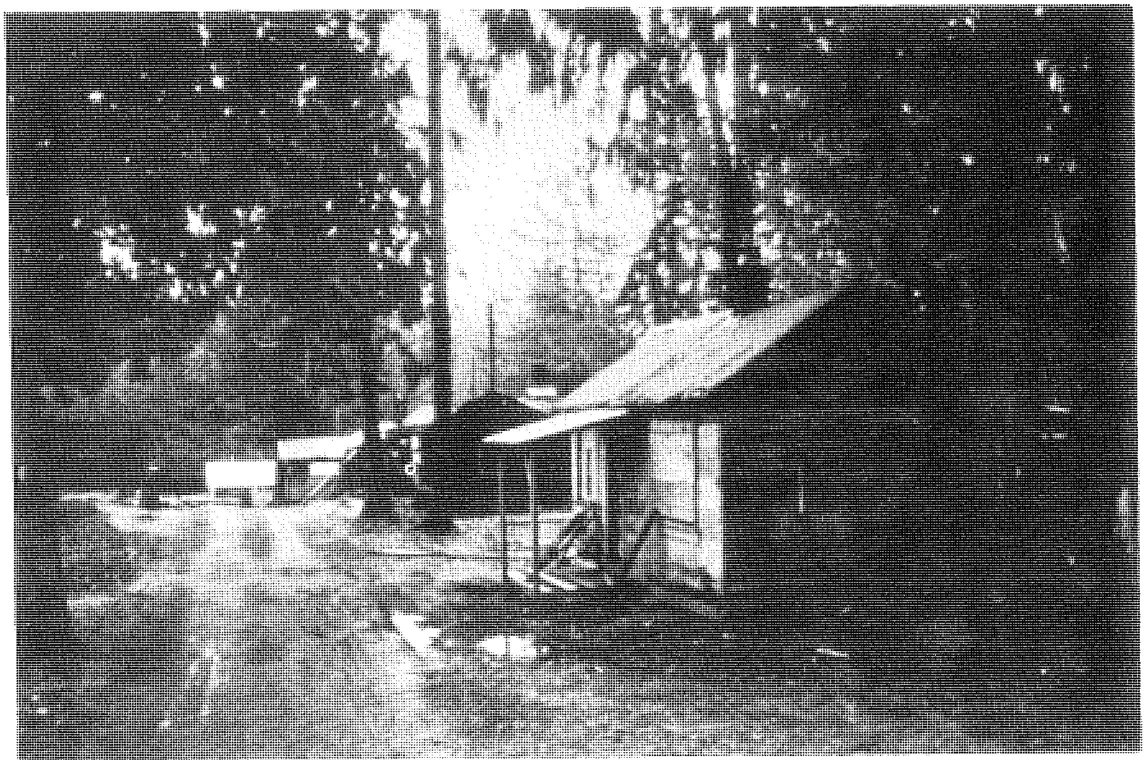
The purpose of a *Management Plan* is defined in the document 'Management Planning Process for National Historic Sites', prepared by Parks Canada in April 1991:

> A Management Plan articulates long range direction for the protection and use of resources of the Site in accordance with the selected and approved Concept. A Management Plan provides the framework within which subsequent implementation and detailed planning will take place.

The Terms of Reference for this plan stressed that 'the management plan will be comprehensive in coverage, but conceptual in content.' Commonwealth's proposal echoed this, stating that the *Management Plan* would be 'first and foremost a conceptual document, providing a framework within which detailed planning and implementation will occur.' This *Management Plan* will be followed by a *Business Development Plan*, which, in the words of the Terms of Reference, will 'refine and detail the specific schedules for development, design requirements for interpretation, visitor facilities, and the operational procedures.'

Many members of the Alberni Valley community have been consulted during the process of this study. They are listed in Appendix F.

This report has been prepared by an interdisciplinary team comprised of eight professional firms, under the direction of Commonwealth. The many members of the Study Team and the Client Group are identified in Appendix G.



2. PLANNING FRAMEWORK

The Management Plan has been guided by a number of statements of themes and objectives, as well as by a series of policy plans adopted by national, provincial, regional, and local authorities. The following is a brief summary of the major sources of direction and information that were considered in preparing this plan.

2.1 Significance of the Site

Commemoration

The national historic significance of the lumber industry in Canada was first recognized in 1943, when the Historic Sites and Monuments Board of Canada (HSMBC) recommended the erection of three regional plaques. The British Columbia plaque emphasized the special lumbering technique arising out of the physical features and the luxuriant growth of timber in the province. The plaque was erected in Port Alberni in 1950, and is at Alberni Harbour Quay.

In June 1976 the HSMBC recommended that the British Columbia forest industry is of such national significance as to merit commemoration beyond the level of a plaque.

In June 1989 the HSMBC recommended that:

> The McLean Mill site, at Port Alberni, British Columbia, with its collection of extant resources relating to logging, sawmilling, transportation and labour in the British Columbia Forest Industry and with its close association with the significant aspects of that Industry, should be declared to be of national significance.

Further, the Board recommended that:

> Without delay, the Program contact the Province of British Columbia, MacMillan Bloedel, the City of Port Alberni and the Alberni Valley Museum in order to determine their interest in co-operating with it in the immediate stabilization of the surviving *in situ* resources at the McLean Mill site and in the future restoration,

> presentation and interpretation of those resources as a major commemoration of the national significance of the British Columbia Forest Industry.

Acting upon this recommendation from the HSMBC, in August 1989 the Minister of the Environment declared the McLean Mill as a National Historic Site for its association with the forest industry in British Columbia.

Significance

The McLean Mill site provides an instance in which the whole certainly has a greater value than the sum of the parts. The *tout ensemble* comprises a uniquely well preserved cultural landscape whose preciousness has been justifiably recognized by the Board. Although the individual resources — the buildings, the equipment, the archaeological remains, and other components — may technically have been commemorated, most would be considered as quite ordinary if taken out of their context. It is the unique combination of 'ordinary' resources that makes the McLean Mill site so representative of the British Columbia forest industry, and so superb a candidate for commemoration.

The 'Establishment Study' for the site has noted this composite value. One conclusion is that

> all of the McLean site resources are important ... because of ... their association with one another and as a group. ... To this end, all the resources, from the beginning, should be considered equally important for protection.

The *collective value of the cultural landscape* should therefore be taken into account in all management decisions.

From the perspective of the *history of technology*, the McLean Lumber Co. milling and logging operations did not contribute in any particularly significant way to the history of the province. What they do superbly, however, is to provide a unique window for interpreting many components of British Columbia's most important industry. They portray not only different aspects of logging and sawmilling technology, but also the integrated nature of the forest industry. They also reveal the differences between the local, rail, and export trades; changes in technology and organization; and the life and work of the people involved in the sawmill and logging operations.

The McLean Mill site also provides an opportunity to interpret the *importance of the railway to the forest industry* in the Alberni Valley and British Columbia, in both the production and the distribution/marketing processes. The McLean Mill Lumber Co. maintained its own small switching operation, which connected with the Esquimalt & Nanaimo Railway and the wider transportation system of the CPR. The McLean Mill site and the Alberni Valley Museum together have a good selection of equipment with which to represent the different types of technology, to illustrate the themes of logging, lumber-hauling, and labour. There is a strong case, in interpretive terms, for demonstrating how the rail equipment worked. (Associated conservation issues are described below in Section 4.3.)

2.2 Themes

Parks Canada has elaborated on the Board's recommendation, by identifying a number of discrete historical themes for interpretation on the site:

Principal Themes

1. *Logging*. This theme involves the cutting of trees, bucking the tree into logs, yarding the logs, and transporting them to the mill site.

2. *Sawmilling*. This theme involves the cutting of logs into two distinct lumber products. Dressed lumber includes boards and studs for use in house construction and the like. Dimension timber includes railway ties, mine timbers, load bearing beams, or rough timbers intended for re-processing overseas. Related to the actual process of manufacturing lumber are activities of selling and distribution.

3. *Labour/People*. This theme includes working and living conditions in logging, the sawmill, and the camp. Reference can be made to the broader context of labour history in the province, such as the role of government and unions in regulating working conditions. This theme should make

specific reference to the McLean operations, drawing examples about the dangerous conditions in logging and at the mill from the company's own history. The theme also relates to the lives of the many people who lived at the site over the years.

Logs being hauled by 1937 White truck with 1934 Hayes trailer, ca. 1937-41, near the sawmill.

4. *Transportation/Marketing*. This theme relates to the shipping of the product to markets. Lumber manufactured at the McLean site was shipped into town for local markets by truck or by train or delivered by rail to the government wharf for shipment overseas.

Town Related Themes

1. *Technology*. This related theme includes changing methods and equipment used in logging and lumber manufacture. The focal points for this theme would be the logging operation and the sawmill, showing how changing technology affected the structure of these two operations.

2. *Camp Life*. This theme centres on the living conditions and social activities of the people associated with the McLean business. In this theme reference should also be made to the role of women in the camp and of ethnic subdivisions, especially the Japanese who for a time comprised a distinct group within the camp.

3. *Agriculture*. Vegetables were grown in the earliest phase of the camp's history to provide fresh food for the table and to reduce the expenses of the families living there. Later, the McLeans engaged in commercial agriculture, producing potatoes and turnips for market.

4. *Forest*. This theme relates to the growth, harvesting, and regeneration of the surrounding forest. Mention can be made of species, properties of wood, and regenerative cycles.

2.3 Management Objectives

The following objectives will provide direction to site development and programming. They respect the preliminary objectives that were developed by the partners and the consultants at the planning workshop of January 1992 (see *Discussion Paper*, p. 12), and which have been modified as a result of community interviews, the public open house, and discussions by the McLean Mill Steering Committee and staff members of the three partner agencies.

1. To preserve, present, and promote the McLean Mill site as a place of national historic importance and as part of Canada's system of national historic sites, harmonized with the principles and objectives of the participating agencies.

2. Through a tripartite agreement undertake the appropriate research, planning, development, implementation, and operation to maintain and operate the McLean Mill National Historic Site for the purpose of commemorating the British Columbia Forest Industry.

3. To contribute to the economic diversification of the Alberni Valley through the development of new and enlarged tourism markets and by the provision of employment opportunities in the service sectors.

4. To ensure the commemorative integrity of site resources by stabilizing and preserving the historic 'in situ' resources and maintaining the technology associated with early lumbering and manufacturing of the McLean Mill site in keeping with the principles of cultural resource management.

5. To protect the historic resources of national significance, retain the historic qualities of the cultural landscape, and restore the natural environmental features in a manner that is sensitive to the potential impacts on the adjacent land uses and that allows the visiting public the opportunity to understand and appreciate the integrity of the resources.

6. To plan, market, and operate the site in co-operation with other attractions and activities in the Alberni Valley whose themes are related to the broad story of the West Coast forest industry.

7. To present the site history and contemporary issues associated with the lumber industry in a manner that is consistent with the Themes and Sub-Themes, and builds a common understanding of the history and importance of the lumber industry amongst the community and the visitors to the area.

8. To provide opportunities for an enjoyable, educational, and safe on-site experience through the provision of appropriate facilities which respect the integrity of the historic resources.

9. To manage the resources of the site — historic, contemporary, geophysical, and biotic — to the highest standard of environmental responsibility, including the conservation of energy, water, land, and other resources and minimize the synthetic inputs and waste disposal.

10. To involve the community in the development, operation, and management of the site.

11. To manage the site in a cost-effective manner with those who benefit from site operations.

2.4 Relationship to Other Policies and Objectives

Additional direction is provided by policies, plans, and objectives of the three partners who are participating in the development and operation of the McLean Mill site. These statements should guide future planning and development of the site.

Environment Canada

Mission Statement for Parks Canada (formerly Canadian Parks Service)

'Parks Canada will commemorate, protect, and present places which are significant examples of Canada's cultural and natural heritage in ways that encourage public understanding, appreciation, and enjoyment by present and future generations.' (Source: Environment Canada, *The Canadian Parks Service Strategic Plan,* October 1990)

Canada's Green Plan

Canada's *Green Plan for a Healthy Environment* expresses the federal government commitment to work with Canadians to manage our resources prudently and to encourage sensitive environmental decision-making. Under the Green Plan three new initiatives relevant to protecting Canada's historic resources, including the McLean Mill site, have been identified:

- Expanding the protection of artifacts and historic objects
- Developing the nation's archaeological and historic resource conservation capabilities
- Supporting staff training in historical resource protection

Cultural Resource Management Policy

Parks Canada has a new Cultural Resource Management Policy. It is a valuable planning tool that proposes a holistic approach to resource management, one that integrates the protection and presentation of cultural resources. This policy is a necessary complement to policies on national historic sites. The objective of the Policy is 'To manage for public benefit cultural resources administered by the Canadian Parks Service.' Its main principles are principles of value, public benefit, understanding, respect, and integrity.

Environmental Sustainability

Programs of Parks Canada are expected to demonstrate the following values:

- *Environmental Citizenship* is founded on the belief that all people have environmental rights, privileges, and duties.
- *Environmental Stewardship* is that subset of citizenship focused on resources and actions where an individual, community, or agency has direct control.
- *Ecological Integrity* is defined as a state of ecosystem development that is optimized for its geographic location.

British Columbia Heritage Trust

Objectives Statement

The objectives of the British Columbia Heritage Trust are to support, encourage, and facilitate the conservation, preservation, restoration/rehabilitation of heritage properties in the Province.

The British Columbia Heritage Trust has published a series of technical papers that provide principles and guidelines for heritage conservation, restoration, and rehabilitation.

The Technical Papers are:

#9 * *Principles of Heritage Conservation*
#10 * *Restoration Principles and Procedures*
#11 * *Rehabilitation Principles and Guidelines*

The McLean Mill site is not at present designated pursuant to the *Heritage Conservation Act*. Should it be designated in the future, whether by the Province or the City of Port Alberni, it would be subject to the provisions of the Act.

City of Port Alberni

Policy on Heritage Facilities

A current draft report to Council with respect to the management of heritage facilities in Port Alberni states: 'The City should continue, with the financial and technical assistance of federal and provincial government, efforts towards the preservation, restoration and presentation of the McLean Mill National Historic Site, provided that this can be achieved within the financial resources of the City as determined by City Council.

Heritage 1990: Planning for the Future

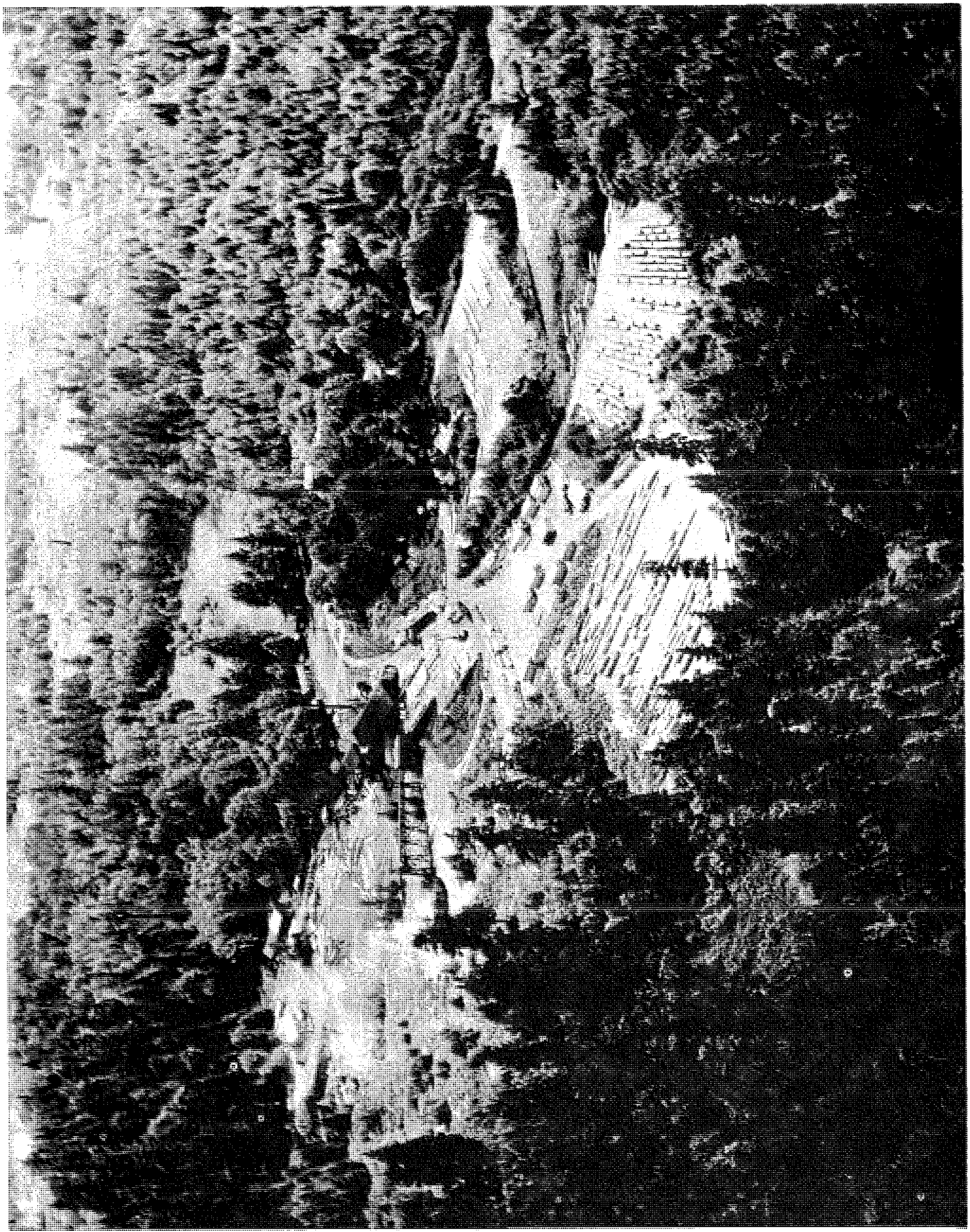
The City of Port Alberni produced a guide to the development of its forest and community heritage, which included participation in the planning and developing the McLean Mill National Historic Site. The report, prepared by former Alberni Valley Museum Director John Mitchell, stressed that the McLean Mill site should be one component of a larger group of attractions, a 'heritage system' that would include waterfront industrial displays and the Echo Centre.

The report proposed two overall reasons for the City to be involved in the McLean Mill site:

- To recognize and celebrate the heritage and social identity of its citizens.
- To encourage economic diversification through development of new tourism markets.

Many people and organizations in the Alberni Valley community have been consulted in preparation of this plan. They are listed in Appendix F.

The Management Plan for the McLean Mill site meets the various policies and objectives of the three partner levels of government.



Aerial view of the McLean Mill site from the west, probably 1937.

3. DEVELOPMENT CONCEPT

3.1 Vision for the Site

The McLean Mill National Historic Site will be developed as a high-quality heritage tourism product that will attract large numbers of visitors to the Alberni Valley while serving as a valued community amenity for residents. The site's priceless cultural and natural resources will receive a high level of protection and preservation through careful management. These resources will be presented to the public by means of enjoyable, educational, and safe exhibits and activities that will interpret themes related to the British Columbia forest industry. These exhibits will range from the passive interpretation of some buildings, archaeological resources, and natural features, to the animated presentation of technical processes by operating historical machinery and equipment. The site will accommodate a flurry of activity, including the words and motion of visitors and interpreters, the sounds and smells of sawing wood, and the noises and movements of steam- and gasoline-powered engines and vehicles.

The development of the McLean Mill site will be the product of a dynamic partnership among the City of Port Alberni (through the establishment of an autonomous society), the Province of British Columbia (through the British Columbia Heritage Trust), and the Government of Canada (through Parks Canada). Additional participation will come from adjacent municipalities, industry, and community support groups. Ongoing management and operation will be the responsibility of a new not-for-profit society formed by the City of Port Alberni.

Port Alberni will bustle with tourists who have come because they have heard exciting reports about the McLean Mill site. As part of their journey, they will also visit other cultural, industrial, and natural attractions in the City and the Alberni Valley. The McLean Mill site will be linked to activities and events around the harbour area by an operating steam railway as well as by roads. The many attractions that make up the Port Alberni Heritage Network will be co-operatively marketed, and will combine to create new job opportunities in the service sector and produce a significant impact on the community's economy.

Visitors will receive their initial orientation at a state-of-the-art Visitor Reception Centre. From there they will tour the core site and its many features. A trail built through the second-growth forest at the periphery of the core site will provide an opportunity to increase awareness of the challenges of integrated resource management and the need to achieve sustainable long-term levels of resource use and to develop environmental conservation strategies. The facilities will be accessible to visitors with disabilities.

Visitors will leave with a real understanding and appreciation of the character, development, impacts, achievements, and issues relating to the British Columbia forest industry, past and present, as well as with the pleasure of having spent all or part of a delightful day on the McLean Mill site.

3.2 Concept Summary

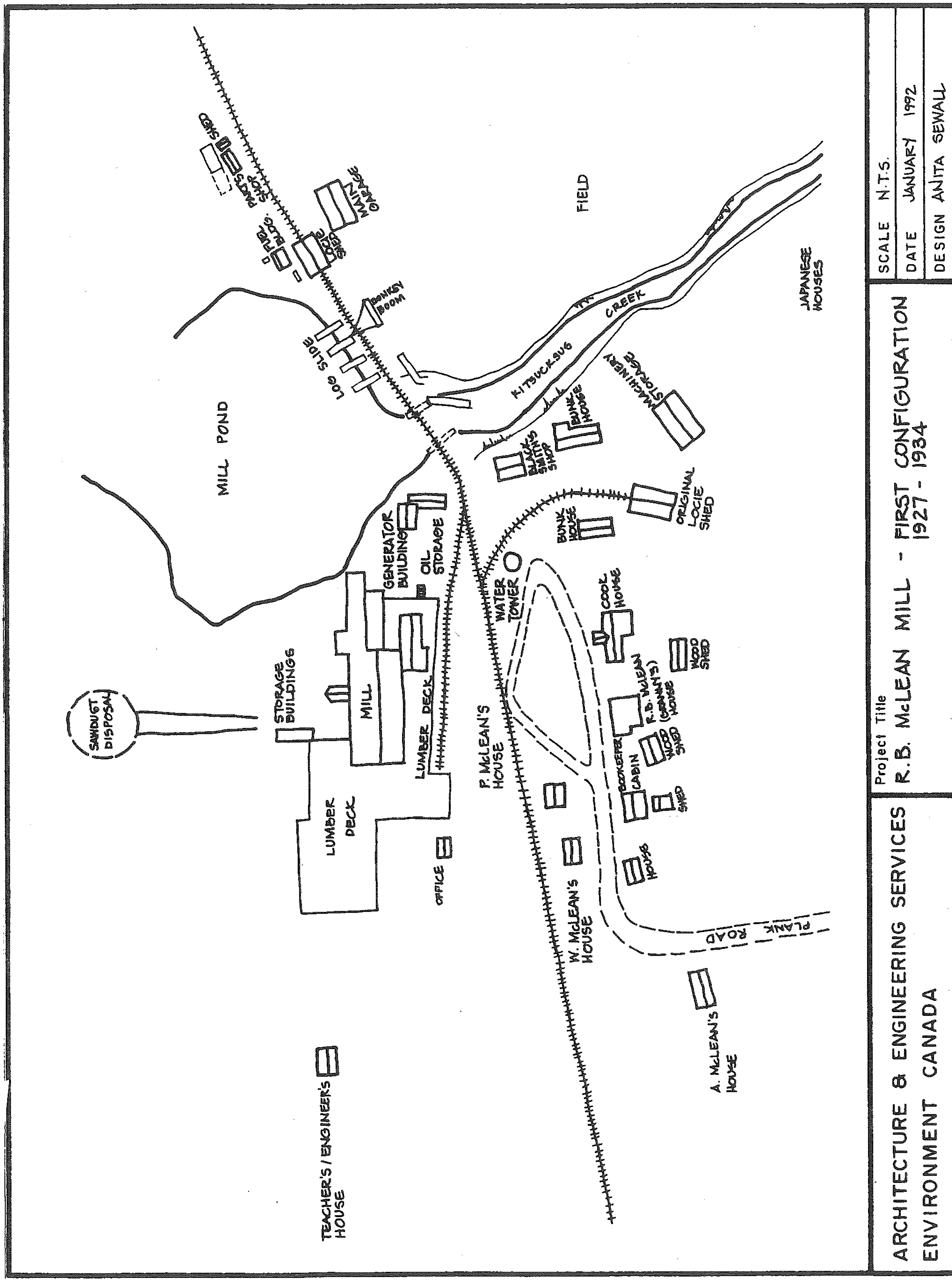
Objectives

The McLean Mill National Historic Site will be presented as a working sawmill community. A moderate degree of animation will occur, consistent with a high level of preservation. Equipment operation will consist primarily of demonstration, although some production will occur as well.

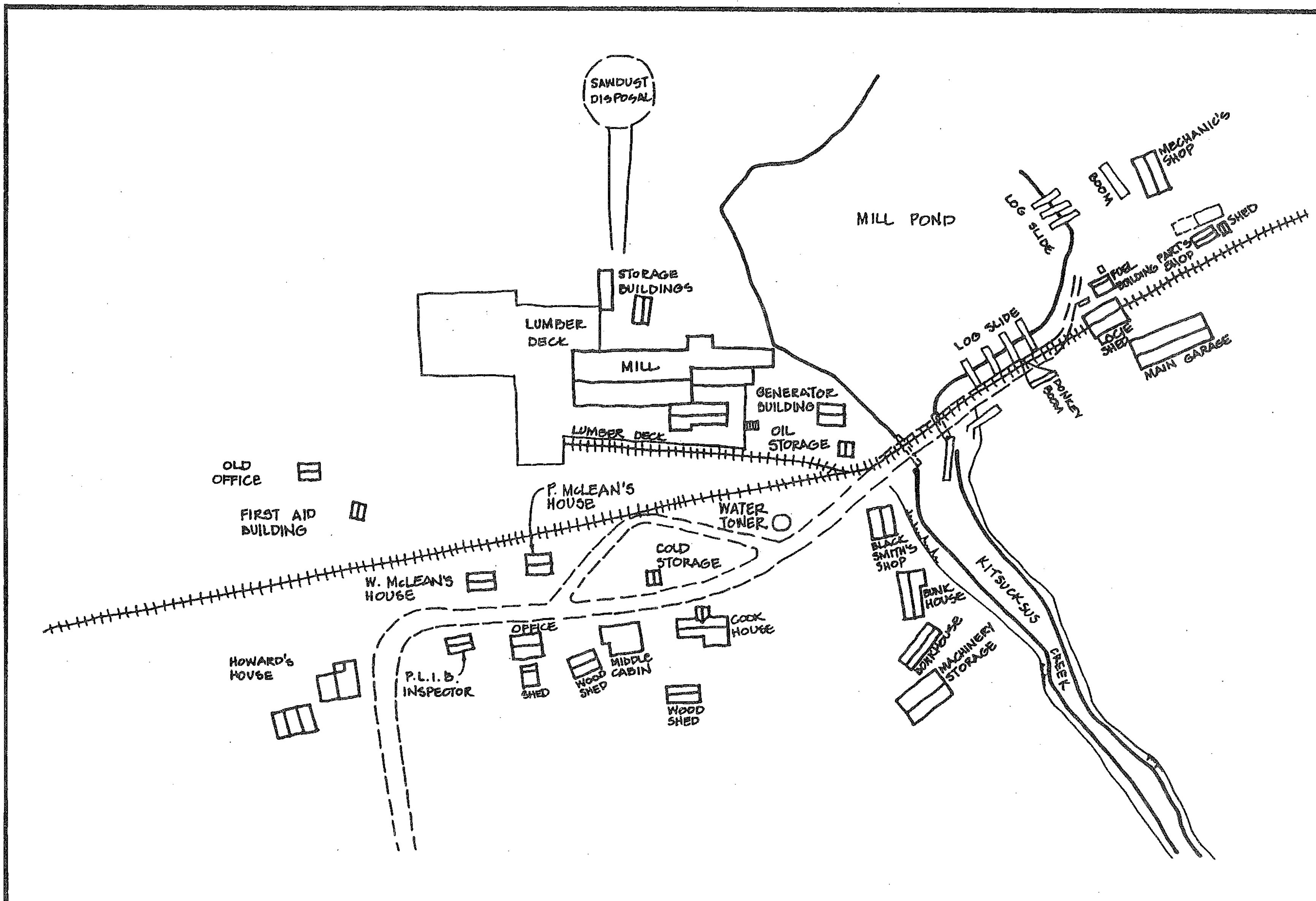
The presentation will draw on all three historical periods of the McLean Lumber Company. These periods, as defined by C.J. Taylor, are:

- 1927-34, during which the small, but typical, sawmill was dependent on rail transport
- 1935-49, a period of recapitalization, the acquisition of gasoline-powered logging trucks, and an emphasis on the manufacture of dimension timber
- 1950-65, marked by the introduction of electrical power to the sawmill, the cessation of rail logging, and a decline in camp life as travel to and from Port Alberni became easier

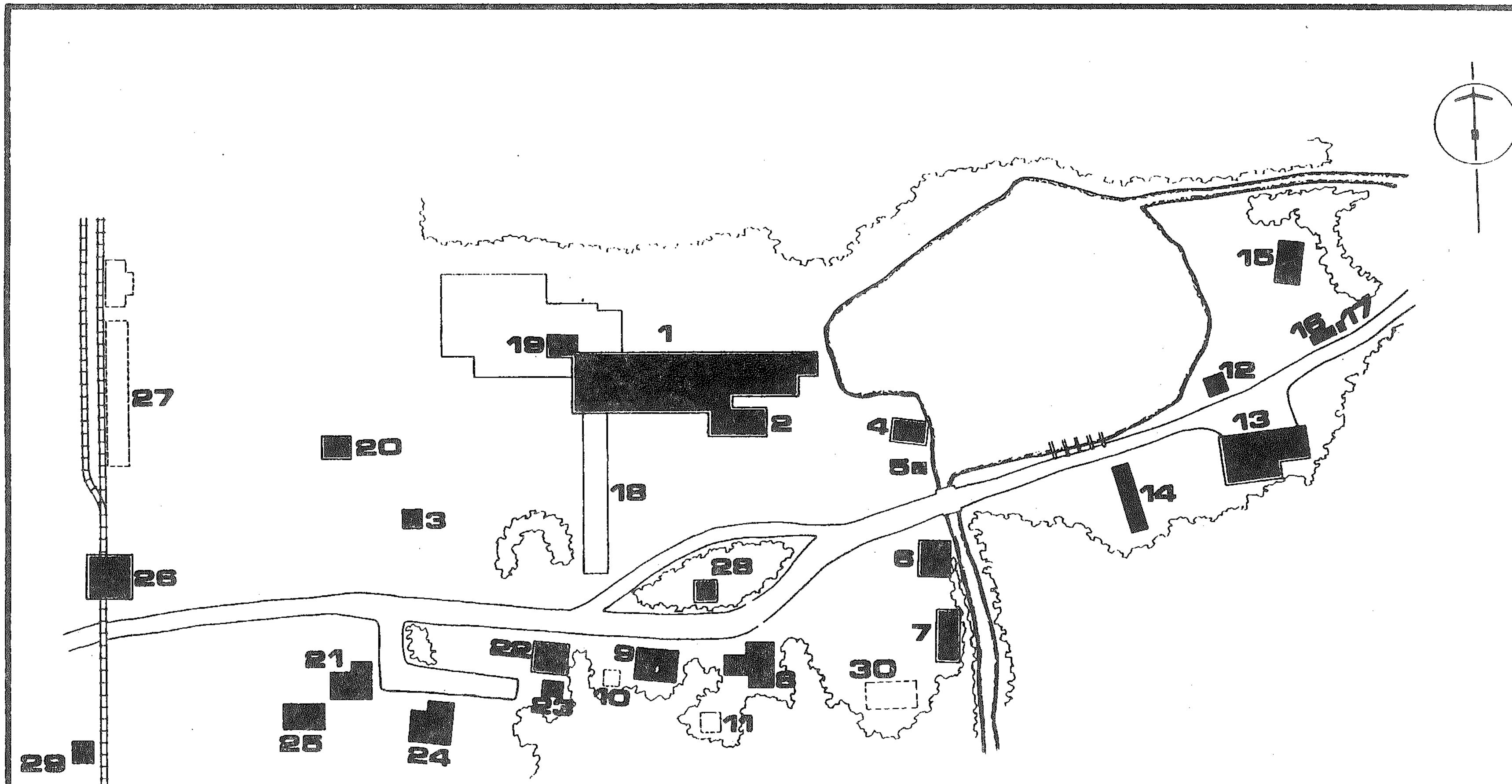
Some anachronisms will occur in the presentation, but they will be introduced in a way that does not confuse the visitor.



ARCHITECTURE & ENGINEERING SERVICES
ENVIRONMENT CANADA
Project Title
R.B. McLEAN MILL - FIRST CONFIGURATION
1927 - 1934
SCALE N.T.S.
DATE JANUARY 1992
DESIGN ANITA SEWALL
MILL POND
FIELD
KITSUCKSUS CREEK
JAPANESE HOUSES
SHED
PARTS SHOP
FUEL BLDG.
MAIN GARAGE
LOCIE SHED
DONKEY BOOM
LOG SLIDE
MACHINERY STORAGE
BUNK HOUSE
BLACKSMITH'S SHOP
ORIGINAL LOCIE SHED
BUNK HOUSE
GENERATOR BUILDING
OIL STORAGE
WATER TOWER
COOK HOUSE
WOOD SHED
R.B. McLEAN (GRANNY'S) HOUSE
WOOD SHED
BOOKKEEPER CABIN
SHED
HOUSE
MILL
LUMBER DECK
STORAGE BUILDINGS
SAWDUST DISPOSAL
LUMBER DECK
OFFICE
P. McLEAN'S HOUSE
W. McLEAN'S HOUSE
PLANK ROAD
A. McLEAN'S HOUSE
TEACHER'S / ENGINEER'S HOUSE



ARCHITECTURE & ENGINEERING SERVICES ENVIRONMENT CANADA	Project Title R. B. McLEAN MILL - SECOND CONFIGURATION 1935 - 1948	SCALE N.T.S. DATE JANUARY 1992 DESIGN ANITA SEWALL



1. MILL
2. POWER HOUSE
3. 'FIRST AID' BUILDING
4. BEARING SHOP
5. FUEL STORAGE
6. BLACKSMITH SHOP
7. BUNKHOUSE
8. COOKHOUSE
9. 'MIDDLE' CABIN, WORKER'S HOUSING
10. WOOD SHED
11. WOOD SHED
12. GAS AND OIL BUILDING
13. MAIN GARAGE
14. DONKEY BOOM
15. TOOL SHED
16. SMALL PARTS SHED
17. SMALL PARTS SHED
18. GREEN CHAIN
19. PLANER MILL
20. YARD OFFICE
21. LOCAL OFFICE
22. WORKER'S CABIN
23. SHED
24. MAIN HOUSE
25. LOCAL OFFICE GARAGE
26. LOCOMOTIVE SHED
27. TELEPHONE SHED
28. ICE HOUSE
29. SWITCHER SHED
30. STOREHOUSE

ARCHITECTURE & ENGINEERING SERVICES ENVIRONMENT CANADA	Project Title M^c LEAN MILL SITE PLAN	SCALE N.T.S. DATE JULY, 1990 DESIGN

The principal themes of logging, sawmilling, labour/people, and transportation/marketing (as well as the related themes of technology, camp life, agriculture, and forest) will be interpreted and animated in the Visitor Reception Centre and in specific locations throughout the site. Exhibits in the VRC (and at associated sites in Port Alberni) will provide the larger picture of the evolution of the forest industry in British Columbia, while those in and around the historic mill and community buildings will present the themes primarily as they can be illustrated by the activities of the McLean Lumber Company.

The site will be developed and animated to a sufficient extent and quality that it becomes a major destination attraction for visitors to the region.

Plan Options

The Plan Concept was arrived at after having developed three alternative concepts, which were presented in the *Interim Report*. Each concept was analyzed for the impact that it would have on the conservation of historic resources, and also for the opportunities that it would provide for presentation and operation. The relative advantages and disadvantages of each option were explained in the 'Options Analysis'. They are summarized here: briefly for Options 1 and 2, and in more detail for Option 3, which was closest to the selected Plan Concept. The full 'Options Analysis' is reproduced as Appendix C.

Option 1: 'Preserved Sawmill Community'

This option called for a relatively passive interpretation of the resources and limited programming, emphasizing preservation. With respect to resource protection, over the *short term,* this option would provide the highest level of protection for the physical resource, since all buildings and structures remaining standing would be stabilized and relatively few would be in active use. Over the *long term,* however, the main threat to the physical resource is from natural causes: deterioration to the wood materials caused by the moist, temperate climate. This would require an ongoing program of maintenance and stabilization, which would surely ultimately involve the replacement of most, if not all, wood structural and non-structural members. The long-term rate of deterioration might be highest with Option 1, since most structures would not be used, heated, or maintained on a day-to-day basis. Although the historic *fabric* would change in the long term, the historic *design* would not, since this option would entail the least amount of intervention to design features for the purpose of accommodating interpretation and circulation needs.

This option would provide the highest level of protection for landscape resources. *In situ* archaeological resources would benefit from fewer people, but might suffer from relative lack of supervision. Machinery and large artifacts, like buildings and structures, would be well protected over the short term, but might deteriorate more over the long term from disuse and lack of maintenance. The option would provide the least opportunity for preservation of historical technologies.

With respect to presentation strategy, Option 1 provided a good opportunity to present the commemorative intent, but its effectiveness would be limited, because of the relatively little opportunity for visitor interaction or for sensory experiences. The operational aspects would be the least complex of the three options.

This option had the lowest capital cost ($4.4 million), the lowest visitor forecast (38,900 in the first full year of operation), and little potential to become financially self-sustaining.

Option 2: 'Evolution of the Lumber Industry'

This provided for the demonstration of machinery with a relatively low level of intervention to the structures. Over the *short term,* this option would provide a reasonably high level of protection for the physical resource; less than Option 1, but more than Option 3. The interventions would be similar to those for Option 1, although a few structures would be restored and operated and a few missing structures would be reconstructed. Over the *long term,* deterioration would require the same ongoing program of maintenance as for the other options, and the structures' limited use might encourage deterioration.

Option 2 would provide somewhat less protection for landscape and archaeological resources than Option 1. With respect to machinery and large artifacts, it would provide the best balance between protection from wear and tear and day-to-day maintenance. Historical technologies would be preserved, since historical machinery would be operated.

With respect to presentation strategy, this option provided the best opportunity to present all of the commemorative themes, since it would interpret the historical evolution of the industry. It would also provide excellent opportunities for variation in interpretive products. Operation would be more complex than Option 1, because of the requirement to conform to health and safety regulations for operating machinery.

The capital costs were estimated to be $5.8 million and the visitor forecast was 62,700. This option had the least potential to become financially self-sustaining.

Option 3: Operating Sawmill and Community

With respect to resource protection, over the *short term* this option would provide a very good level of protection for buildings and structures, although less so than either of Options 1 or 2. In many cases the level of intervention would be highest. Most extant structures would be restored or rehabilitated, rather than stabilized; and some would be reconstructed (as in Option 2). The mill would be operated more intensively than in Option 2, possibly requiring additional structural reinforcement.

Over the *long term*, deterioration would require the same ongoing program of maintenance (and replacement of fabric) as for the other options. Long-term deterioration would, in fact, be less than in Option 1, because more buildings would be used and therefore would be heated and would benefit from housekeeping and maintenance on a day-to-day basis.

This option would provide somewhat less protection for landscape resources than Options 1 or 2, since it would have a higher visitation level. Furthermore, it would be necessary to provide broader and more durable circulation routes than in the other options. The higher visitation level would also yield somewhat less protection for *in situ* archaeological resources. The use of the field by many picnickers might threaten the remains of the Japanese Village more than in the other options.

Machinery and vehicles would be operated on a regular basis. This would provide the most wear and tear; however it would also lead to day-to-day maintenance. The machinery would therefore remain in a good state of preservation, although with the continual replacement of moving parts. With respect to small artifacts, there would be little, if any, difference among the three options.

This option would provide the best opportunity for the preservation of historical technologies, since historical machinery would be operated and under conditions that approximate those of the working mill.

With respect to presentation strategy, the site and its activities would be presented as they were in the 1950s. This would provide an excellent opportunity to interpret the commemorative themes as they relate to the third (final) period of operation of the McLean Mill. However, the appearance, activities, and technologies associated with the first and second periods of operation would not be presented directly. They would be interpreted passively, both on site and at the VRC. As with the other options, the VRC would be available for the interpretation of thematic issues in which the site may be deficient.

This option would provide the best opportunities for animated and interactive communications products, and would offer the best sensory experiences. Historical machinery and vehicles would be operated on a continual basis, and there would be a high-quality program of personal interpretation. However, this option would offer fewer opportunities than the other options for static exhibits, which would therefore likely require that the VRC be used to a greater extent to interpret aspects of site development and operation.

As for operations, this option would be the most complex to administer and operate. The milling, logging, and transportation operations and schedules would have to conform to both the mill's requirements and the site's interpretation and programming requirements, requiring a considerable amount of co-operation between the site superintendent and the mill manager. Furthermore, the health and safety requirements would likely be more stringent than with Option 2, because of the more extensive use of machinery and the larger number of visitors on site.

The capital costs were estimated to be approximately $7.4 million, and visitor forecasts during the first full year would be about 114,600. This option is the only one of the three to have the potential to become financially self-sustaining.

The Selected Plan Concept: Working Sawmill Community

The present Plan Concept (dubbed 'Option 3A') was selected by the Client Group, after consultation with their respective colleagues and constituencies. It resembles

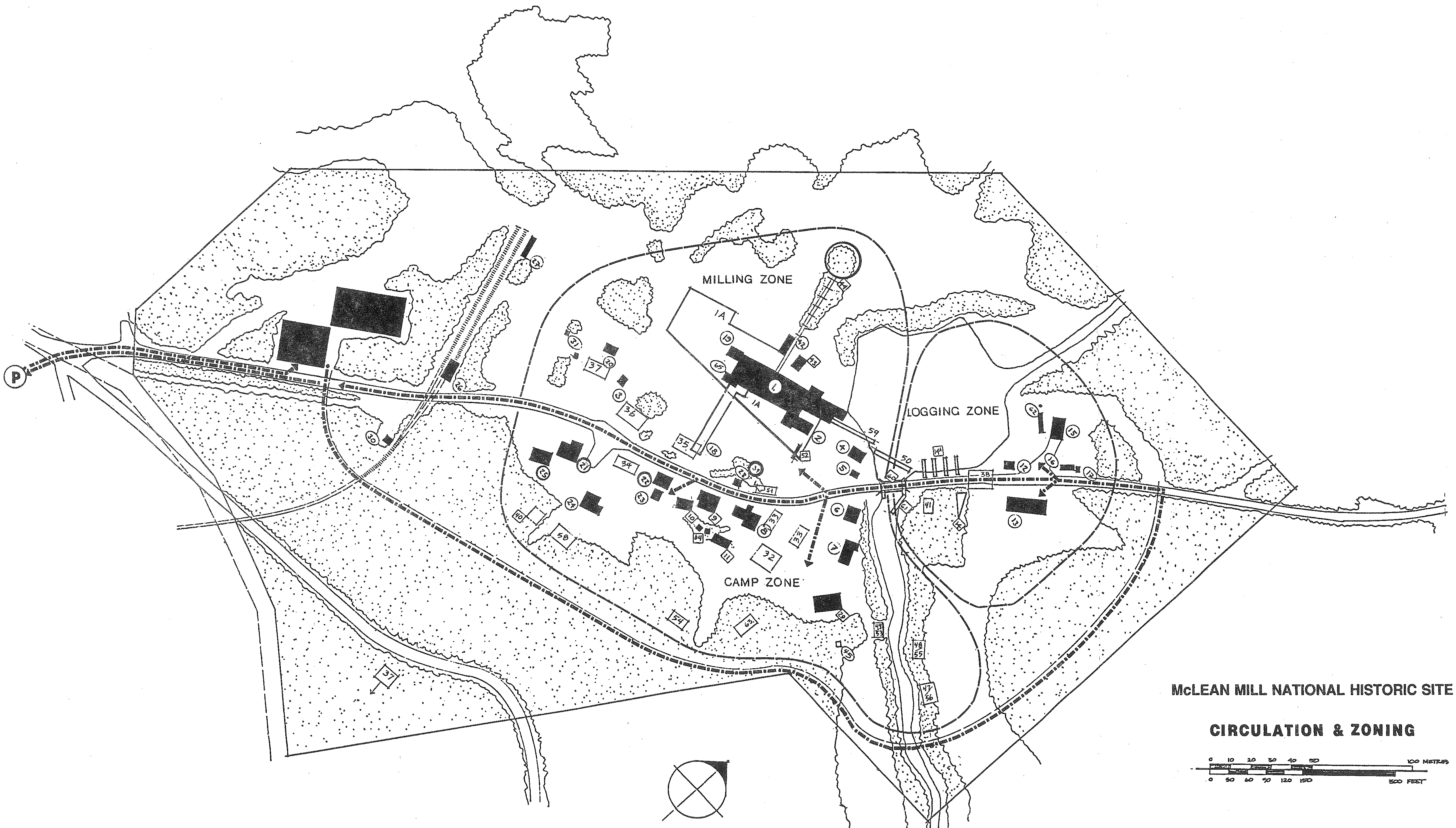
Option 3 in most respects. The changes include some variations in the periods to which some buildings will be restored, the first priority of the operating sawmill being visitor and interpretive needs (and not production needs), and removal of the operating railway from the core site. Following is a detailed description of the Plan Concept:

Visitor Experience

Access and Orientation

The McLean Mill site has a linear configuration on a northeast and southwest orientation (referred to in this report as east and west). The historic logging activity was to the east of the milling, shipping, and residential areas, with access provided by way of a road through the entire site. The current access is from the west, and although it is feasible to develop an eastern access and facilities for visitor arrival (by both rubber-tire vehicles and railway) and the Visitor Reception Centre (VRC), this cannot be accomplished within the present site boundaries. Therefore the VRC is shown on the accompanying site plans as being at the west end of the site.

The ideal approach to presenting the site is to develop the visitor flow from the forest area on the east to the finished-product area on the west. The description of the Visitor Experience that follows is based on the visitor moving through the historic area in this same direction as the forest products were moved during the operation of the lumbering and milling activities. For now it will be necessary for visitors who arrive at the present western entrance to move to the eastern edge by means of a forest trail along the periphery of the site or by on-site vehicular transportation. (The trail is shown in the site plan on the next page as being along the southern edge of the site; however, it could be located equally well along the northern edge.) They will then begin their journey through the interpretation of the McLean Mill site and the presentation of the history, sociology, and technology of the British Columbia forest industry.



McLEAN MILL NATIONAL HISTORIC SITE

CIRCULATION & ZONING

As the site is developed, before visitor attendance increases significantly (and prior to construction of the VRC), the final site for the arrival point (including parking and the VRC) will be reconsidered. Whatever the final configuration, the visitor will have the opportunity to access the core site through a pathway system and also to experience rail transportation. In the event that permanent access may be developed from the east, the peripheral trail and other on-site transportation initially developed to accommodate arrivals from the west will be used to return visitors to the eastern entry point after their site visit.

Description

Visitors arrive at the site either by automobile — in which case they will leave their cars at a parking lot at the edge of the site — by bus, or by steam train along a scenic route from the historic railway station in downtown Port Alberni. Regardless of how they came, visitors have the option of transferring to a steam-powered logging train (powered by the 'Two-Spot' Shay locomotive), where they ride in 'crummies' (work cars) for the final leg of the journey to the McLean Mill site. Alternatively they may walk the short distance from the parking lot to the site along a pathway. (At off-peak times, rail service may not be available, or a gasoline speeder may be used instead of the Two-Spot, to reduce operating costs and wear and tear on the Shay. While the train experience has no relationship to the commemoration of the site, it will be a positive addition to the visitor experience.)

The logging train and the path lead to the Visitor Reception Centre (VRC). An audio-visual presentation, interactive exhibits, and passive displays combine to present forest industry themes in the broad context of British Columbia, preparing visitors for the more site-specific elements within the historic core of the site. A variety of visitor services are also provided.

Upon leaving the VRC (assumed for now to be at the west), visitors travel to the east end of the site. This journey may be made either by walking along a trail through the wooded periphery of the site (which would be interpreted to tell the story of the forest), by rail (perhaps in a crummy or an adapted flat car pulled by a replica of the gasoline-powered Buda locomotive, on the former track alignment), or by rubber-tired vehicle (perhaps an old bus or an adapted logging truck).

The directed portion of the site tour begins in the **logging zone**, where visitors may watch one or more active logging demonstrations, such as felling, high-rigging, yarding, and logging by rail. The donkey engine and spar are located there, as will demonstrations of hand-sawing techniques. There is a further exhibit of logging machinery around the machine shop and garage to the east of the log pond. The garage displays restored logging and lumbering machinery, such as trucks, loaders, and carriers, which operate from time to time.

Visitors have opportunities to take part in hands-on activities that relate to logging. In time, some of these events may occur beyond the present eastern boundary of the site, at the foot of the Beaufort Range, where the McLeans used to obtain their logs, should additional land become available for use. Provision may be made to connect to hiking and walking trails, following old logging roads up the lower reaches of the Beaufort Range.

Beyond the logging area, the dam and fish ladder have been rebuilt, allowing the pond to fill and return to life. The pond is shared by logs and fish, as it was during the operating years of the mill. Trucks dump logs into the mill pond, where they are snatched by the log haul and pulled into the mill for processing.

It is only a short walk to the sawmill and the **milling zone**. (Motorized vehicles are available to transport people with disabilities.) The restored sawmill is fully operational, from log haul to green chain, animated by the chugging of the steam engine, the buzzing of the saws and planers, and the rumbling of the finished lumber as it is sorted into piles. The mill is powered by both steam and electricity, as it was in the 1950s. The lumber deck has been rebuilt, and the green chain still exists. The west end of the mill demonstrates the piling of lumber. The mill operates at frequent intervals during the day, according to the number of visitors and the needs of the interpretative program, and it may also produce lumber for on-site use or for special order. Many opportunities exist for visitors to watch the lumber manufacturing process from the safety of a protected walkway and also to examine the old machinery when the mill is quiet.

Demonstrations or exhibits relating to lumber manufacture and distribution will also occur in the rehabilitated mill office and on the railway loading platform at the E&N siding.

In the **camp zone**, across from the mill, the office, McLean house, bookkeeper's house, cookhouse, bunk house, and blacksmith's shop are restored and refurbished to their original appearance and use. Some are animated with costumed people and activities, while others have passive exhibits. Other extant structures are stabilized. On or near the site of the collapsed machinery shed, a new structure sympathetic to the surroundings may be built to be used as a washroom facility. The water tower may be rebuilt and used for its original functional purpose — for the storage of water. It also provides a striking landmark. Altogether there is sufficient 'critical mass' to recreate the feel of a living logging camp. Visitors enter the restored buildings and learn, by means of static and animated exhibits, about the McLean operation and the people who worked and lived on the site. The themes of labour, people, and camp life are presented here.

Near Kitsuksis Creek, an exhibit provides information on the Japanese-Canadian community that lived here until their internment. The visitor may have an opportunity to watch archaeologists at work, learning more about that area's past.

Visitors explore the site at their own pace. They encounter a variety of interpretive events, depending on the time of year. There are costumed interpreters and operators, one or two uniformed guides, and perhaps a silent ghost who beckons to people to follow him to see passive exhibits. Lumber camp meals may be offered in the cookhouse. Special events and festivals occur regularly, involving many volunteers and community groups.

After strolling through the active zones, the visitor may find peace in the surrounding second-growth forest, through which paths have been made. He/she will also be enchanted by the surrounding peaceful natural environment, and may explore the forest paths, old skid roads, and perhaps a demonstration forest, learning more about the natural (as well as the industrial) component of the forest industry, and about the industry's interface with the natural environment, perhaps being challenged by issues of integrated resource management. The natural history of the pond, the forest, and the wetland are interpreted, explaining themes such as forest regeneration. Interpretive trails are clearly a part of the McLean site experience in that they will contribute to communicating the site themes. Picnic facilities are available on the banks of Kitsuksis Creek.

Archaeology and Research

Archaeological investigation will be carried on in the mill pond before it is filled, and also during and after development in the former Japanese-Canadian residential area and elsewhere on the site. Archaeology will be integrated into the interpretive programming.

Parallel research efforts will continue with respect to aural history in the community, research into the operations of the McLean Lumber Co. specifically and the lumber industry generally, and also in other areas relevant to the site.

The operation and interpretation of the McLean Mill site will be integrated into the Port Alberni Heritage Network, providing a co-ordinated approach to presenting the broader heritage of the forest industry.

4. PRESERVATION OF RESOURCES

A primary management objective for the McLean Mill National Historic Site is to preserve and protect its cultural and natural resources. The quantity, quality, and integrity of the cultural resources are the factors that have led to the Mill's commemoration as a national historic site, and to the subsequent decision to proceed with development. It is therefore essential that these resources be protected on a long-term basis so as not to erode the site's significance. The site programming will use many of the resources in ways that must be compatible with their long-term conservation. The significance of the site features is expressed by the statement of commemoration, which refers to the 'collection of extant resources'.

For each category of resource, the text that follows describes the present situation, states the relevant levels of intervention, and makes recommendations for the appropriate management actions for each resource or group of resources.

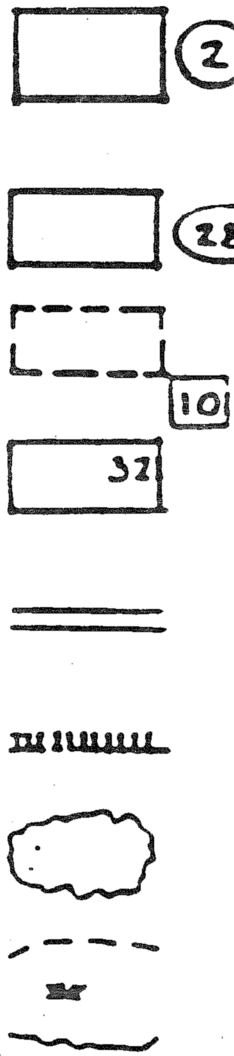
4.1 Buildings and Structures

Description

More than 65 buildings and structures have been identified as currently or formerly being on or near the McLean Mill site. Of these, 22 are standing and have been stabilized since 1991 (completely or in part); 8 are standing and have not yet been stabilized; 9 have collapsed, and most of them protected from further damage; and the remainder) are missing but have been identified through research and/or aural history. The site plan that follows shows the location of the structures; and the chart on the subsequent page lists them and indicates their present condition. Four conditions are noted:

- *Stabilized*. A stabilization initiative has been undertaken since preliminary site development has started.
- *Unstabilized*. No stabilization has been undertaken.
- *Collapsed*. The structure has collapsed and no conservation work has been done.
- *Missing*. The structure is known from research, but there are no above-ground remains.

LEGEND: EXISTING SITE CONDITIONS



BUILDING OR STRUCTURE STANDING AND TEMPORARY STABILIZED

BUILDING OR STRUCTURE STANDING AND UNSTABILIZED

BUILDING OR STRUCTURE COLLAPSED

MISSING BUILDING OR STRUCTURE

ABANDONED RAILWAY ROADBED

RAILWAY ROADBED, PARTIALLY INTACT

TREED AREA OR SECOND GROWTH FOREST

FORMER MILLPOND AND/OR MARSH

BUILDINGS AND STRUCTURES: EXISTING SITE CONDITIONS

	STRUCTURE	STABILIZED	UNSTABILIZED	COLLAPSED	MISSING
1	MILL	■			
1A	MILL DECK				■
2	POWER BOILER	■			
3	FIRST AID SHACK	■			
4	MILLWRIGHT AND GENERATOR BLDG.	■			
5	OIL SHED	■			
6	BLACKSMITH SHOP	■			
7	BUNKHOUSE	■			
8	COOKHOUSE	■			
9	R.B. McLEAN HOUSE			■	
10	WOOD SHED AND STORAGE			■	
11	WOOD SHED			■	
12	GAS AND OIL SHED	■			
13	MAIN GARAGE	■			
14	"A" FRAME			■	
14A	LOG DUMP			■	
15	MACHINE SHOP	■			
16	SMALL PARTS SHED		■		
17	SMALL PARTS SHED		■		
18	GREEN CHAIN		■		
19	PLANER	■			
20	YARD OFFICE	■			
21	ARNOLD McLEAN HOUSE	■			
22	BOOKKEEPER'S HOUSE AND OFFICE	■			
23	WOOD SHED	■			
24	MILLWORKER'S HOUSE	■			
25	ARNOLD McLEAN GARAGE	■			
26	LOCOMOTIVE SHED	■			
27	LOADING DECK AND DIP TANK	■			
28	ROOT HOUSE		■		
29	MACHINERY SHED			■	
30	SAND HOUSE		■		
31	LUMBER GRADER'S SHED		■		
32	ORIGINAL LOCOMOTIVE SHED				■
33	ORIGINAL BUNKHOUSES (2)				■
34	KIRK'S HOUSE				■
35	PHILIP McLEAN HOUSE				■
36	WALTER McLEAN HOUSE				■
37	MATHESON HOUSE				■
38	FORMER LOCOMOTIVE SHED				■
39	WATER TOWER				■
40	BUILDING FLOOR			■	
41	SVEN'S HOUSE				■
42	WOOD BIN	■			
43	SAWDUST BIN			■	
44	SCRAP BURNER			■	
45	OUTHOUSE		■		
46	SHOWER				■
47	JAPANESE HOUSE				■
48	JAPANESE HOUSE				■
49	CHINESE HOUSE				■
50	BOOM SHACK				■
51	PREVIOUS BUNKHOUSE				■
52	TRANSFORMER			■	
53	JAPANESE HOUSE (= 49?)				■
54	SUMI HOUSE				■
55	JAPANESE HOUSE (= 48?)				■
56	JAPANESE HOUSE (= 47?)				■
57	SCHOOL				■
58	TEACHERAGE				■
59	LOG HAUL				■
60	DAM			■	
61	FISH LADDER			■	
62	GIN POLE/DONKEY ENGINE		■		
63	BUNKHOUSE				■
64	OUTHOUSES			■	
65	LUMBER GRADER'S SHED (GREEN CHAIN)		■		

As noted in Section 2.1, the significance of the site lies largely in the relatively intact grouping of *in-situ* resources, and therefore it is important that all of the extant buildings and structures be preserved.

The buildings were erected throughout the period of the mill's operation, between the 1920s and the 1960s. They are utilitarian frame structures, built for the present with little thought to permanence. Most are constructed of conventional wood framing, with posts set on or into grade, or resting on sleepers on grade. Those that are enclosed have a variety of exterior cladding materials, including board and batten, and vertical and horizontal siding of different dimensions and profiles. Roofs are typically wood shingles or corrugated metal. The buildings have been empty since the mid-1960s, and most have suffered from deterioration. Their condition in 1990 is described in the *Interim Protection Plan* prepared by Parks Canada in June 1990. (Full references to this and other reports may be found in Appendix A.)

> The majority of the buildings were constructed of unfinished timber and many did not have even minimal provisions for closure of the buildings during inclement weather. Most of the construction techniques employed did not contribute to the longevity of the structures. Many of the structures were constructed expediently to solve immediate short term problems. ... The majority of buildings and structures are suffering from various degrees of rot and decay caused primarily by moisture. Some structures have collapsed.

A program of interim stabilization was begun in 1991, following in part the recommendations in the *Interim Protection Plan*. Technical and financial support have come from all three partners, after MacMillan Bloedel Limited donated the land. Most of the work has consisted of replacing rotted wood elements in kind, securing cladding, adding bracing where required, and improving drainage. Some of the buildings that have been stabilized will not require any additional intervention over the short term.

Even with improved drainage, the wood will continue to deteriorate in the moist, temperate coastal climate. All of the structures will require an ongoing program of maintenance and stabilization, which will ultimately involve the replacement of most, if not all, wood structural and non-structural members — the replacement components as well as the original ones. Although the historic *fabric* will therefore change over the long term, the historic *design* will not necessarily change. Given the nature of the resources and the climate, a conservation program cannot preserve the original building materials, short of enclosing them within a rainscreen — a solution that is not desirable from a presentation perspective. The Cultural Resource Management Policy emphasizes the need for 'routine and cyclical maintenance ... to mitigate wear and deterioration without altering the performance, integrity, or appearance of a resource' (section 3.4.3).

Since the plan concept stipulates that a number of buildings be used actively, some of them with machinery operating, it will be necessary to ensure that all are structurally adequate for their use, and to reinforce the structures where necessary. (Uses are described in Section 5.1.) This process will achieve the appropriate balance between preservation and presentation. Once again, all new work should be distinguishable from extant resources.

Levels of Intervention

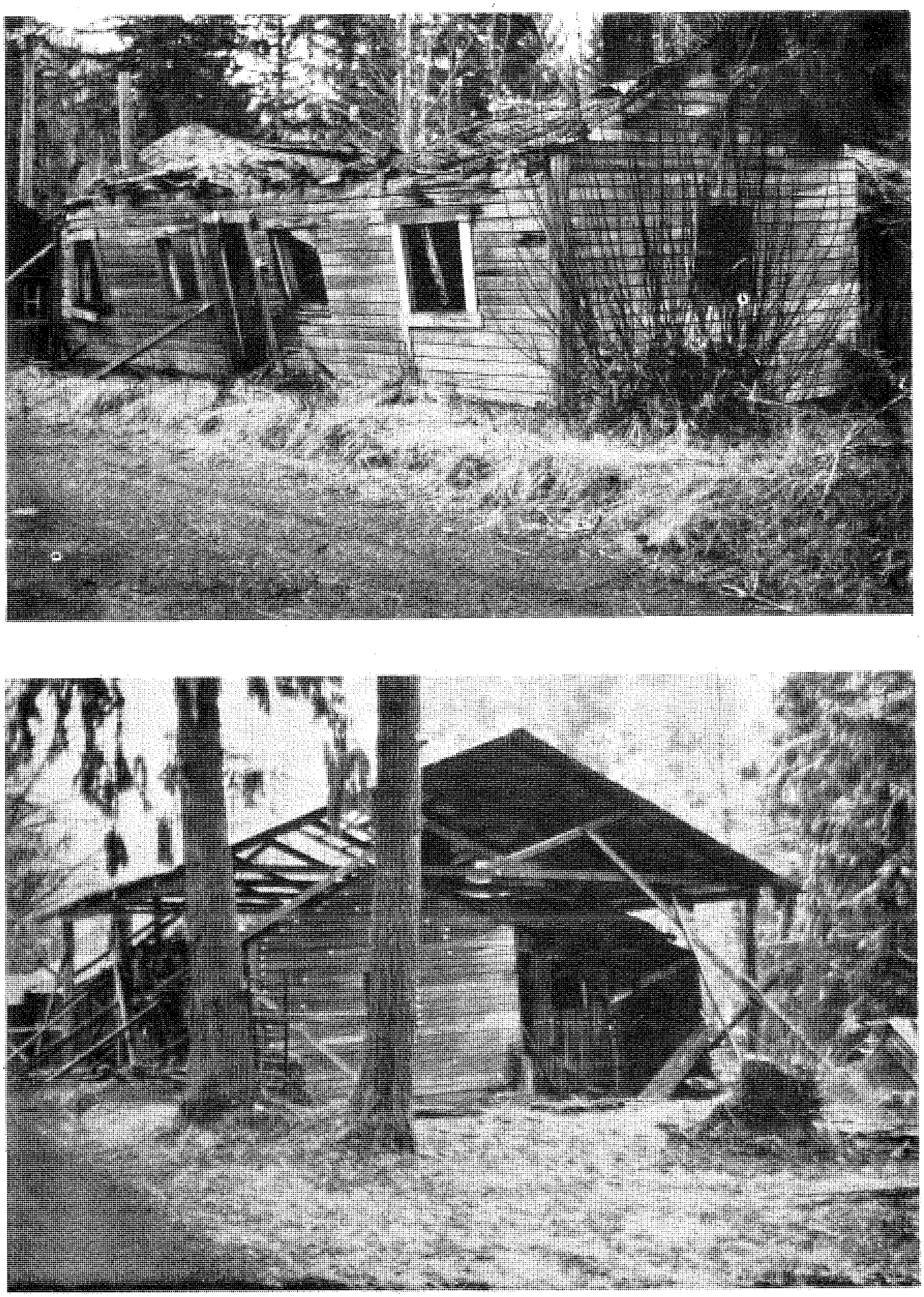
The CPS and the BCHT define alternative approaches that can be taken in safeguarding a cultural resource. These 'levels of intervention' (or 'conservation treatments') are defined in Section II.3 of the *Discussion Paper* and in the CPS *Cultural Resource Management Policy*. Those interventions that are applicable to the McLean Mill site, are:

- *Preservation*. A programme of maintenance and intervention designed to prevent further deterioration and to keep a resource 'as is' — that is, to respect its present form, material, and integrity.

- *Stabilization*. A minimum amount of work is done to safeguard a resource from the elements and/or destruction and to protect the public from danger.

- *Restoration*. A resource is returned to the appearance of an earlier time by removing later material and by replacing missing elements and details. Two kinds of restoration may be used:

    Composite Restoration. All significant architectural features from all historical periods are left intact, revealing the continuity of the history of the resource.



R.B. McLean House (No. 9) in near-collapsed condition, March 1990; and after stabilization and protection by a new roof shelter, July 1992.

Bookkeeper's House and Office (No. 22) as found, January 1990, and after stabilization, July 1992. Note new sills and floor joists, removal of vegetation around the house, and removal of organic growth from the roof.

Period Restoration. A building or site is returned to its appearance at an earlier time.

- *Rehabilitation.* The process of returning a resource to a useable state through repair or alteration. Rehabilitation makes possible an efficient contemporary use while preserving those portions and features which are significant to the property's historic, architectural, and cultural values.

- *Replacement.* A building, site feature, or artifact that no longer exists is reproduced with new construction that exhibits many features of the shape, material, and detailing of the resource as it once appeared. The replacement may use modern construction methods and need not be a precise reproduction. It therefore differs from *period reconstruction,* which the *Cultural Resource Management Policy* stipulates may not be undertaken, unless reconstruction would make a significant contribution to knowledge and its cost can be justified.

- *Demolition.* The systematic and deliberate destruction of all or part of a building or structure. While demolition is not a conservation action, it is a valid component in a conservation program in which certain accretions are being removed.

The Preservation of Buildings and Structures

A preservation strategy should be developed, allowing curatorial and interpretive staff to determine, on a structure-by-structure basis, the most appropriate level of intervention, following the principles in the *Cultural Resource Management Policy.* This will be determined by assessing the present condition of the structure, its potential use and interpretive function, its intrinsic historical significance, and the extent of surviving historical fabric and finishes. All of these factors will interact: for example, the ultimate use in the interpretive program will be determined in part by the significance and present condition; and the level of intervention by the intended use. The schedule of interventions in this section and the proposed uses in Section 5.1 may require modification after the final preservation strategy has been developed.

The *Cultural Resource Management Policy* and *Restoration Principles and Procedures* state that new work should be 'suitably marked' and 'distinguishable' from extant cultural resources. At present the new wood members can be distinguished from the old by colour, but as it weathers it will gradually become indistinguishable. It is therefore recommended that all new members introduced since the initiation of the stabilization process should be stamped (or otherwise marked) with the date of their insertion.

A detail of the mill structure showing new wood components (light) inserted among old components (dark) for stabilization.

The *Restoration Principles and Procedures* further state that 'the signs of age (also known as the patina)' should be retained. Accordingly the marks left by time should be retained on historic fabric, but should not be recreated on replacement fabric.

Recommended Actions

- The program of stabilizing the *in-situ* resources should continue, ensuring that all of the buildings and structures are adequately stabilized and adequate drainage is provided to ensure protection for the short term.

- A long-term plan for preservation, maintenance, and protection, including provisions for decision-making, monitoring, and routine and cyclical maintenance, should be prepared and implemented. This will consider all buildings and structures, including contemporary structures such as the Visitor Reception Centre.

- A structural analysis should be made of all buildings and structures that will be subjected to active use by people and/or operating machinery, and recommendations should be prepared for structural upgrading where required. Structural design should be consistent with the management objective of preserving and protecting the resources.

- All new building components that are inserted into the extant resources for the purposes of stabilization, restoration, or structural upgrading should be distinguished from the historic fabric by being stamped or otherwise marked with the date of insertion.

- The schedule and the chart that follow indicate the appropriate level of intervention for each building and structure on the site. Individual designs and specifications should be prepared for every one that will be restored or rehabilitated. Designs will take into account the uses that will be accommodated, the communications requirements, and the need to preserve and protect the resources.

Schedule of Interventions

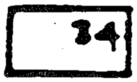
The site plan and chart on the following pages indicates the recommended level of intervention for each structure on the McLean Mill site. (Their use is discussed in Chapter 6.) The decision for each building has been reached by considering the following factors:

- Architectural or historical significance
- Interpretive potential and role in the overall presentation

- Present condition
- Principles in the *Cultural Resource Management Policy*

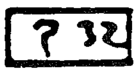
In general, exterior and interior restoration has been recommended for those buildings and structures that retain a significant amount of historical fabric, were important in the technical or social operation of the McLean Mill, offer the potential to contribute to the presentation of the site, and whose restoration can be achieved in a manner consistent with the *Cultural Resource Management Policy*. Other situations have led to recommendations for alternative interventions. Uses for the buildings are proposed in Section 5.1.

LEGEND: DEVELOPMENT CONCEPT



NONE

DEMOLISH

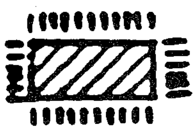


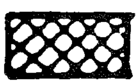
INTERPRET

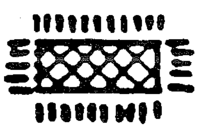

PRESERVE

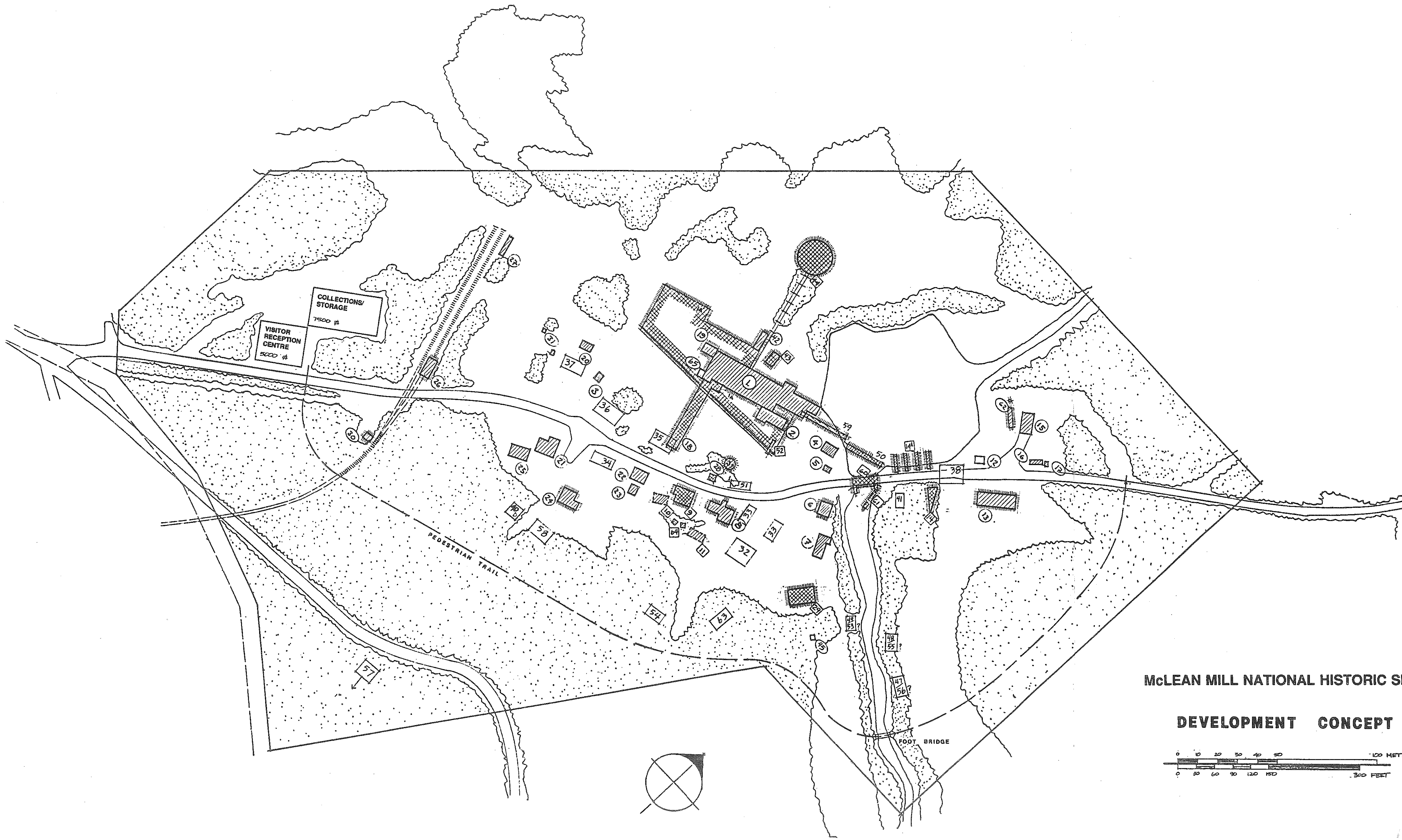

STABILIZE


RESTORE (STATIC)


REHABILITATE (OPERATIONAL)


REPLACE (STATIC)


REPLACE (OPERATIONAL)



McLEAN MILL NATIONAL HISTORIC SITE

DEVELOPMENT CONCEPT

SCHEDULE OF INTERVENTIONS

No.	STRUCTURE	NONE	INTERPRET SITE	PRESERVE	STABILIZE	RESTORE (STATIC)	REHABILITATE (OPERATIONAL)	REPLACE (STATIC)	REPLACE (OPERATIONAL)	DEMOLISH
1	MILL						X			
1A	MILL DECK								X	
2	POWER BOILER						X			
3	FIRST AID SHACK					X				
4	MILLWRIGHT AND GENERATOR BLDG.					X				
5	OIL SHED					X				
6	BLACKSMITH SHOP						X			
7	BUNKHOUSE					X				
8	COOKHOUSE						X			
9	R.B. McLEAN HOUSE								X	
10	WOOD SHED AND STORAGE							X		
11	WOOD SHED							X		
12	GAS AND OIL SHED				X					
13	MAIN GARAGE						X			
14	"A" FRAME								X	
14A	LOG DUMP								X	
15	MACHINE SHOP					X				
16	SMALL PARTS SHED					X				
17	SMALL PARTS SHED					X				
18	GREEN CHAIN								X	
19	PLANER						X			
20	YARD OFFICE					X				
21	ARNOLD McLEAN HOUSE					X				
22	BOOKKEEPER'S HOUSE AND OFFICE					X				
23	WOOD SHED					X				
24	MILLWORKER'S HOUSE						X			
25	ARNOLD McLEAN GARAGE					X				
26	LOCOMOTIVE SHED						X			
27	LOADING DECK AND DIP TANK					X				
28	ROOT HOUSE							X		
29	MACHINERY SHED								X	
30	SAND HOUSE						X			
31	LUMBER GRADER'S SHED					X				
32	ORIGINAL LOCOMOTIVE SHED	X								
33	ORIGINAL BUNKHOUSES (2)	X								
34	KIRK'S HOUSE	X								
35	PHILIP McLEAN HOUSE	X								
36	WALTER McLEAN HOUSE	X								
37	MATHESON HOUSE	X								
38	FORMER LOCOMOTIVE SHED	X								
39	WATER TOWER								X	
40	BUILDING FLOOR									X
41	SVEN'S HOUSE	X								
42	WOOD BIN						X			
43	SAWDUST BIN								X	
44	SCRAP BURNER								X	
45	OUTHOUSE				X					
46	SHOWER	X								
47	JAPANESE HOUSE		X							
48	JAPANESE HOUSE		X							
49	CHINESE HOUSE		X							
50	BOOM SHACK								X	
51	PREVIOUS BUNKHOUSE	X								
52	TRANSFORMER					X				
53	JAPANESE HOUSE (= 49?)		X							
54	SUMI HOUSE	X								
55	JAPANESE HOUSE (= 48?)		X							
56	JAPANESE HOUSE (= 47?)		X							
57	SCHOOL	X								
58	TEACHERAGE	X								
59	JACK LADDER								X	
60	DAM								X	
61	LOG HAUL								X	
62	GIN POLE/DONKEY ENGINE						X			
63	BUNKHOUSE	X								
64	OUTHOUSES							X		
65	LUMBER GRADER'S SHED (GREEN CHAIN)					X				

4.2 Archaeological Resources

Description

A preliminary archaeological survey was undertaken in 1990 by I.R. Wilson Consultants Ltd., and a brief visit was made in 1992 by Millennia Research for the Commonwealth study team. Within the core area, the Wilson survey 'was largely confined to cleared areas, though features such as rail lines, ditches and so on, were followed through more heavily vegetated terrain.' In the clear areas the survey was intensive, with transects at 5-m intervals. Limited test excavations were carried out as well. Outside the core area the survey was cursory, restricted to judgmental observations of the roads and clearings. Some potentially rich areas were looked at only briefly, or not at all.

More than 8,000 artifacts have subsequently been recovered from the site by work crews as they cleaned the site and stabilized the structures. The artifacts have been located within 5-m square cells and recorded in a database. They are mainly steel objects — parts of engines or equipment, pieces of cable, and other fragments — and also some bottles and pottery sherds. They are stored in several buildings on the McLean Mill site, with the storage locations recorded on the database. Some of these artifacts will be used for exhibit and interpretive purposes on the site. They should become a part of the general artifact collection and conserved in an appropriate manner (see Section 4.4).

Prehistoric archaeological resources are almost certainly absent from the site. There are therefore no concerns regarding aboriginal remains.

The area with the most potential for uninvestigated subsurface archaeological resources is in the vicinity of the houses of the Japanese-Canadian millworkers, which straddled Kitsuksis Creek. There is considerable potential here for house, garden, and bath remains. It is possible that this area may contain intact deposits, but virtually all archaeological data may have been destroyed at the time of demolition.

An area of completely unknown archaeological potential is the mill pond. This area has been filled with several metres of silt since its use began. The pond may have been a principal area for refuse disposal, particularly as no major dump sites have been found within the larger mill property. Because of the rapid silt build-up and the waterlogged nature of the site, there is a potential for perishable artifacts to be very well preserved. Artifacts are most likely to be found at the west end, near the mill, and the east end, near the machine shop.

There is some potential for archaeological excavation to reconcile inconsistencies between historical sources and informants on building locations and functions. There seems to be little doubt regarding building identification within the core area, but there are many uncertainties in the peripheral zones.

Recommended Actions

- Work crews on the site should continue to recover and record any archaeological remains that are found on the site.

- Additional archaeological survey work should be undertaken in the vicinity of the former Japanese-Canadian community. Should the survey indicate the likelihood of there being archaeological remains, test excavations should be carried out, perhaps followed by a more intense excavation. The investigation process should be interpreted to visitors as it is underway. The area should not be used for picnics or other public activities until archaeological work has been completed, or unless the survey and the tests indicate that there is unlikely to be any useful archaeological data.

- The archaeological potential of the mill pond should be explored. Archaeological testing could be done using a backhoe under the supervision of an archaeologist, prior to the commencement of dredging. If the pond will not be modified, other than by refilling it to a minimal depth, then the value of the resource may not be sufficient to justify independent investigation at this time. Any significant artifacts or deposits would remain undisturbed in a similar environment to that present at the time of their deposition.

- The more than 8,000 artifacts found on the site should be grouped into classes, such as domestic utensils or refuse, general-purpose tools, and artifacts associated with specific industries or tasks. The database of artifacts should then be transferred into a mapped format, using a GIS or other mapping program. Maps should be separated or 'layered' according to the classifications of artifacts; this may reveal or confirm disposal patterns and the location of various structures or activity areas within the site.

- Once recorded, artifacts that have been recovered through archaeology should be classified, exhibited, used, stored, and/or de-accessioned in the same manner as artifacts that have been acquired by other means (see Section 4.4).

- The digging of test pits might be helpful to locate missing structures out of the core area. However, unless such information were felt to be important on an individual basis, archaeological excavation for this purpose is not recommended in the near future.

4.3 Large Artifacts

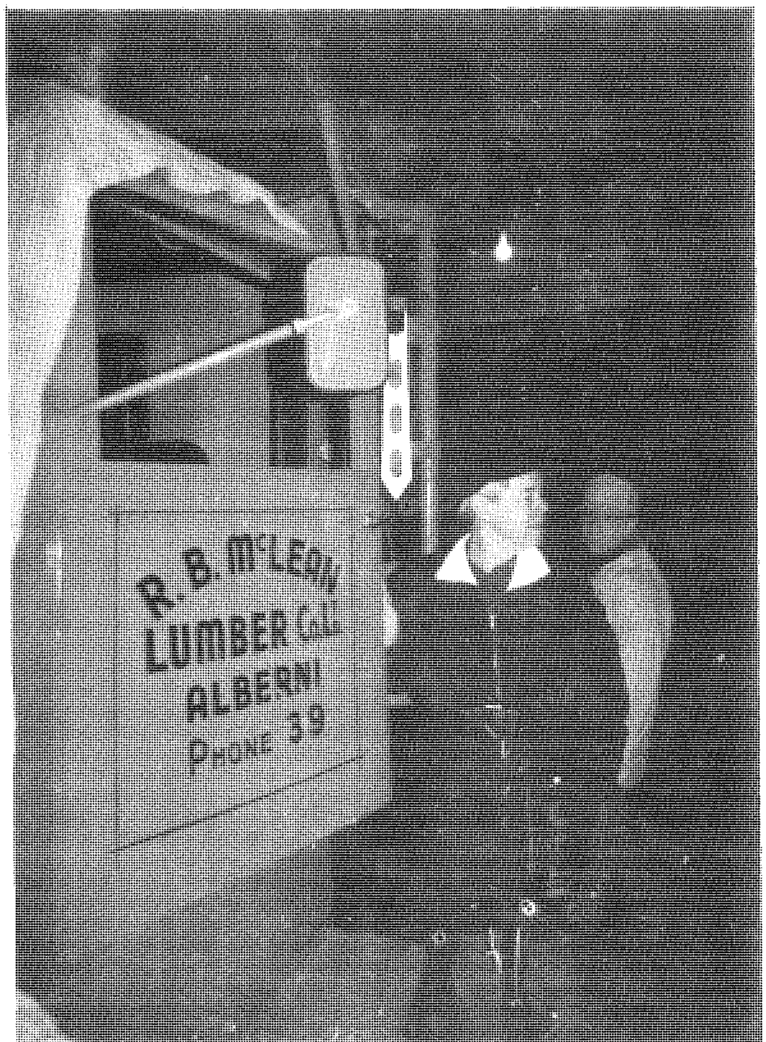
Description

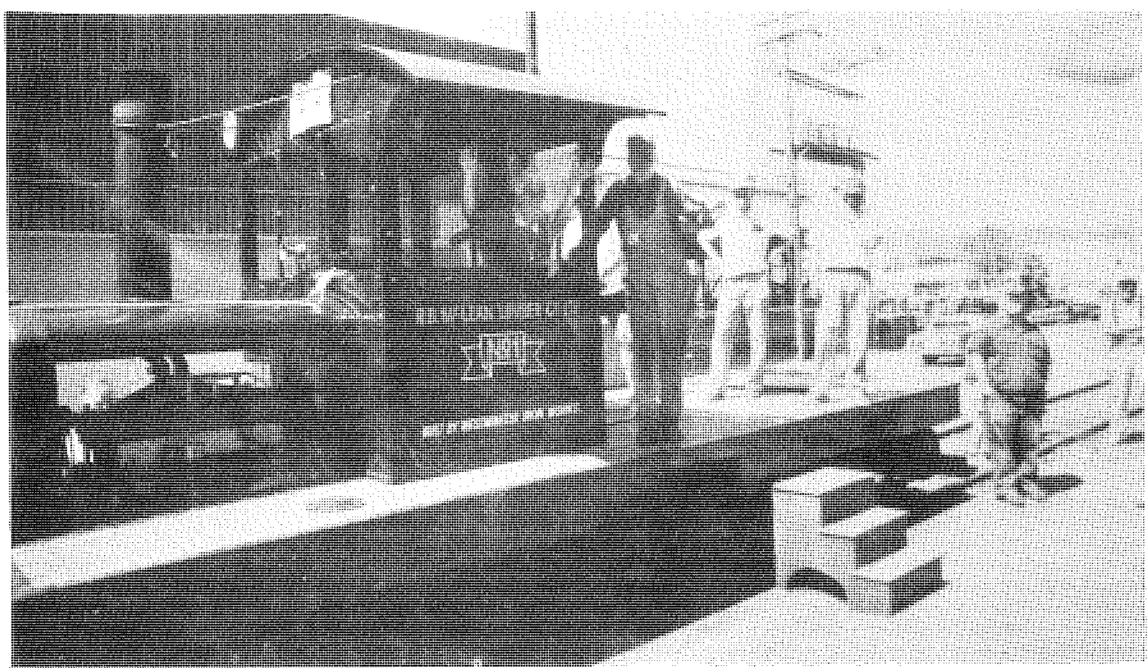
The large industrial artifacts associated with the McLean Mill site include a wide range of moveable artifacts (such as rail and rubber-tired vehicles) and immoveable objects (such as the constituent parts of the sawmill). Numbering more than fifty artifacts in all, they generally fall into one of two collections, both of which are owned by the City of Port Alberni:

- The McLean Collection, which consists primarily of artifacts acquired with the McLean Mill site.

- Artifacts in the collection of the Alberni Valley Museum, which includes donations from the Western Vancouver Industrial Heritage Society and acquisitions from the former British Columbia Transportation Museum, as well as other donations and purchases.

Together, the artifacts form a superb collection of Hayes trucks, as well as a good representative collection of other trucks, logging equipment, and rail equipment.





A Hayes truck and the Buda locomotive, both restored by the Western Vancouver Island Industrial Heritage Society. Muriel McLean and WVIIHS Director 'Soup' Campbell are at the cab of the Buda, seen at its launching in June 1992.

(The significance of the rail equipment is discussed in Section II.7 of the *Discussion Paper.*)

Much of the equipment has been meticulously restored by the Western Vancouver Island Industrial Heritage Society (a community volunteer organization). The AVM and the WVIIHS jointly manage many of the artifacts. At present they are stored in several locations generously provided on a temporary basis by the City of Port Alberni and MacMillan Bloedel. One or more permanent locations will have to be found in the near future.

The curation of this kind of collection, especially when used or displayed in an external environment, requires policy direction on care, conservation, and use. The Director of the Alberni Valley Museum is currently conducting a review of the large industrial artifacts and, with the WVIIHS, establishing restoration, care, maintenance, and display policies for the collections. It is anticipated that the AVM and the WVIIHS will continue to co-operate on curatorial and management issues.

Both large and small artifacts (see Section 4.4 for the latter) that may be used in conjunction with the McLean Mill site should be separated into three classes:

- Display collection
- Demonstration collection
- Study collection

The management policies involved in acquisition, registration, and classification of large artifacts should be an extension of those for small artifacts, and should not differ from them other than in scale and logistics.

The *display collection* should be reserved for those moveable or immoveable artifacts that possess a high degree of historical and industrial significance. One example is the unique Buda locomotive, which has recently been restored to operating condition. If regular use of the Buda or other artifacts in the display collection is desired for interpretive purposes, then replicas should be constructed for operation. Replication for this reason is consistent with the *Cultural Resource Management Policy. Replication* is the making of an exact copy of an existing structure, feature, or artifact. The *Cultural Resource Management Policy* stipulates that reproductions (i.e. replicas) may be manufactured and used in interpretation when there is sufficient knowledge for accurate reproduction and the original is too fragile to use; when multiples are required; or when an object is to be handled or consumed.

In contrast, the majority of artifacts, like the buildings and structures, do not have particular individual intrinsic historical significance; their value derives rather from their collective conservation *in situ*. These artifacts should be assigned to the *demonstration collection* and may be used for public programs.

The Preservation and Use of Historical Equipment and Technology

In keeping with the commemoration of the site, the collections will support the presentation of the British Columbia forest industry. A preservation strategy should be prepared whereby curatorial and interpretive staff will determine, on an artifact-by-artifact basis, the most appropriate level of intervention and whether or not operable equipment should be used. (See *Discussion Paper*, pp. 68-75, for an explanation of the principal issues that must be considered in the preservation strategy.)

- The most appropriate level of intervention should be determined in a manner similar to that for buildings and structures (see above, Section 4.1). Options include preservation, composite restoration, period restoration, and rehabilitation. Considerations should include the intended use and interpretation of the artifact, its intrinsic historical significance, and the extent of original materials and finishes. The preservation process should be followed by a program of preventive conservation.

- A decision as to whether or not operable equipment should be used should be based on whether the presentation mandate is best served by active use or by static display. If presenting the *historical processes and technology* is more important, the equipment should be used; if presenting the *material fabric of the equipment* is more important, it should be reserved for static display. Artifacts in the display collection should not be operated, except perhaps in certain extraordinary circumstances.

There are two fundamentally different approaches to the preservation of historical industrial technology:

- *Preservation by use.* Using an artifact as part of an operating system is usually the best way to preserve the technology, skills, and knowledge of industrial processes, and may also be the best manner of making the process understandable to the visitor. This approach will cause wear and tear on the artifact, and will require the continual replacement in kind of moving parts, just as was necessary during its period as a 'living' machine. Certain records of its creation and use, such as finishes, wear marks, or significant modifications, will be lost in the process. Also, the vibrations caused by operation of immoveable artifacts may cause additional stresses and wear on the historic buildings that support them. As with buildings and structures that are exposed to the climate, the historic *fabric* of operated machinery will change over the long term, but the historic *design* will not necessarily change. Since use requires regular maintenance, it may protect the artifact from rust and other kinds of environmental deterioration associated with disuse.

- *Preservation by static display.* Keeping an artifact out of use provides it with a higher level of physical protection, without risking important or unique material information and ensuring the long-term preservation of the historic fabric. Static immoveable artifacts will not threaten the stability of the buildings that support them. Static display does not, however, preserve the technology, and so over the long term the technology may be lost. However, it should be recognized that if displayed equipment is preserved *in situ* in exposed locations, it will gradually suffer deterioration from exposure to the environment, even if a high level of physical conservation is maintained; and so over time even unused equipment may require the replacement in kind of components.

Under a managed program of controlled use and careful maintenance, one may achieve a good balance between technological preservation and material preservation. If machinery is operated, there should first be a concerted effort to document its condition as found.

Operating historical machinery is a part of preserving the 'culture of use'. This should be accompanied by a research initiative that documents the broader story of how machinery of this kind was operated and used. This can be achieved in part through a program of aural history, and by encouraging older operators to pass their skills and stories on to younger people who are training to be operators.

It is possible that the operation of individual pieces of equipment in the demonstration collection may not be feasible. Reasons may include the inability to replace or fabricate certain components, the stresses that operation may cause to the structures that support them, or issues of safety (which are discussed below). If the particular inoperable machine is part of a larger system or process, then its absence may threaten the success of the operating program. Should this occur, consideration may be given to a number of alternatives:

- Replication of the inoperable machine.
- Replacement in kind of the inoperable machine with another historical piece of equipment that achieves the same process, but which did not originate at the McLean Mill site.
- Operation of the equipment, or a replica or replacement, in a location other than where it originally was situated.
- The elimination of this particular process from the larger system.

With any of these alternatives, it is important that the interpretation clearly explain the nature of the equipment that has been substituted (or eliminated), as well as the particular circumstances, so as to avoid any confusion among visitors.

> Issues related to the operation of machinery are discussed more fully in Appendix 3 of the *Interim Report*. Appendix 2 of that report provides an account of selected industrial heritage sites across North America, several of which operate machinery. Pages 74-75 of the *Discussion Paper* introduces considerations for a program of preventive conservation.

Safety Considerations

Working places can be dangerous. The operation of machinery requires addressing a number of related concerns, which focus on legislation and regulations related to occupational health and safety.

Most working industrial heritage attractions have adopted voluntary safety measures for the protection of both operators and visitors. These include physical items, such as guards and posted warnings, as well as internal regulations and procedures. Some basic safety considerations should include whether there are guards on saws and conveyor belts, and whether the entire system can be 'locked-out' during maintenance procedures or in the event of a breakdown in some part of the system.

In addition, a number of provincial and federal statutes and regulations must be considered:

British Columbia Workers' Compensation Act: Industrial Health and Safety Regulations

The Industrial Health and Safety Regulations set out in considerable detail the safeguards required by law in sawmills in British Columbia. Applicable sections address many topics, ranging from general procedures and programs to specific regulations for wood-working machinery and processes. The Act has implications for site operation, staff selection and training, operating procedures, and the physical set-up. Although these requirements may seem daunting, the experience at other historic sites with operating machinery suggests that much of what is required is common-sense.

The evolution of safety standards, and how they were (or were not) followed by the McLean Lumber Co., is a story which can be interpreted. British Columbia was the first province in Canada to pass a Workmen's Compensation Act, in 1902. Insurance companies also played a role in the introduction of safety equipment, as they began recommending certain equipment and procedures to their clients at roughly the same time.

British Columbia Power Engineers and Boiler and Pressure Vessel Safety Act

Several sections of this Act will affect operations at the site, including the Boiler and Pressure Vessel Code; the Regulation Respecting Competency, Licences and Registrations; Boiler and Pressure Vessel Fees and Expenses Regulation; and Mechanical Refrigeration Plant Regulation. This Act sets out the standards which boilers, steam engines, and their operators, must meet to be certified.

Canada Labour Code and *Canada Occupational Safety and Health Regulations*

The Occupational Safety and Health Provisions of the *Canada Labour Code* (Part II) are intended to prevent workplace accidents and injuries in areas of jurisdiction of the Code. The only jurisdictional area applicable to the McLean Mill site would seem to be with respect to members of the federal public service, and this will likely pertain only if Parks Canada staff are employed at the site (even if in an advisory role). The Code regulates a number of items, including building safety, boilers, and tools and machinery. Summaries of the Code and the regulations are contained in *A Guide to the Canada Labour Code: Occupational Safety and Health* and *A Guide to the Canada Occupational Safety and Health Regulations*, both available from Labour Canada.

Recommended Actions

- All vehicles, railway equipment, and moveable large machinery should be managed and cared for in a manner that produces the most effective and efficient protection. This will require that a management agreement be drawn up between the Alberni Valley Museum and the Western Vancouver Island Industrial Heritage Society and approved by the City of Port Alberni. The Society's participation will continue to be voluntary, but some of its expenses may be covered or reimbursed by the City, at the pleasure of the Council.

- Effective management and care are required as well for the fixed large machinery and equipment (e.g. the sawmill and the boiler). This would best be the responsibility of the management of the McLean Mill site.

- All participants (i.e. the Alberni Valley Museum, McLean Mill management, and WVIIHS) should freely interchange curatorial and technical assistance for all artifacts managed by any of the three organizations, ensuring uniform systems and standards for conservation and classification.

- All artifacts should be *categorized* either as immoveable objects (i.e. those that were attached to structures or functioned as parts of a larger, fixed-in-place system of machinery) or as moveable objects (e.g. vehicles). They should further be *classified* as to type and provenance; and into a display collection, a demonstration collection, and a study collection.

- A preservation strategy should be developed to assist in determining the appropriate level of intervention for each artifact.

- A conservation and maintenance plan should be developed for artifacts in all collections.

- A decision should be made with respect to whether or not operable equipment in the demonstration and study collections may be used. This should be done on an artifact-by-artifact basis, by assessing the respective importance of preserving the historical technology *vs.* preserving the historical fabric.

- All artifacts should be recorded, following uniform documentation standards. Any equipment that will be operated should be recorded before being restored or rehabilitated for use.

- Safety considerations with respect to operating machinery should be addressed, paying heed to common sense as well as to statutes and regulations. The existing safety guards on the machinery should be assessed and compared to those required by current regulations. Consideration should be given to what steps might be taken to meet current standards, and the implications of these changes for the machines as artifacts and for the interpretive programming; and also to what additional steps might be necessary to ensure complete visitor safety.

- Any new machinery or safety features that are introduced to meet safety regulations should be clearly distinguished from the historic resources and interpreted as such to visitors where appropriate.

- Once the fundamentals of the situation have been established and tentative solutions proposed, but not yet committed to, the local Workers' Compensation Board Occupational Safety Officer should be contacted and discussions initiated. This should be done with some care, since the facility will require the Safety Officer's ongoing support and interest to successfully establish a safe workplace that meets both the site's and the WCB's objectives.

- The current condition of the boilers, fittings, and steam engine should be established, and it should be determined what their condition will be upon restoration. Consideration will be given as to whether this will conform to current standards and what adaptations or replacements may have to be made.

- The area inspecting power engineer for the Boiler and Pressure Vessel Safety Branch, Ministry of Municipal Affairs, Recreation and Housing should be contacted, and discussions held about precisely how the Act applies to older boilers.

4.4 Small Artifacts

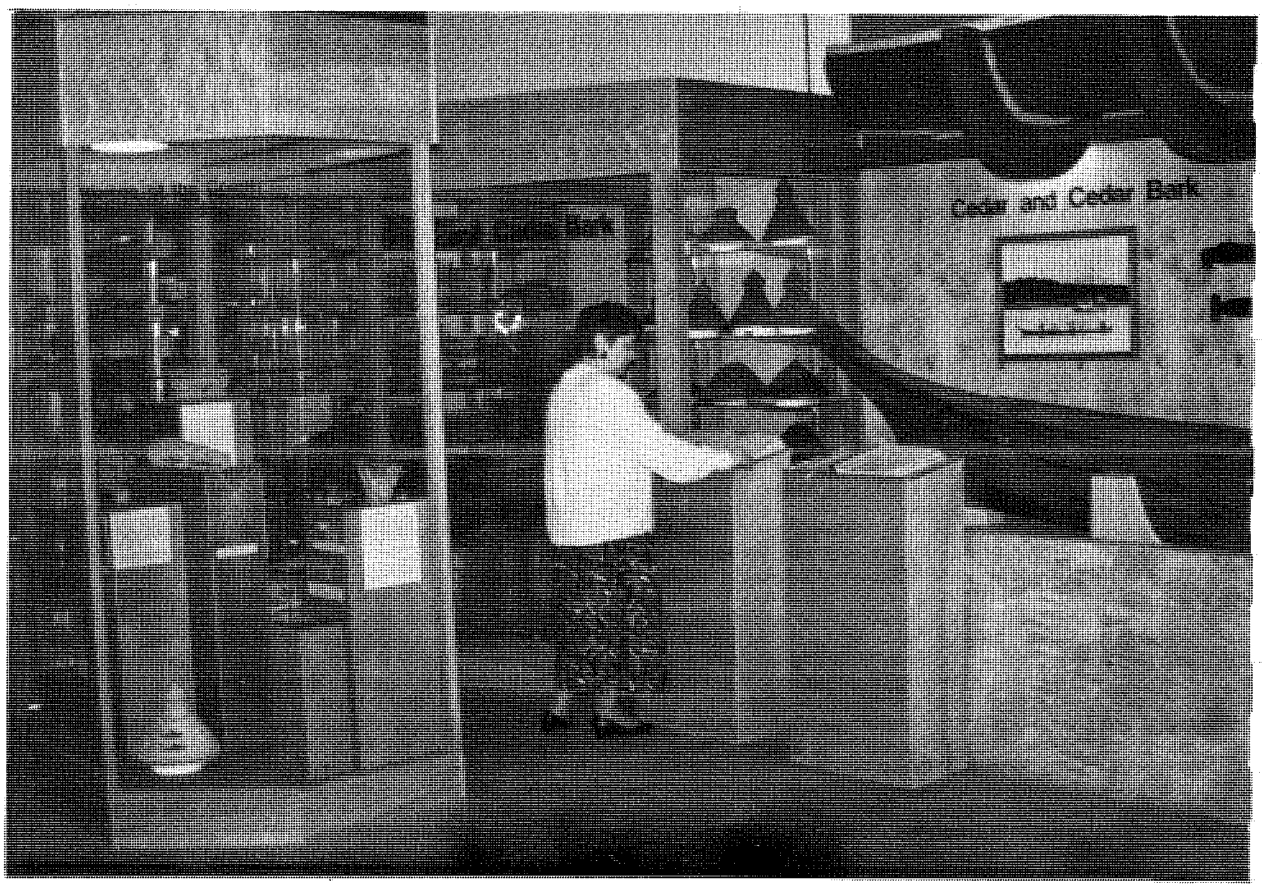
Description

In 1983, when it was intended that the McLean sawmill be dismantled and re-erected in Port Alberni, the Museum 'acquired' the mill. At that time the Alberni Valley Museum made a commitment to develop its collection of forest-industry artifacts. When it was subsequently decided to restore the mill on its site, the Museum reaffirmed its intention 'to develop collections relating to more recent history and specifically to the operations of MacMillan Bloedel.' This commitment was contained in the Alberni Valley Museum's booklet, *Forest Industrial Collections*, which also issued a Statement of Intent:

> It is the established intent of this Museum to research, document, collect, exhibit and interpret the heritage of the forest industry with emphasis on milling and manufacturing.

A series of goals and priorities was described, closely associating the continued collecting of material with the restoration and development of the McLean site.

The forest industrial collection includes a number of artifacts that can be used to interpret the industry in British Columbia, although they are not specific to the McLean Lumber Co. These include ten chainsaws, a collection of hand-logging equipment (saws, spring boards, climbing spurs, log stamps, hard hats, etc.), and a variety of small equipment and memorabilia from logging camps and mills,



At the Alberni Valley Museum, a girl and her grandmother admire the dolls while another visitor uses an artifact catalogue in the ethnology exhibit in the permanent gallery.

including a model and paper samples from the province's first paper mill. These pieces are all on display in the Alberni Valley Museum. In addition, a large proportion of the Museum's historic photograph collection pertains to the forest industry.

Collections that relate directly to the McLean Lumber Co. operation fall into three categories:

- The collection of artifacts found on the site and stored there (see Section 4.2)

- Archival resources, specifically all the records from the McLean Lumber Co. office, which were collected from the site in 1984 and are now stored in acid-free folders and containers in the Alberni Valley Museum. This is an extensive collection, which contains a fairly complete record of the company's business operations for the period 1922-1962. The Alberni District Historical Society owns and manages this collection as part of the Community Archive. Access to the collection is gained through the Society or the Museum Director. A preliminary finding aid is in place.

- Donations from the community. Fewer than 25 artifacts that originated on the McLean Mill site have been donated to the Alberni Valley Museum. These include items such as office equipment, dishes, and personal memorabilia.

Artifacts in the Museum are regulated by the *Alberni Valley Museum Collections Policy,* a comprehensive document that addresses all areas of collections management.

Recommendations

- A plan should be developed for a joint management strategy for the McLean Lumber Co. collection and the Alberni Valley Museum's Forest Industrial Collection, to ensure high curatorial and conservation standards that meet the needs of the various interested groups in an efficient manner.

- In the interim, all artifacts relating to the forest industry generally and the McLean Lumber Co. specifically should be managed as a part of the Forest Industrial Collection of the Alberni Valley Museum. Development, exhibition, conservation, use, and other management procedures should be governed by the AVM's Collections Policy.

- The AVM Collections Development strategy should be reviewed, with consideration given to revising it to accommodate the objectives of the McLean Mill site.

4.5 Landscape Resources

Description

The McLean Mill site is located within a clearing in the midst of a dense second-growth forest. The experience of coming into this large clearing through the trees is one of discovery and surprise. The forest around the buildings is thus key to the historic landscape of the site and helps to express the isolation of McLean Mill from Port Alberni. The forest edge provides an authentic backdrop to all site activities and limits distant views except where the mountain tops of the Beaufort Range can be seen above the treetops.

Within the clearing, the landscape can be divided into quadrants by the east-west road through the site and the mill pond and Kitsuksis Creek running north-south. The landscape character of each quadrant has been established by its historical pattern of activity: the milling zone, the camp zone, the logging zone, and the agricultural zone.

The mill occupies the area north of the road and west of the creek. The landscape character has an open, industrial appearance, dominated by the scale of the mill and its related outbuildings. The large cleared areas west of the mill functioned historically as storage for finished lumber. The pond adds to the openness of this quadrant, as well as being important in interpreting the sorting of logs for milling.

The McLean Mill is located within a varied landscape setting. Here we look east from the mill, across the empty mill pond to the logging zone, the second-growth forest, and the Beaufort Range.

The road separates the camp zone from the mill complex. The landscape character is residential and village-like with domestic-scale structures in picturesque groupings. The buildings front on the road and the mill. There are trees and some remnants of cultivated shrubs in close proximity to the buildings creating a strong contrast with the cleared mill site.

East of the mill pond is a zone traditionally used for log supply, as well as for garages and storage buildings related to the servicing of mill equipment and vehicles. The area is cleared of vegetation, giving prominence to the collection of garages, sheds, and log slides around the road.

South of the storage zone is an overgrown, unused stretch of land surrounding Kitsuksis Creek. None of the buildings that stood in this area remain. This was formerly the site of Japanese workers' residences and their associated agricultural plots; after internment the area was reportedly ploughed and used for a different mode of agriculture. The once orderly landscape character is at present engulfed in vegetation.

Recommended Actions

The following directions for the conservation of the historic landscape are proposed.

- The surrounding forest and the configuration of the forest edge should be retained as a key element in the site's landscape character. The forest edge should be managed and interpreted as second-growth forest. The forest could also be used to demonstrate historic logging practices in combination with a sustainable reforestation programme.

- Further research should be undertaken on the historic landscape in order to develop guidelines for ongoing protection, maintenance, restoration, and replacement.

- The existing trees on site should be inventoried and inspected as part of ongoing site management. New exotic plant species should be monitored and controlled if necessary.

- The variations in landscape character for each of the zones of the site should be respected in the process of site development. Specifically, the logging and milling zones should be kept cleared and open to contrast with the much denser vegetation of the areas south of the main road. The camp zone should continue to mix native trees with introduced exotic shrubs while the landscape around the creek should be kept naturalistic, with a minimum of intervention in its current vegetation. New site features, such as signage and site furnishings, could be differentiated by zones to build on these distinctions.

- The mill pond, dam, fish ladder, and bridge should all be replaced and interpreted as part of the site's historic landscape, as well as to reinstate the pond's function in supplying logs to the mill and to re-establish this portion of Kitsuksis Creek as a spawning area.

- The former cleared area at the 'northwest' corner of the site, originally used for the storage of finished lumber, may be cleared and managed as open field if it will be used for lumber storage, a visitor gathering point, rail operations, or any other interpretive or operational use. It should not be cleared if there is no use for it.

- The surface treatment of the roads and pathways on site should be chosen to be compatible with the site's landscape character. The historic plank surface could be recreated on the main east-west road. It should be installed with a parallel route of a more all-weather, relatively smooth surface to provide a choice for wheelchair users and the elderly and for rainy days. The existing dirt roads are not appropriate to the intensity of use which will occur with site development. Circulation routes should be kept as narrow as possible, with grass or gravel shoulders and a rough, rural surface such as crushed limestone or compressed gravel.

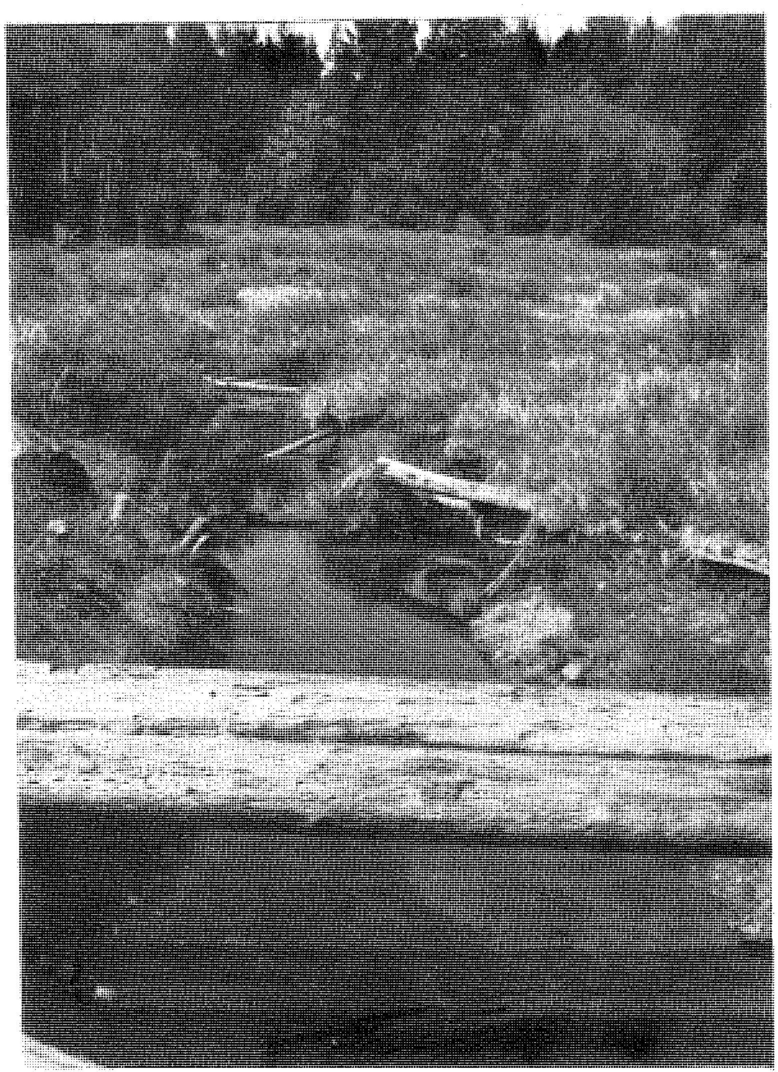
- It would be useful to work in the long term towards expanding the present site boundaries, in order to encompass more of the forest and thus to preserve an adequate forest context and isolate the site from visual intrusion of possible future, incompatible activities on adjacent land. Establishment of a sufficiently deep forest zone will also help to buffer neighbouring land uses from the impacts of an active heritage tourism site. This buffer zone could be acquired through a variety of methods, ranging from purchase or lease to an easement or protective covenant registered on the land.

4.6 Natural Resources and Environmental Considerations

Description

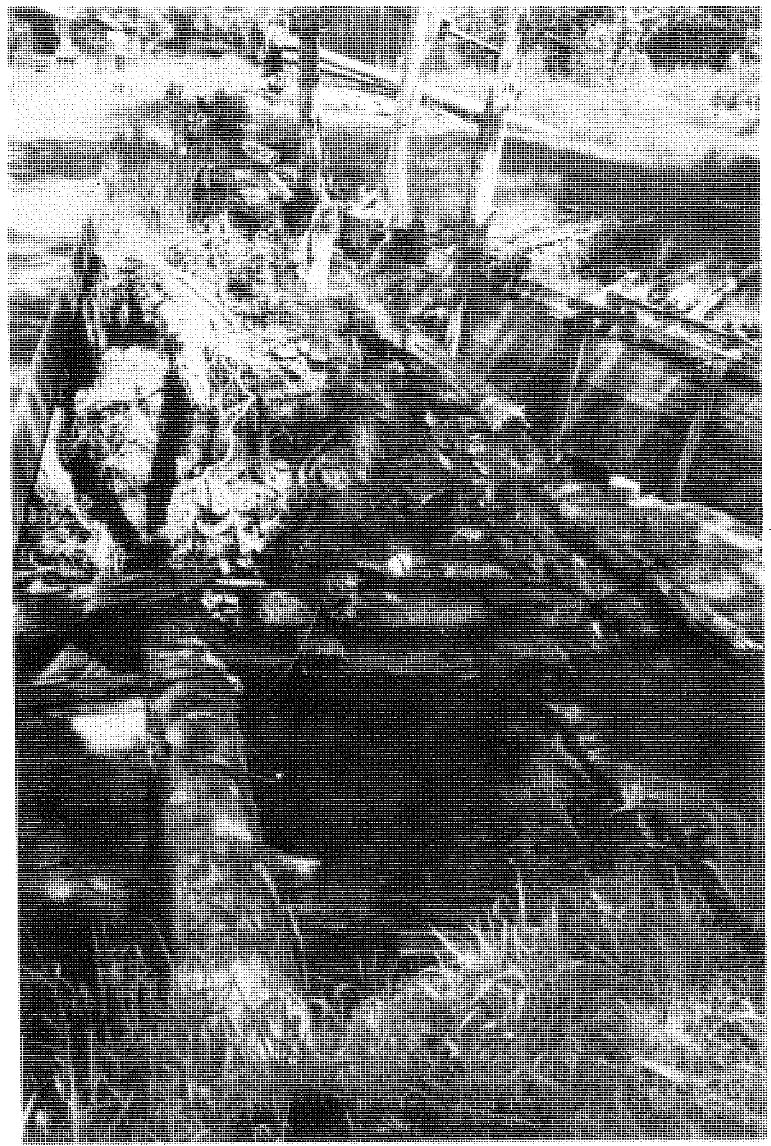
The McLean Mill site is large and encompasses a variety of natural features, vegetation types, and wildlife habitats. The site's natural resources occupy much of the site's area, ringing the mill buildings and associated outdoor storage areas. Five distinct biophysical units have been delineated on site:

- the Kitsuksis Creek riverine habitat
- the riparian area along the creek
- the marsh and millpond
- the disturbed areas around the mill and railway right-of-way
- the second-growth coniferous forest



A view of Kitsuksis Creek.

Kitsuksis Creek is a typical coastal stream which is moderately productive for coho salmon and probably for other species as well. The dam and fish ladder which created the mill pond were breached in a flood around 1991, resulting in a new channel for the stream within the old pond area and siltation downstream.



The collapsed dam and fish ladder, which will be restored.

The *riparian zone* of Kitsuksis Creek extends throughout most of the site with its characteristic willow, alder, and coniferous vegetation. The riparian zone provides a movement corridor for ungulates such as blacktailed deer. It also provides habitat for small mammals, such as shrews and voles, and for reptiles and amphibians.

The vegetation which has established itself in the *marsh and mill pond* is predominantly a mix of grass species. Remnants of freshwater marsh vegetation, including hardhack, cattail, sedges, and rushes are still present. The wildlife use of the pond is limited to occasional use by songbirds.

The *central portion of the site* has been highly disturbed as a result of the mill operation and railway use. In some areas, there are stands of large trees, including western red cedar, Douglas fir, and bigleaf maple. The understorey consists of introduced shrubs and grasses. These disturbed areas are of low value to wildlife.

The *secondary coniferous forest* on site is dominated by red alder in transition to a western hemlock / Douglas fir forest. A high groundwater table has resulted in shallow tree rooting, increasing the likelihood of windthrow. Thimbleberry, salmonberry, red elderberry, mountain ash, and sword fern are prevalent in this forest; and there are many opportunities for wildlife viewing. It would be desirable to be able to identify those plant materials whose growth began after the closure of the McLean Lumber Co., in order to enable decisions to be made as to whether the land should be restored to its 1960s appearance. However, this may not be possible, since most growth is a part of the natural succession of the second-growth forest.

Certain requirements for environmental assessment and accountability will have to be met:

Environmental Assessment and Review Process

The Environmental Assessment and Review Process (EARP) evaluates the impact of proposals on natural and cultural resources, to determine, in advance, the environmental acceptability of projects. All projects that are proposed or sponsored by federal departments and agencies or involve federal funds must meet the requirements of the federal EARP process. This process is required for the McLean Mill site.

British Columbia Waste Management Act: Pollution Control Objectives for the Forest Product Industry

These guidelines were developed by the Board of Pollution Control in 1977. The Waste Management Act is currently under review by the provincial Government. Initiated in 1991, it is anticipated that the review will take five years to complete. Some idea of the policy direction is provided in Ministry of Environment, Lands and Parks, *New Approaches to Environmental Protection in British Columbia: A Legislation Discussion Paper* (1992). The paper emphasizes that the Province plans to move away from simply controlling the discharge of pollutants towards waste minimization and pollution prevention. One method of prevention is to set standards based on the level of discharge generated by the best available control technology (BACT).

Waste Management

The necessary compliance with the above regulations, combined with Parks Canada's commitment to environmental sustainability, means that the industrial process at the McLean Mill site must be assessed in terms of both inputs and outputs. Consideration must be given to how outputs (e.g. smoke, wastewater, and sawdust) can be minimized by managing inputs and using the best available control technology. Review of the existing resource material and information from comparable sites should be used to inform this process. An important question to ask in this regard is how the McLeans managed their waste during the active period of the mill: did they reduce, re-use, or recycle?. Their approaches to waste management *may* suggest strategies for approaching this issue.

Recommended Actions

The following approaches are recommended to develop the site in an environmentally sensitive manner.

- Any excavation within the old mill pond or along Kitsuksis Creek for archaeological or other purposes should be subject to a hydrological/fisheries study to ensure that negative impacts on fisheries resources through erosion and loss of habitat are ameliorated. It is preferable if excavation work is carried out in the summer low flow period and with very cautious use of any heavy machinery required. All disturbed areas should be filled and reseeded or replanted in appropriate species.

- A minimum 5-metre (16-foot) setback for all alterations to existing conditions should be established along the banks of Kitsuksis Creek to avoid impact to its riparian values. A 15-metre setback would be desirable for development which would result in a loss of riparian vegetation. Any archaeological work in the vicinity of the creek, or other significant disturbances, should involve approvals from Environment Canada, Fisheries and Oceans Canada, and the B.C. Ministry of Environment, Lands and Parks, even if it is planned to occur outside the recommended setbacks.

- Replacement of the dam and reintroduction of water into the mill pond should be undertaken in consultation with the B.C. Ministry of Environment, Lands and Parks (Water Management Branch). More detailed environmental and engineering studies should be prepared to optimize the design and timing of construction of the dam. A new fish ladder should be installed with the dam to permit migration of spawning fish. A reconstruction of the historic fish ladder appears to be acceptable as long as it meets the guidelines of Fisheries and Oceans Canada. Environment Canada and the B.C. Ministry of Environment, Land and Parks should also be consulted regarding the design and installation of the fish ladder.

- The refilling of the mill pond should be done with the intent of enhancing its habitat potential. Freshwater marsh vegetation should be transplanted into the pond where depths are suitably shallow. Deciduous trees and shrubs should be planted to overhang the pond edge where possible to create fish rearing areas. Provision of some pond areas with depths preferred by waterfowl should also be considered in the pond design. The potential impacts on the fishery of storing logs in the pond should also be reviewed with the involved government agencies.

- The removal of trees or construction activity over their root zone should be done with advice of a registered forester, especially with regard to the high potential of windthrow due to the shallow rooting habit of trees on site. A vegetation management plan, recommended for protection of the site's landscape resources, will also assist in ensuring safe tree retention and the enhancement of the site's vegetation for environmental purposes, including wildlife habitat improvements.

- The soils in the vicinity of the dip tank, which was used to treat lumber in the vicinity of the railway right-of-way, and in the basin of the mill pond should be assessed by a toxicologist for contaminants.

- Initiate the Environmental Assessment and Review Process (EARP), to determine, in advance, the acceptability of the environmental impacts of the proposed site development.

- Initiate discussions with local officers of the Ministry of Environment, Lands and Parks responsible for administration of the Waste Management Act.

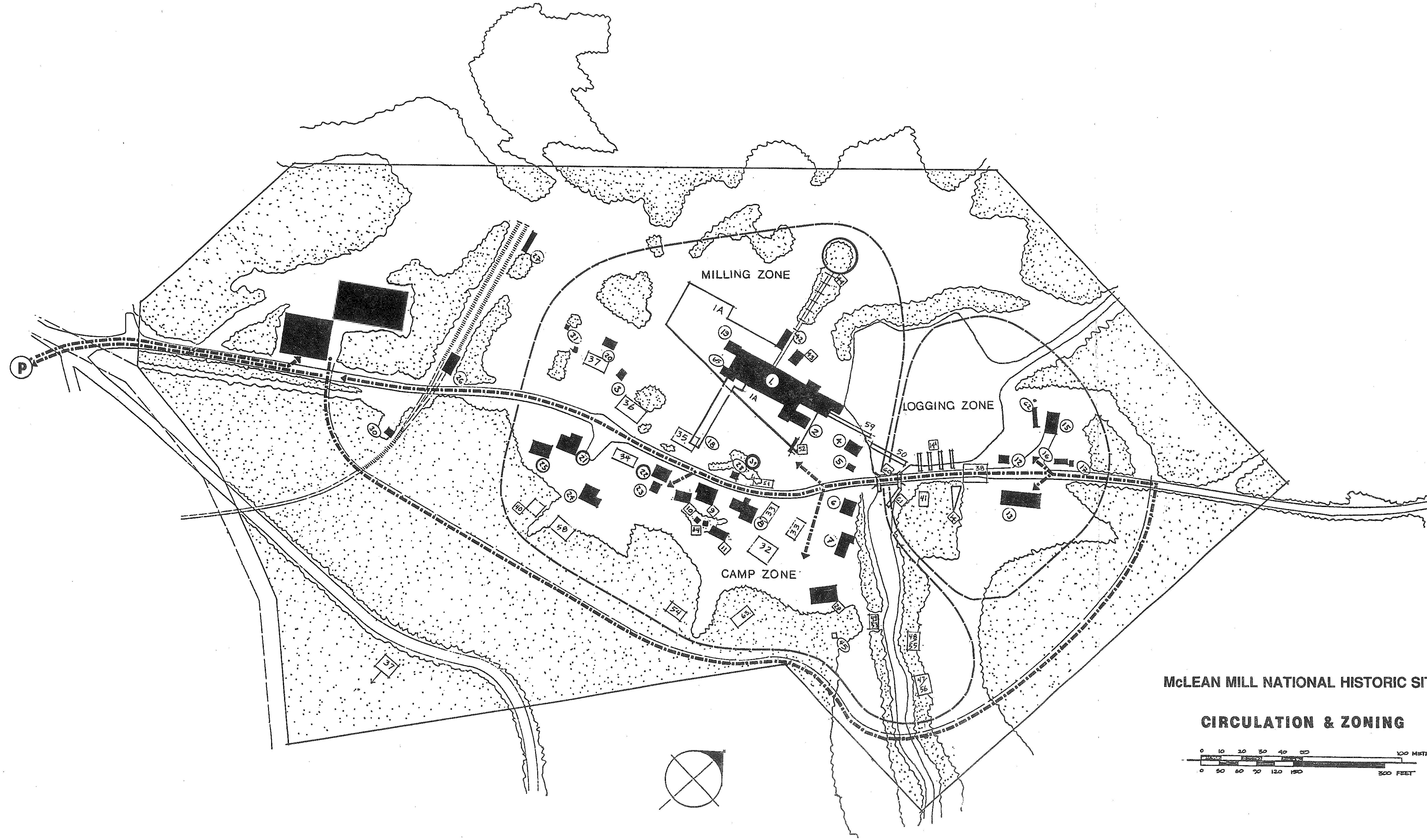
5. VISITOR SERVICES AND USE OF RESOURCES

5.1 Communications Strategy

A fully developed communications strategy, which lies beyond the mandate of the present Management Plan, will determine the manner in which the site's themes and resources are presented to the public, both on and off the site. The communications strategy should be developed and shaped in tandem with the preservation strategy (see Chapter 4), each informing the other, and the two combining to define the totality of the visitors' experience on the site. This section provides initial direction for the communications strategy.

The communications strategy will determine what the site will interpret and which markets are reached; that is, it will develop a linked series of messages (what is said) and markets (to whom it is said). The manner in which the themes are communicated should, in turn, affect the preservation strategy for the resources. Preservation, interpretation, and marketing are all intertwined, and the communications strategy is the key to their inter-relationship.

At present, prior to development of the site, the site is open to visitors. Marketing and interpretation are limited to publicizing the site in leaflets and by word of mouth, a sign at the site entrance, and guided tours of the site offered by the Site Manager on a demand basis. The themes presented in the tours focus on a description of the resources, the stabilization work done to date and plans for site development, as well as by answering visitors' questions. This interim procedure has sufficed, given the relatively low level of visitation. As visits increase, however, the tours will increasingly interfere with the Site Manager's other responsibilities. For this reason, interpreters should be retained during the summer season (likely on both a paid and a volunteer basis) to handle these tours. The interim tours should also begin to introduce the themes that will form the basis for interpretation following development.



McLEAN MILL NATIONAL HISTORIC SITE

CIRCULATION & ZONING

On-Site Interpretation

The presentation of the site will derive from the themes that have been approved for the site (see Section 2.2) and will contribute to the mandates and objectives of the three partners (see Section 2.4). As described above, the primary themes are logging, sawmilling, labour/people, and transportation/marketing; and the related themes are technology, camp life, agriculture, and forest. The communications strategy will develop a hierarchical list of messages to be presented, derived from the commemorative themes and the stakeholders' mandates.

Since the commemorative intent relates the site to the British Columbia forest industry in general, only some of the messages will be able to be presented directly from the extant resources on the McLean Mill site. Themes and messages that are represented by the McLean Lumber Co. operation should be interpreted primarily in the *core site,* while those themes and messages that may be deficient in the McLean operation should be interpreted primarily on the *periphery of the site,* either in the Visitor Reception Centre (VRC) or the forest fringe. Additional forest-related themes will be presented at the Alberni Valley Museum and other sites within the Alberni Heritage Network.The presentation will also identify the three partners and describe the development process.

It is intended that the *personal interpretation* program be extensive. This may include the following products:

- Animators, perhaps in costume, who will occupy a selection of the restored structures and some outdoor areas, and will demonstrate activities and lifestyles prevalent at the mill site. The animators may leave their personae to answer visitor questions, as at other national historic sites and provincial heritage properties.

- Demonstration of machinery and equipment, including the various components of the operating sawmill and a logging demonstration at the north end of the site.

- Operation of vehicles, primarily logging trucks and railway equipment (including the ride from the parking lot to the core site).

- Guided tours of the site, perhaps offered only for those who purchase a premium admission ticket.

The personal interpretation will be somewhat seasonal, with the highest level of animation happening during the summer visitor season, but some personal interpretation should be provided at all times when the site is open.

There will be a parallel program of *non-personal interpretation* on site. This may include the following products:

- The Visitor Reception Centre will provide an introduction to the commemorative themes and the McLean Mill site. Products will likely include an audio-visual presentation and a variety of static and interactive displays and exhibits.

- Self-guided tours of the site, provided through printed material (e.g. a map and pamphlet) and interpretive signage on site that introduces the various structures and the themes that they convey.

- Static exhibits within certain of the structures.

- Printed material and/or signage along the pathways in the forest fringe, which introduce the themes of forest management and environmental sustainability.

Because the presentation will draw on all three historical periods of the McLean Lumber Company, it is important that the presentation provide a sense of continuity and protect the visitor from being confused by anachronisms. This can be achieved through both the personal interpretation (the animators and guides) and the non-personal interpretation (the printed material and signs). One such anachronism is the simultaneous presence of a logging railway and logging trucks. Operators and interpreters can explain that both are used to demonstrate changing methods of transporting logs from the forest to the mill.

Use of Resources

The resources on site will be preserved so that they may be used in the presentation programs. Those that are preserved or stabilized will be presented as static artifacts. The following is a preliminary schedule of recommended uses for the principal buildings and structures that will be restored, rehabilitated, and/or reconstructed. (Sheds and other ancillary structures are omitted from this list, although they will form an integral part of the development and interpretation of the site.) This schedule may be adapted as appropriate as the communications and preservation strategies are further developed.

1,1A	Mill, Mill Deck	Operation and animation
2	Power Boiler	Operation
4	Millwright and Generator Building	Static display
6	Blacksmith Shop	Operation and animation
7	Bunkhouse	Static display
8	Cookhouse	Operation and animation
9	R.B. McLean House	Animation
13	Main Garage	Storage and display of operating equipment
14	A-Frame	Operation
14A	Log Dump	Operation
15	Machine Shop	Static display
18	Green Chain	Operation
19	Planer	Operation
20	Mill Office	Static display or mill operations centre
21	Arnold McLean House	Static display
22	Bookkeeper's House/Office	Static display
24	Millworker's House	Animation
25	Arnold McLean Garage	Static display or vehicle storage
26	Locomotive Shed	Storage and display of operating equipment
27	Loading Deck and Dip Tank	Static display
28	Root House	Static display
29	Machinery Shed	Static display

30	Sand House	Operation
31	Lumber Grader's Shed	Static display
39	Water Tower	Operation
43	Sawdust Bin	Operation
44	Scrap Burner	Operation
50	Boom Shack	Operation
59	Log Haul	Operation
60	Dam	Operation
61	Fish Ladder	Operation
62	Gin Pole	Operation
63	Bunkhouses	Visitor Services (possible washrooms)
64	Outhouses	Static display

Related Sites and Outreach Programs

The presentation of the forest-industry themes by the McLean Mill National Historic Site should be linked to other visitor and educational opportunities in the region that present these and related themes. These include a variety of facilities:

- Other visitor attractions in the Port Alberni Heritage Network.
- Visitor attractions with forest-related themes and other forest opportunities in the broader region, including those along the Island Highway (e.g. B.C. Forest Museum), Highway 4 (e.g. MacMillan Provincial Park), Pacific Rim National Park, Clayoquot Sound, demonstration forests, etc.
- School and post-secondary curricula relating to the history, geography, and economy of British Columbia.
- Public forums and programs that are concerned with issues relating to forests, the forest industry, the economy, and the environment (e.g. the

public debate on logging *vs.* conservation, the Commission on Resources and the Environment.

This should be achieved co-operatively by the McLean Mill N.H.S. and by the other relevant organizations. The McLean operation can do this in three ways:

- On-site, by means of interpretive panels and printed brochures or leaflets.

- Off-site, by an outreach program that is delivered through an ongoing series of public activities in the schools, community centres, Alberni Valley Museum, and other locations.

- Through co-operative marketing initiatives.

Marketing, including a discussion of target audiences, forms the subject of Chapter 6.

Recommendations

- A communications strategy should be developed as part of the ongoing planning process. The content of the presentation should develop from (and, in turn, inform) the nature of the resources, the commemorative intent and approved themes for the site, the mandates and objectives of the three partners in development, and the target markets.

- While site planning and development continue, interpreters or docents should be retained during the summer season, on either a paid or a volunteer basis, to conduct tours of the McLean site. Marketing should be done on only a limited basis during this period.

- The core site should be reserved for presenting themes represented by the McLean operation, and the VRC and the site periphery, and the other sites in the Network should be used to interpret the less site-specific themes of the broader forest industry in British Columbia.

- The presentation on site should include both personal and non-personal interpretive products.

- The presentation of themes and marketing initiatives should be linked with those of other, theme-related, visitor attractions and educational institutions in the region, and should be expressed in part through an outreach program.

- Provision should be made for presenting a portion of the non-personal interpretation in languages other than English and French. Consideration should be given to offering supplementary language services in Japanese, Cantonese, Punjabi, and German.

- Once the site development has been completed, an ongoing program of monitoring visitor satisfaction should be initiated, to ensure that the site is providing a positive experience.

5.2 Visitor Facilities and Amenities

Site development will include the provision of a number of visitor facilities and amenities on the site. New facilities will be constructed only on the periphery of the site, outside the core historic zone. The core will be reserved for the preservation and enhancement of existing resources.

The following is an indication of the new facilities that will be required. Sizes are estimated, based on the discussion of site capacity in Section 5.4. A functional program, prepared in conjunction with preliminary design, will determine functional requirements and sizes.

- A *Visitor Reception Centre,* located near the entrance to the site, will provide visitors with their introduction to the site and its themes. The facility, of about 5,000 sq. ft., will contain an audio-visual theatre (which will show an introductory multi-image presentation) and exhibit area (for a variety of displays and exhibits), as well as a lobby, secondary ticket sales point (the primary point is at the parking lot), souvenir and gift outlet, restaurant, washrooms, and first-aid station.

- A *facility for collections maintenance and storage,* which will contain space for a conservation workshop, artifact storage, and curatorial offices. This may be integrated into the VRC, or one or two separate facilities with easy access to the VRC for moving artifacts from one to the other. The maintenance space will require about 5,000 sq. ft., the climate-controlled storage about 2,500 sq. ft. (Although the Alberni Valley Museum could accommodate some of the uses of this facility, it is recommended that the facility be built at the site.)

- *Parking lot:* Until such time that the permanent point of arrival is established, a temporary parking area will be located on the western portion of the site. In the event that the western access remains as the permanent access, the parking lot and arrival point will be constructed near the west end of the site. Two potential sites appear feasible. One is just within the present boundaries (although the land is low-lying and will require considerable drainage and fill). The second site, and the preferred one, is on land adjacent to Smith Road and the proposed railway line from Port Alberni (the cleared residential property on the east side of Smith Road near the site entrance and just outside the present McLean Mill site). Compacted gravel parking should be provided for 125 automobiles, 25 RVs, and 5 buses. (This will accommodate about 500 visitors, 25% more than the typical peak load described in Section 5.4.)

- The *primary ticket booth* will be located adjacent to the parking lot. The ticket booth should contain *washroom facilities*. The intention is that arriving visitors, whether they have come by road or by rail, should buy tickets to the site at or near the parking lot, and have the opportunity to board the 2-Spot train for transportation to the VRC. Alternatively, visitors may walk the short distance to the site. (Rubber-wheeled transportation will be available for the physically challenged.) A secondary souvenir and gift outlet should be provided here. The building should be about 500 sq. ft.

- *Washrooms* should be situated at several locations: the primary ticket booth, the VRC, and a building within the core site.

- *Food services* should be provided on the site. It is recommended that there be a full-service cafeteria (and/or table-service restaurant) in the VRC. It is also recommended, subject to health, physical services, and resource impact considerations, that consideration be given to fitting up the Cookhouse (structure no. 8) as a limited-menu, fast-service, food facility offering a 'logger's lunch'. Consumption could be permitted in a controlled area(s) with picnic tables behind the Cookhouse and/or along Kitsuksis Creek, beyond the Bunkhouse (structure no. 7).

The design of any new buildings on the periphery of the McLean site should follow the *Guidelines for New Construction* on page 58 of the *Discussion Paper* (reproduced as Appendix E).

5.3 Utilities and Services

Utilities

The site will require water supply, waste water disposal, electrical power, and steam power.

There is no municipal water supply to the area near the McLean Mill site, nor is service foreseen in the near future. *Water* can continue to be taken from a higher point on Kitsuksis Creek., as at present, and gravity-fed to the site. Appropriate permits will be required. A filtration plant will likely have to be built at the site, to treat water for drinking and for the steam boiler. It is recommended that the Water Tower (structure no. 39) be reconstructed and used for water storage, and that water be pumped into it to ensure an adequate supply for the increased demand, particularly in summer. The Water Tower will also provide an effective visual landmark on the site. Additional water can be pumped from Kitsuksis Creek in the event of fire.

All water supply within the site should be provided by underground pipes. A series of fire hydrants or stand pipes should be provided. Although they be an anachronistic element within the site, their utilitarian need would warrant their use. They can be designed so as to be noticeable without being intrusive. Fire-fighters can supplement the hydrants by pumping water from the mill pond.

Waste water should be disposed through a septic system. An engineering study will be required to estimate the sewage needs, identify the most appropriate locations for septic tanks, and to determine whether additional treatment facilities will be required. Extreme care must be taken not to introduce any pollution into Kitsuksis Creek. An alternative would be to construct holding tanks and remove waste water on a regular basis under a maintenance contract.

Electrical power will be provided by B.C. Hydro service, as at present. Within the core site, overhead service should be restricted to approximate the distribution of poles at the close of the McLean operation. If additional service points are required, they should be provided by underground conduit. Overhead wires may be used along the periphery of the site, but should be kept inconspicuous so as to minimize their impact on the natural and cultural setting.

Steam power will be required for the operation of the mill. Detailed study will be required to determine which components of the boilers, fittings, and steam engine can be restored, and which will require replacement. As discussed in Section 4.3, all work (and operators) will have to meet the requirements of the Boiler and Pressure Vessel Safety Act and other regulations.

Other Services

A number of additional services will have to be considered in the detailed planning for the site.

Visitors with disabilities should be given the opportunity for liberal access to the site and its interpretive services. With respect to those with physical disabilities, buildings and structures should be made as accessible as is compatible with an acceptable impact on the cultural resources, using appropriate surfaces for paths and inserting ramps where practicable. If certain buildings must remain partially inaccessible because of their historical design, then alternative interpretive experiences should be provided as substitutes. All work should conform to federal and provincial standards for publicly-owned sites, and also to the provisions of the British Columbia Building Code. Consideration should be given to providing transportation through the site for visitors with physical disabilities.

With respect to visitors with perceptual, mental, and learning disabilities, the interpretive material should ensure that they are able to comprehend information sufficiently to derive a positive experience from the site.

Signage should be well designed and co-ordinated, so that directional, precautionary, and interpretive signs are distinguishable from each other, yet share a common style. Care should be taken to avoid a proliferation of signs, since this would have a negative impact on the appearance and historical authenticity of the site. The graphic design of signs should be co-ordinated with that used for printed materials and advertising, so as to develop a readily identifiable image for the McLean Mill site (rather than the standard graphics of Parks Canada). This design should be further co-ordinated with that for other attractions in the Port Alberni Heritage Network, so that each is identifiable while all retain a 'family resemblance'.

As the *Cultural Resource Management Policy* requires ongoing review and monitoring of activities that affect cultural resources and their presentation, provision should be made so that visitors to the site can provide *comments and feedback* on their experiences. This will help to ensure that management is kept informed about visitor reactions, and can make improvements to the programming as required.

5.4 Site Capacity

It is important that the number of visitors to the site not be so high as to have a negative impact upon the sustainability of the cultural and natural resources. To do so would be to violate the principles of environmental stewardship and the *Cultural Resource Management Policy*. Furthermore, it would simply be bad management, since it would lead to the destruction of the very resources that people have come to see and enjoy. Stated differently, the site should be designed to accommodate the projected number of visitors without causing harm to the cultural or natural resources.

Current projections anticipate that 141,000 people will visit the site in year 10 (see Section 6.2). It would therefore be appropriate to design for 150,000 visitors annually.

Existing (1989) market data for the Alberni-Clayoquot region indicates that 33% of resident visitation and 44% of non-resident (overnight) visitation occurs during the months of July and August. (See Chapter 6.) As the table indicates, 36% of all visitors came during July and August.

Visitors to Alberni-Clayoquot Region, 1989

	Total Visitors	Percent in Summer	No. in Summer
B.C. Residents	640,000	33%	211,200
Non-Residents	197,860	44%	87,058
Total	837,860	36%	298,258

By extrapolation, we may anticipate that 36% of the 150,000 visitors to the McLean Mill site, or 54,000 people, will visit during July and August. (School groups may, however, boost the shoulder seasons.) If evenly distributed over the nine weeks, this would result in 6,000 visitors per week during the summer season. If 20% come on Saturday and 20% on Sunday (and 12% each of the other five days), then a summer weekend day would attract 1,200 people. Assuming daily turnover is three times, it will be necessary to design for a load of *400 people being on the site at once.* (This number might be exceeded occasionally, as on the Canada Day and Labour Day weekends, and for occasional special events. Occasional overcrowding on site would be acceptable, but the parking lot must be built to accommodate the overflow.)

Detailed planning can avoid potential negative impacts by distributing the visitor load evenly across the site. This is done by creating nodes of interest in the different zones (i.e. the VRC, the residence area, the mill, the machinery and millpond area, the logging demonstration, the forest fringe trail, and the picnic area), and by adjusting the times at which animated activities occur at the different places. It is particularly important that visitors be attracted to the periphery, so as to relieve pressure on the core.

It is reasonable to assume that 400 people can be accommodated on the 32-acre (13-hectare) site without damaging the resources or overloading the services. However, it will be necessary to monitor the impact on a continual basis, and to take mitigative actions if required.

If deterioration occurs, or if visitation rises above 150,000 people per year, it might be necessary either to alter the design of the site (such as by widening paths and dispersing crowds with additional peripheral attractions), or to discourage visitation (as by raising admission fees, or requiring timed reservations). There will have been ample time to monitor the impact of the lower numbers on the resources, allowing management to plan for the best way to respond to the increased visitation. Should private automobiles become a problem, it may be appropriate to institute a good shuttle bus service from Port Alberni or to increase the capacity of the railway link.

6. MARKETS AND MARKETING STRATEGIES

6.1 Current Markets and Comparable Attractions

Description

The McLean Mill National Historic Site is located in the Alberni-Clayoquot/West Coast region of Vancouver Island. Within its boundaries are the communities of Port Alberni, Tofino, Ucluelet, and Bamfield. An estimated 200,000 non-B.C. residents, as well as an estimated 640,000 B.C.-resident overnight travellers visited the region in 1989, the most recent year for which reliable figures are available. (For Vancouver Island, excluding Victoria, the figures are 843,000 and 2.6 million respectively.)

Pacific Rim National Park, which covers nearly 50,000 hectares, is the region's biggest tourism draw. An estimated 500,000 to 600,000 visits to the park are generated annually because of its spectacular scenery and outdoor/recreational activities. The tourism industry of the Alberni-Clayoquot/West Coast region is focused on these activities in terms of services and promotions. There is a very limited tourism product of a heritage/historical nature. Visitor patterns reflect the supply of product accordingly.

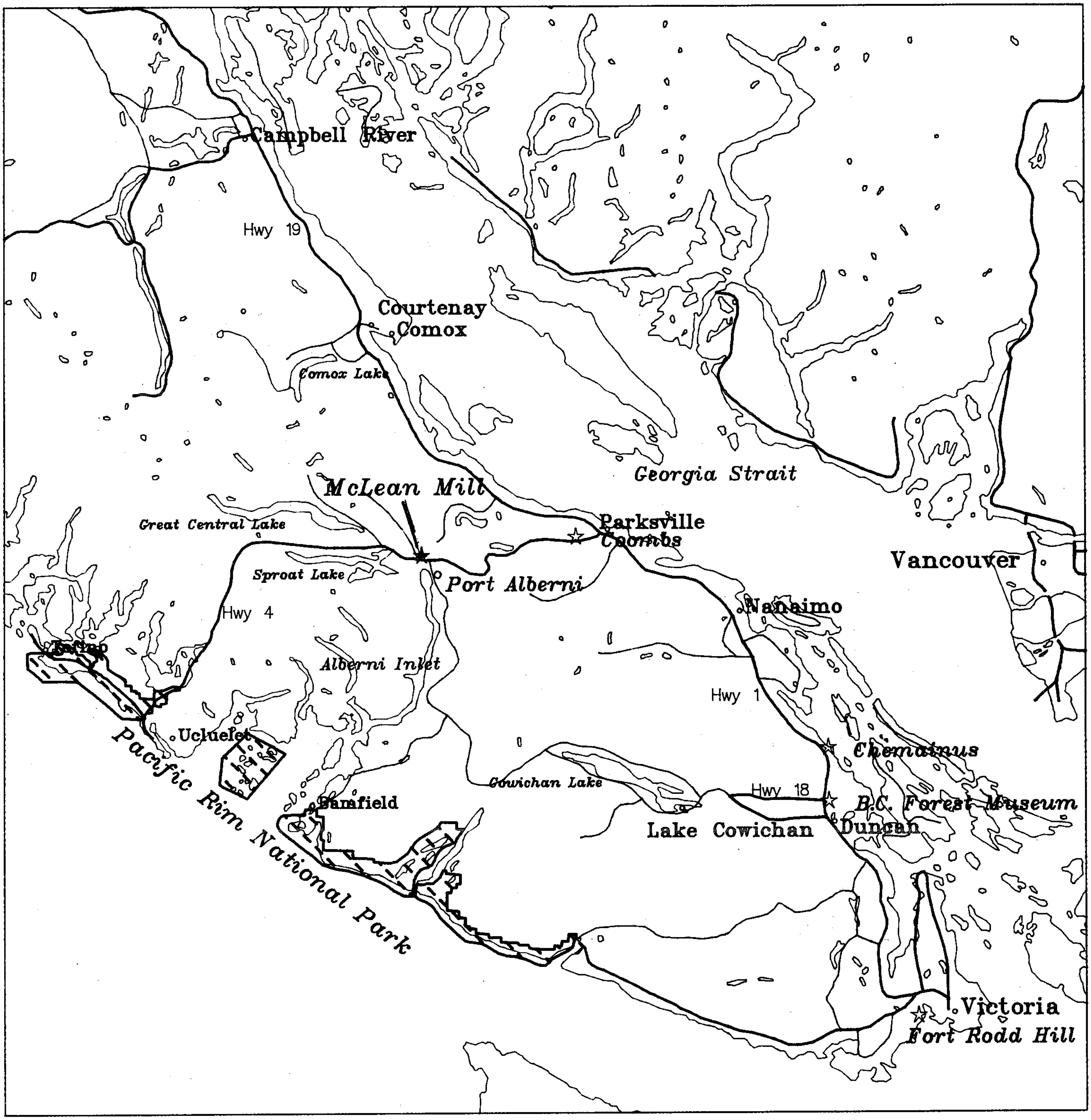
Research into the characteristics and travel patterns of resident and non-resident visitors travelling in the Alberni-Clayoquot/West Coast region has indicated the following. (The material below has been summarized from Chapter 2 and Appendix 1 of the *Interim Report*.)

B.C. Residents

- Residents most frequently travel to the region to visit friends and relatives (VFR) (38%), outdoor/wilderness (36%), and touring (13%).

- Families are an important segment (32%) and the majority are camping (42%).

- Seasonality of travel has become much more evenly spread throughout the year, largely as a result of promoting whale-watching.



Map of southern Vancouver Island, showing the principal tourism attractions.

Non-B.C. Residents (rest of Canada and international)

- Non-residents visit the region as part of a touring trip (48%), visiting friends and relatives (20%), and outdoors/wilderness (18%).

- Approximately 14% of this market visits museums/historical attractions in the region. This is reasonably strong, given the limited supply in the region.

- 22% of non-resident visitors are from overseas. Recent Tourism Canada surveys show a strong interest from overseas markets in heritage and cultural attractions.

Implications

- For the most part, the resident traveller is destination-oriented, with planned or scheduled outdoor/wilderness activities representing a significant proportion of activities. Market potential lies in capturing benefits of the VFR market to the region and outlying areas such as Parksville and Nanaimo.

- Developing 'rainy-day' activities will appeal to the outdoor recreationist market, as well as families. Children and family programs will also be an important draw for the latter group.

- The potential may exist to develop year-round programming or, at a minimum, for three seasons.

- The non-resident is more dependent on visitor information and commercial tourism services, so strong linkages with the travel trade are recommended.

- 48% of non-resident visitors are on a touring vacation. Since non-resident visitation of heritage attractions is high in areas which offer high-quality products (e.g. 35% in Victoria), there is potential for a significant heritage attraction in the Alberni region to meet this interest. Therefore a high quality and well-interpreted heritage attraction could capture a share of this market.

The West Coast and Pacific Rim National Park comprise a world-class attraction appealing to local, regional, national, and international travellers. Only highly unique and excellent quality products are likely to have a significant effect on otherwise well-established travel patterns in the region. Existing travel patterns and preferences suggest that, properly developed and marketed, the McLean Mill site could attract significant numbers of visitors and Port Alberni has the potential to receive significant tourism spin-offs.

Other Attractions

Port Alberni acts primarily as an information and service centre, or a 'pass-through' altogether, for destination-oriented travellers on their way to the Pacific Rim area.

The regional attractions studied for the purpose of comparison to the McLean Mill site are primarily located along Highway 4, between Parksville and the West Coast. They are:

	Estimated Visitor Volume
Alberni Harbour Quay	150,000
MacMillan Bloedel Interpretation Centre	30,000
Alberni Valley Museum	25,000
Robertson Creek Fish Hatchery	20,000
MV Lady Rose	15,000
Coombs Highway Attractions	500,000
Butterfly World, Coombs	80,000
B.C. Forest Museum	73,000
Chemainus Murals	200,000
Royal British Columbia Museum, Victoria	800,000
Fort Rodd Hill, near Victoria	120,000

(A detailed review of these and other attractions in and near the study region is contained in Appendix 1 of the *Interim Report*. In addition, eleven comparable industrial heritage attractions across North America have also been studied. Detailed analysis and review are contained in Chapter 3 and Appendix 2 of the *Interim Report*.)

ALBERNI
HARBOUR QUAY
RESOURCE MANAGE
Pacific Rim
a self-guided forest tour
EXPERIENC
M.V. LADY ROSE
Alberni Valley Museum
PORT ALBERNI
Vancouver Island
British Columbia
CANADA
ROYAL BRITISH COLUMBIA MUSEUM
The Western Vancouver Island Industrial Heritage Society and The Alberni Valley Museum present the
TWO-SPOT
Environment Canada
Environnement Canada
Parks
Parcs
Fort Rodd Hill
National Historic Park
Victoria, British Columbia
he many faces of
Chemainus

Clearly a product gap exists on Vancouver Island for a significant heritage attraction of high quality. The McLean Mill site can potentially fill this need if planned in a manner that will achieve:

- a first-rate, top-quality visitor attraction
- broad market appeal to all visitor segments
- strong visitor enthusiasm through an interactive/participatory visitor experience
- active marketing and promotions
- central Vancouver Island focus of activity
- ongoing community and regional support

The McLean Mill site has the potential to change existing travel patterns by increasing visitation to the region and lengthening visitor stays, and possibly increasing the visitor volumes currently being attained by other community and regional attractions in the Alberni-Clayoquot/West Coast region. While the McLean Mill site would be a significant attraction in itself, its greater role would be to strengthen the tourism product of the region, helping to make the collective sites into a major destination attraction.

Recommended Actions

- The McLean Mill site should be developed as a high-quality visitor attraction, with a wide range of animated programming that appeals to all visitor segments. This presentation must be compatible with protection of the resource and fulfilment of the commemorative intent.

- An active program of marketing and promotion should be maintained, and should be co-ordinated with other attractions and tourism businesses in Port Alberni, the region, and Vancouver Island.

- A high level of community and regional support should be attained by involving the participation of area communities in planning, developing, and operating the site.

6.2 Target Markets and Market Projections

Target Markets

A number of identifiable visitor groups will visit the McLean Mill site. Pending development of a communications strategy, it is anticipated that the following will comprise the key market segments. They are listed, with an indication of some of the market strategies applicable to each.

- *Touring*. Travellers who are on Vancouver Island for a touring holiday are likely to be interested in cultural and heritage attractions. They will be receptive to travel touring guides and literature, advertising, signage, and local word-of-mouth. This is the only segment in which there are more non-B.C.-residents than residents, and so advertising should be targeted to attract them. Signage along the Island Highway and Highway 4 will be important, as will a conspicuous visitor centre in Port Alberni along Highway 4. This segment will make the largest purchases from the gift shop. There may be additional potential for marketing support from municipal, provincial, and federal tourism organizations, since encouraging visitors to spend an extra day or two in the region will have a considerable impact on the overall economy.

- *Outdoor/Adventure*. Generally speaking, people seeking an outdoor or adventure experience visit cultural sites less often than the touring market. However, they form a large segment and there is potential to tie in with existing travel patterns, given the attraction will be a 'must-see' and will be convenient to visit. Many outdoor/adventure travellers to the West Coast are headed to the Pacific Rim National Park area. Forest and environmental themes are likely to interest them, as is the knowledge that a visit to the McLean Mill site can be combined with hiking in the forest in the Beaufort Range. A very large proportion are B.C. residents and the majority travel in their own vehicle.

- *Visiting Friends and Relatives (VFR) and Personal*. The important VFR market is reached by generating interest among local and regional residents (the next category of visitor) in the McLean Mill site, because residents will recommend attractions to their visitors and many will visit the attractions together with them. This market is most likely to go where residents go.

- *Day-Trippers*. These are the local and regional residents referred to in the previous item. They are best attracted by a high-quality development with changing on-site activities and exhibits, by a meaningful outreach program, and by an awareness program developed in co-operation with other attractions in the Port Alberni Heritage Network, local business interests, and special-interest groups (such as seniors' organizations). The program should encourage new and repeat visitation.

- *Education/Schools*. Regular visits to the McLean Mill site should become a part of the school and college programs. This can be achieved by linking interpretive themes with the school curricula in history, geography and economics, maintaining an outreach program in the schools, offering participatory experiences, providing separate spaces for classes to congregate and talk, and convincing educational authorities of the educational values of a visit. Most school groups make visits in May and June. Students in technical courses in the colleges may be attracted by providing restoration-related opportunities.

- *Workers in the Forest Industry*. It is important to make this segment aware of, and encourage it to visit, the McLean Mill site. It is equally important to encourage people who are not associated with the industry.

Market Projections

The following are the market projections for the McLean Mill site. They assume that development will occur as described in Chapter 3.

The market for the McLean Mill has been segmented into *resident and non-resident tourists or travellers; daytrippers* from within the region, which is defined to include Port Alberni, Tofino, Ucluelet, Nanaimo and the Parksville/Qualicum area; and *school groups*. The travel markets based on origin are further segmented based on purpose of trip.

The most recent tourism data (termed 'actual' in the analysis) is from 1989. Conservative growth estimates have been forecast for each market segment, based on available data as well as communication with industry contacts. Notably, due to the recession of the early 1990s, no growth is projected for the resident market until 1993, at which point it is slow at only 1% per annum. In the case of the non-resident travel market, growth is similarly conservative at 1%, with the exception of the outdoor/adventure market, which is considered the strongest and has a projected rate of growth of 2% per annum.

The size of the day-tripper and school markets is based on census population and school enrolment data. The projected rate of growth is influenced by the high rate of migration to the area, particularly among the coastal communities.

All markets are projected forward to the year 1997, which is anticipated to be Year One for the project. Segment-by-segment 'capture rates' to the McLean Mill site have been estimated based on the needs, characteristics, and interests of each.

A forecast of annual visitation (Year 1), by segment, is derived accordingly. Upon opening, it is assumed that each segment will continue to be strengthened annually for at least each of the first five years as a result of both overall growth in the region and the interest generated by the attraction. However, after that time, unless a significant new component is added to the site, annual visitor growth will slow to the rate of regional growth.

The assumptions are considered reasonable and conservative, given that the attraction developed will meet the standards and criteria set out in Section 3. Furthermore, a commitment to the long-term successful development and operations of the facility is considered essential. Specifically this includes:

- Creation of a first-class destination attraction which meets the changing needs and interests of the travelling public, regional resident market, and educators

- A focus on exhibit development that incorporates interactive/participatory and educational visitor experiences

- Ongoing liaison with the Port Alberni community and Heritage Network, regional and island tourism industry attractions, services and facilities, associations, and government agencies

- Highly targeted and effective marketing and promotions activities

McLEAN MILL MARKET ANALYSIS

Regional Forecast Assumptions by Market Segment

Resident Tourist:
0% for all segments to 1992
1% for all segments after 1992

Non-Resident Tourist:
1% annually for all segments except outdoor/adventure
2% annually for outdoor/adventure

Day-Trip:
3% annually for regional area population
3% annually for schools

Regional Forecast by Market Segment

Market Segment	1989 (Actual)	1990 (Est.)	1991 (Est.)	1992 (Est.)	1993 (Est.)	1994 (Est.)	1995 (Est.)	1996 (Est.)	1997 (Est.)
Resident Tourist:									
Touring	83,200	83,200	83,200	83,200	84,032	84,872	85,721	86,578	87,444
Outdoor/Adventure	230,400	230,400	230,400	230,400	232,704	235,031	237,381	239,755	242,153
VFR/Personal	243,200	243,200	243,200	243,200	245,632	248,088	250,569	253,075	255,606
Other	83,200	83,200	83,200	83,200	84,032	84,872	85,721	86,578	87,444
Total Resident Tourist	*640,000*	*640,000*	*640,000*	*640,000*	*646,400*	*652,864*	*659,393*	*665,987*	*672,646*
Non-Resident Tourist:									
Touring	96,000	96,960	97,930	98,909	99,898	100,897	101,906	102,925	103,954
Outdoor/Adventure	36,000	36,720	37,454	38,203	38,968	39,747	40,542	41,353	42,180
VFR/Personal	52,000	52,520	53,045	53,576	54,111	54,653	55,199	55,751	56,309
Other	16,000	16,160	16,322	16,485	16,650	16,816	16,984	17,154	17,326
Total Non-Resident Tourist	*200,000*	*202,360*	*204,751*	*207,173*	*209,627*	*212,113*	*214,631*	*217,183*	*219,768*
Day-Trip:									
Area Population	150,650	155,170	159,825	164,619	169,558	174,645	179,884	185,280	190,839
School Population	28,400	29,252	30,130	31,033	31,964	32,923	33,911	34,928	35,976

McLEAN MILL MARKET ANALYSIS

McLean Mill Base Year (1997) Market Capture Rate Assumptions by Market Segment

Resident Tourist:
15% Touring
5% Outdoor/Adventure
15% VFR/Personal
2% Other

Non-resident Tourist:
15% Touring
5% Outdoor/Adventure
15% VFR/Personal
1% Other

Day-Trips:
8% Area Population
26% School

McLean Mill Base Year (1997) Visitation Forecast by Market Segment

Resident Tourist:
13,117 Touring
12,108 Outdoor/Adventure
38,341 VFR/Personal
1,749 Other

Non-resident Tourist:
15,593 Touring
2,109 Outdoor/Adventure
8,446 VFR/Personal
173 Other

Day-Trips:
15,267 Area Population
9,354 School

116,257 Total

McLean Mill Visitation Forecast Assumptions by Market Segment
(This assumption is the percent increase (decrease) in growth over the base year capture rate for the first five years.)

Resident Tourist:
2% Touring
1% Outdoor/Adventure
2% VFR/Personal
1% Other

Non-resident Tourist:
3% Touring
1% Outdoor/Adventure
2% VFR/Personal
1% Other

Day-Trips:
1% Area Population
3% School

McLEAN MILL MARKET ANALYSIS

McLean Mill Visitation Forecast by Market Segment

Market Segment	Base Year	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Resident Tourist:										
Touring	13,117	13,513	13,921	14,341	14,774	14,922	15,071	15,222	15,374	15,528
Outdoor/Adventure	12,108	12,351	12,599	12,852	13,111	13,242	13,374	13,508	13,643	13,780
VFR/Personal	38,341	39,499	40,692	41,920	43,186	43,618	44,055	44,495	44,940	45,389
Other	1,749	1,784	1,820	1,856	1,894	1,913	1,932	1,951	1,971	1,990
Total Resident	*65,314*	*67,146*	*69,032*	*70,971*	*72,965*	*73,695*	*74,432*	*75,176*	*75,928*	*76,687*
Non-resident Tourist:										
Touring	15,593	16,222	16,875	17,555	18,263	18,445	18,630	18,816	19,004	19,194
Outdoor/Adventure	2,109	2,173	2,238	2,306	2,376	2,423	2,471	2,521	2,571	2,623
VFR/Personal	8,446	8,701	8,964	9,235	9,514	9,609	9,705	9,802	9,900	9,999
Other	173	177	180	184	188	189	191	193	195	197
Total Non-Resident	*26,322*	*27,272*	*28,258*	*29,280*	*30,340*	*30,667*	*30,998*	*31,332*	*31,671*	*32,013*
Day-Trips:										
Area Population	15,267	15,882	16,522	17,188	17,881	18,417	18,970	19,539	20,125	20,729
School	9,354	9,923	10,528	11,169	11,849	12,205	12,571	12,948	13,336	13,736
Total	**116,257**	**120,225**	**124,340**	**128,608**	**133,035**	**134,984**	**136,971**	**138,996**	**141,061**	**143,166**

6.3 Economic Diversification

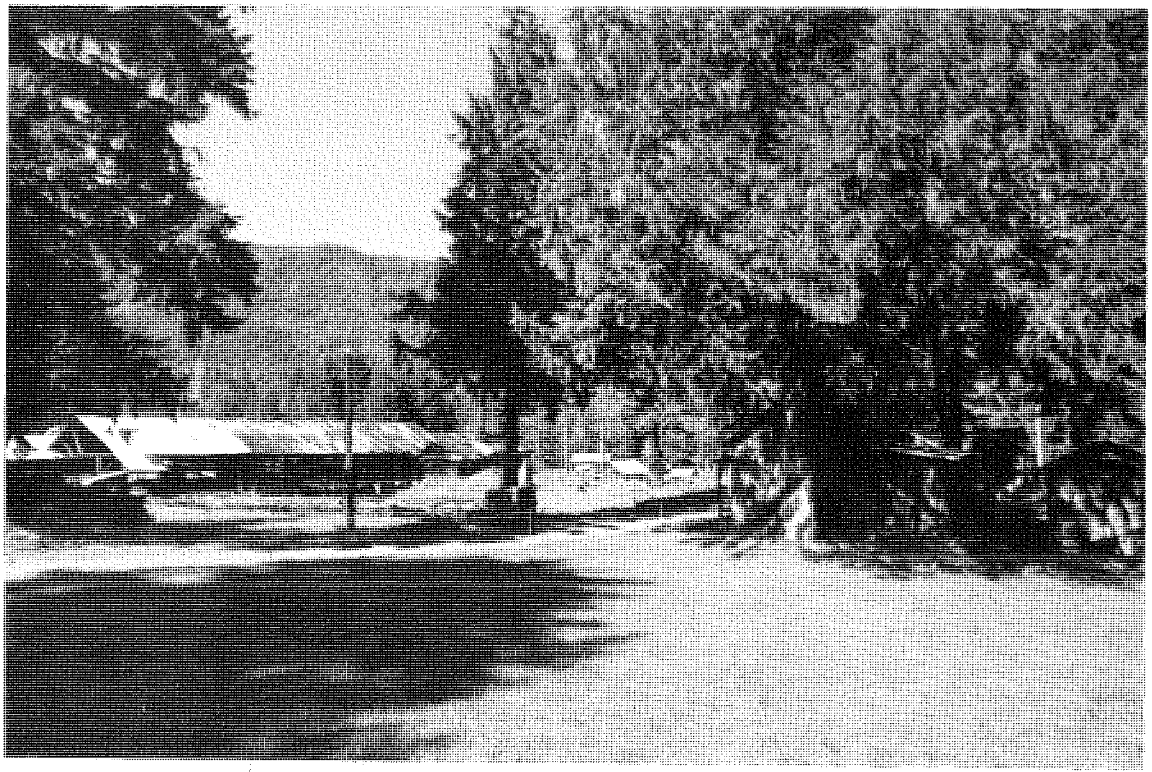
The historical dependence of the Alberni Valley on the forest industry, which created the McLean operation, has made the region vulnerable to economic cycles. Current trends suggest a long-term weakening of the industry, with the consequent loss of much forest-related employment. Port Alberni has recognized this trend, and is making efforts to diversify the economic base. Economic diversification forms a key municipal objective for the development of the McLean Mill site.

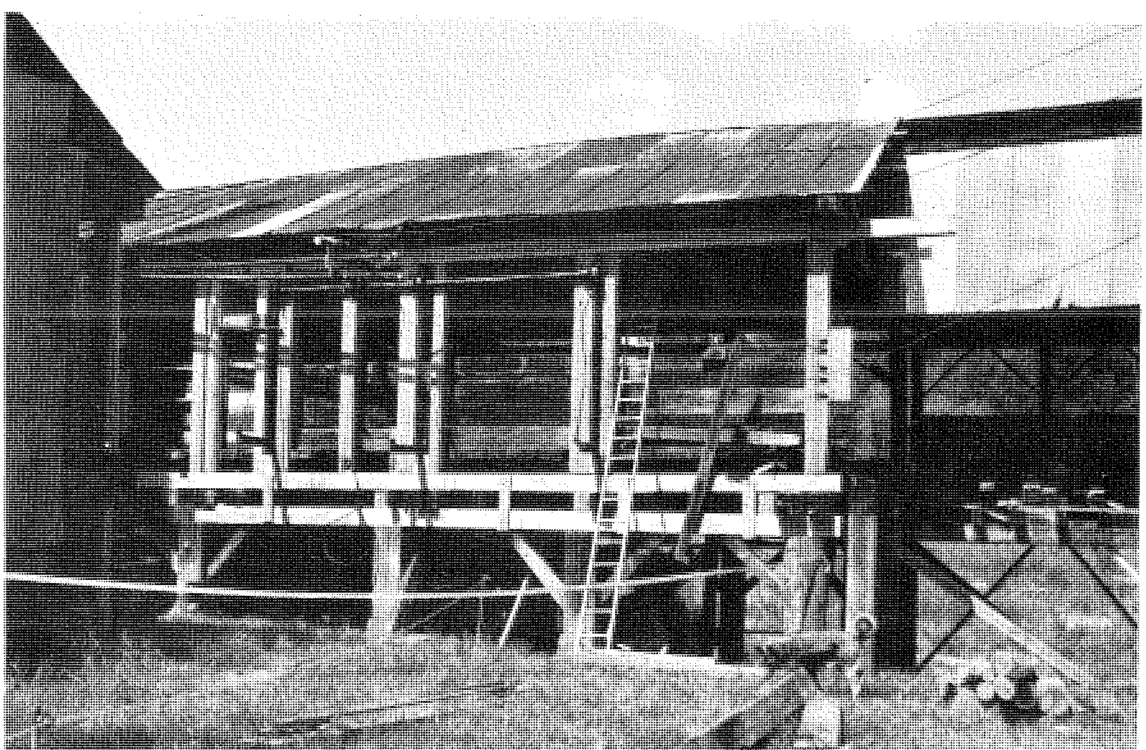
The economic impact of the McLean Mill site will occur in several ways. Development of the site will create *direct employment and wage income* in the construction industry sector. A significant portion of this direct construction income will be re-spent locally, with additional *employment and income spinoff* for local residents. Once it opens, the McLean Mill site will create additional direct employment for staff. A portion of this staff income will also be re-spent in the region, incurring *induced income and employment* in regional businesses. *Visitor expenditures* will include money spent at the site (for admission, purchases, services, and special events) and elsewhere in the region (for accommodation, food, and incidental purchases); and these expenditures will in turn have a further *income and employment impact*.

Operation of the site will also have a positive social and cultural impact in the area. Port Alberni is already a community with many cultural and recreational amenities, as well as a strong contingent of volunteers for community activities. The McLean Mill site will provide additional educational and cultural opportunities for residents in many ways, including training and upgrading local staff, special events, outreach programs, and activities shared with the Alberni Valley Museum, the schools and colleges, and other existing institutions and organizations.

Recommended Action

- Consideration should be given to doing an economic impact study of the McLean Mill development. This would quantify the benefits of the project to the region.





Two views of the sawmill, from the distance (top) and close up, showing the stabilization work (bottom).

7. LOCAL AND REGIONAL INTEGRATION

7.1 Planning and Jurisdictional Issues

Description

The McLean Mill National Historic Site occupies 32 acres (13 hectares) of land that is the property of the City of Port Alberni. It was donated to the City by MacMillan Bloedel Limited, which retains ownership of much of the surrounding forest.

Planning for the development of the McLean Mill site requires co-ordination among a number of jurisdictions and levels of government. The Management Plan itself has involved three parties: the City of Port Alberni, the Provincial government through the British Columbia Heritage Trust, and the Federal government through Parks Canada. Although owned by the City of Port Alberni, the site is located outside its boundaries, in the Regional District of Alberni-Clayoquot, and falls within the Beaufort Official Settlement Plan Area.

The Beaufort Official Settlement Plan was prepared and adopted by the Regional District in 1982 and therefore does not anticipate the development of the McLean Mill site as a cultural heritage attraction. The plan identifies the mill as Forest Related Industry. The area to the north and east of the mill are categorized as Existing Farm, to the south and west as Acreage Residential, and immediately adjacent to Kitsuksis Creek as Environmentally Sensitive. Given the change in use that the McLean Mill development represents, a Plan amendment, probably to a new category of land use would be appropriate.

The Regional District of Alberni-Clayoquot is also responsible for planning of the road network in and around McLean Mill site. The Beaufort Area Settlement Plan and the plan for the adjacent Beaver Creek Settlement Area identify two planned future roads of particular interest: a new east-west route intersecting with Beaver Creek Road and passing immediately south of the mill along the southern edge of Lot 106; and another new road at the foot of the Beaufort Range, running generally parallel to Beaver Creek Road. The development of McLean Mill site should be factored into the planning of the future road network in this area, taking into consideration both the concerns of nearby residents regarding increased traffic and the long-term needs for additional road capacity in the Regional District.

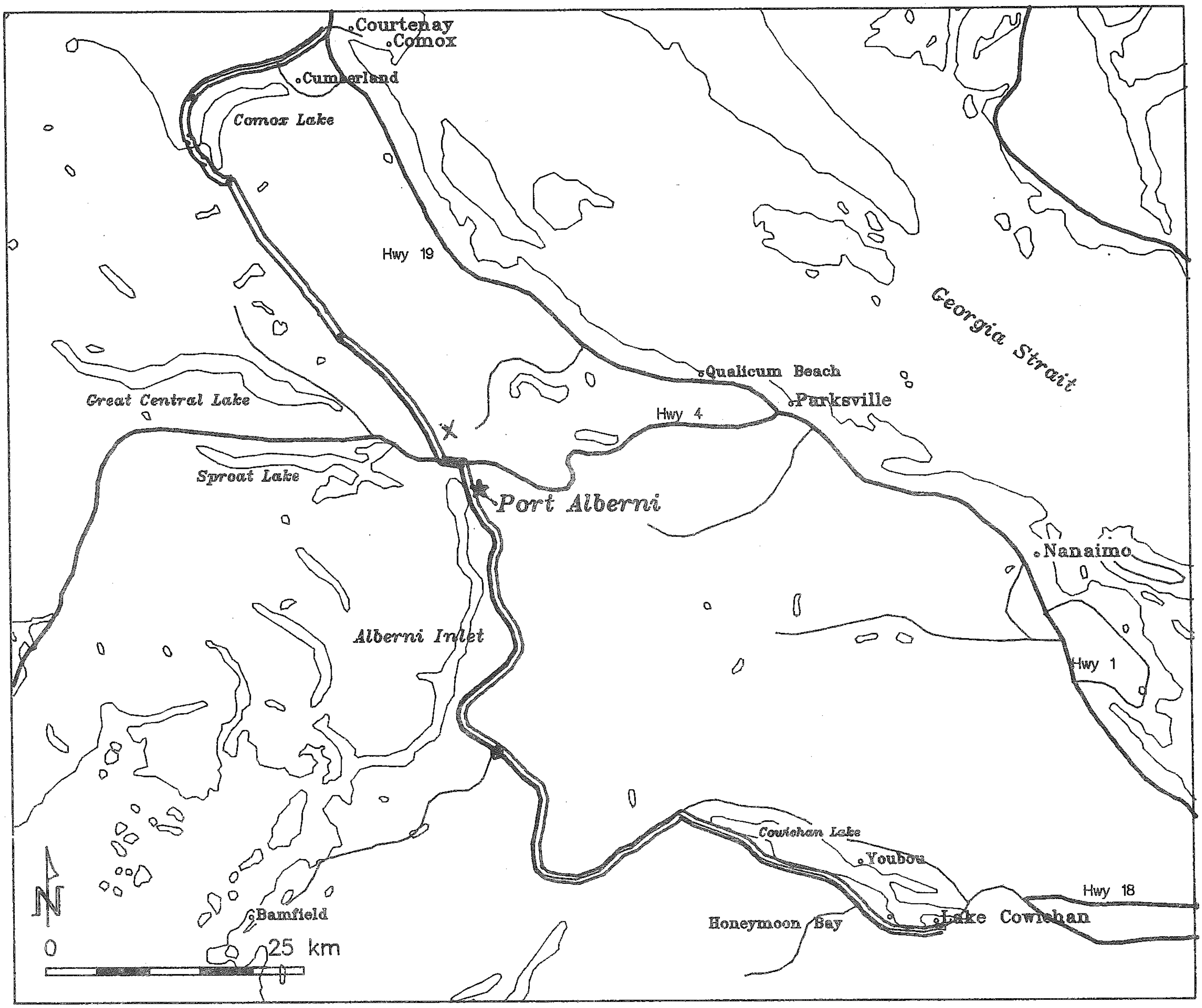
It has been proposed that a new 'Three Valleys Highway' (or 'Valley Link') be constructed to link the Comox, Alberni, and Cowichan valleys, running from Courtenay and Comox, through Port Alberni, to Lake Cowichan and Duncan. Preliminary location studies have been underway for some time. The two planned roads mentioned above have been suggested as possible alignments for the highway in the Port Alberni region. Should the highway be located in the vicinity of the McLean Mill site, it is important that proper access be provided between it and the site. This would also create a large volume of drive-by traffic in the immediate area, which would increase the visitation.

About one-quarter of the McLean Mill site lies within the Agricultural Land Reserve. The ALR area which overlaps the site is substantial in size and encompasses the Kitsuksis Creek drainage both upstream and downstream from the mill. The implications of this land status on the plans for site development has been reviewed with the Agricultural Land Commission.

Recommended Actions

- An amendment to the Beaufort Official Settlement Plan should be requested from the Regional District of Alberni-Clayoquot, changing the category of land use for the site to represent its use as a cultural heritage attraction, and addressing such other issues as may be appropriate.

- The development of the McLean Mill site should be considered in planning the future road network in the area, including regional roads and the proposed provincial 'Three Valleys Highway'.



The proposed Three Valleys Highway is indicated by the heavy line linking Courtenay and Lake Cowichan.

7.2 Port Alberni Heritage Network

Description

The City of Port Alberni has been an enthusiastic proponent of the McLean Mill site development, in large part because of the role it will play in augmenting the network of heritage attractions in the community. People in Port Alberni have been working to develop a number of heritage resources into tourist attractions with the result that the city now offers a wide variety of tourism opportunities. Introduction of the mill as a heritage destination is anticipated to benefit all the existing sites by drawing visitors in greater numbers and from greater distances.

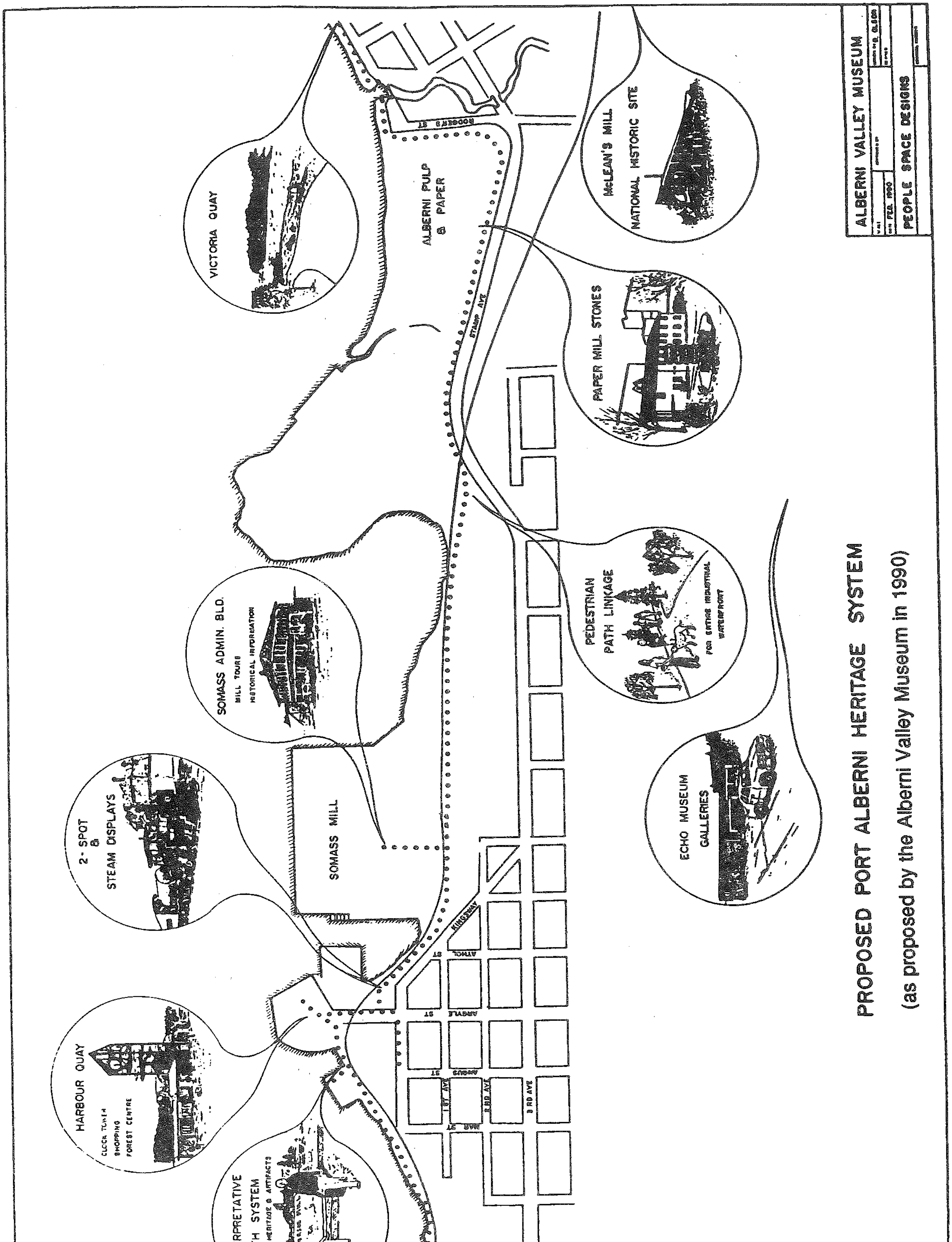
The Alberni Valley Museum's report, *Heritage 1990*, set out the objectives and components of the Port Alberni Heritage Network (or 'System'). These heritage-related attractions in Port Alberni will support and strengthen each other. The principal sites that together comprise this network are:

- The *Alberni Valley Museum*, with its collections relating to community history and Native crafts and artifacts, travelling exhibits on a variety of topics, and its archival and educational functions.

- The recently restored *E & N Railway Station*, built in 1912, with its displays interpreting Port Alberni's railway heritage. The station is planned to be used as a display facility, perhaps to exhibit a part of the Alberni Valley Museum's Forest Industrial Collection.

- The *2-Spot steam train*, which supports the interpretation of the railway station and offers excursion rides for residents and visitors.

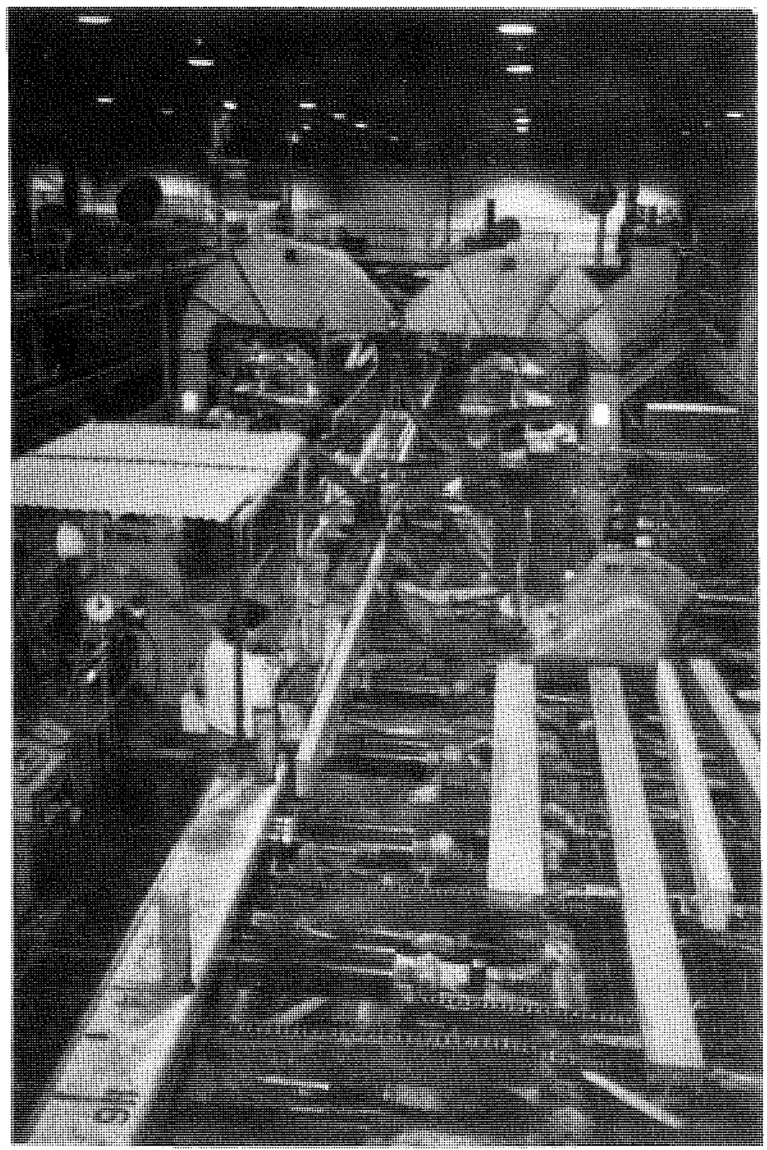
- The *Alberni Harbour Quay*, which features interpretive signage of the historic operation of the industries along the waterfront and a Forestry Visitor Centre sponsored by MacMillan Bloedel. This site is also a vantage point from which the activities of the port and several mills can be observed. The historic coastal freighters, the *M.V. Lady Rose* and the *M.V. Francis Barkley*, dock on a nearby wharf and offer visitors day excursions to the small communities along Alberni Inlet and Barkley Sound.


PROPOSED PORT ALBERNI HERITAGE SYSTEM
(as proposed by the Alberni Valley Museum in 1990)
ALBERNI VALLEY MUSEUM
FEB. 1990
PEOPLE SPACE DESIGNS
VICTORIA QUAY
ALBERNI PULP & PAPER
McLEAN'S MILL NATIONAL HISTORIC SITE
PAPER MILL STONES
SOMASS ADMIN. BLD.
MILL TOURS
HISTORICAL INFORMATION
PEDESTRIAN PATH LINKAGE
2-SPOT & STEAM DISPLAYS
SOMASS MILL
ECHO MUSEUM GALLERIES
HARBOUR QUAY
CLOCK TOWER
SHOPPING
FOREST CENTRE
INTERPRETATIVE PATH SYSTEM
INDUSTRIAL HERITAGE & ARTIFACTS
STAMP AVE
KINGSWAY
ATHOL ST
ARGYLE ST
ANGUS ST
1ST AVE
2ND AVE
3 RD AVE

The Alberni Harbour Quay and the MacMillan Bloedel Forestry Visitor Centre (top), and the restored E & N Railway Station (bottom).

- A *pedestrian interpretive path system* along the harbourfront, with interpretive signage links several of the heritage and tourism destinations along the waterfront and integrates them into a self-conducted walking-tour opportunity.

- The *contemporary mills* of MacMillan Bloedel Limited offer tours to visitors and complement the attractions that interpret the history of the forest industry with a look at present-day milling operations.



The highly automated Alberni Pacific Division mill of MacMillan Bloedel.

The establishment of a visitor reception centre in Port Alberni would considerably facilitate the communication of information about the Port Alberni Heritage Network (and the McLean Mill site). The present Travel InfoCentre does not attract enough visitors to fulfil this function. Several sites for a new centre have been suggested, including Alberni Harbour Quay. The site with the highest visibility to travellers would be the present offices of the Regional District of Alberni-Clayoquot (originally built as the Alberni Municipal Hall) at the foot of Johnston Street, which will soon be vacated. It is located conspicuously on the axis of Highway 4, as cars from Parksville descend the hill, at the point where they would turn to go to Pacific Rim National Park. The site has space for parking and could be linked to other harbour attractions by a small ferry, as has been proposed in the Port Alberni Shoreline Masterplan.

Recommended Action

- The City should co-ordinate (or manage) joint promotion of the Alberni heritage attractions. This may include integrating initiatives such as co-ordinated signage, printed materials, and ticket sales. These efforts should enhance the visitation rates for all of the attractions.

7.3 Public Involvement

Description

The community of Port Alberni is remarkably active and participatory. The people who attended the open houses and stakeholder interviews, which were part of the study process for the Management Plan, expressed almost universal support for the development of the McLean Mill site and for the intensification of Port Alberni's heritage tourism base. A summary of opinions expressed in those consultations is found in Appendix 4 of the *Interim Report*, and a tabulation of the responses to the questionnaire at the public open houses is contained in Appendix D of the present report. These opinions have been listened to carefully, and many have influenced the subsequent decision-making and the content of this Management Plan.

The concept for developing the McLean Mill site has been supported by the efforts of the members of the Western Vancouver Island Industrial Heritage Society, who have been active in the direction of the Management Plan study by participating in the Steering Group. The Society has spent considerable effort, over the span of several years, restoring equipment to produce the operational railway and trucking equipment, all of which will play an important role in the interpretation of the McLean Mill site.

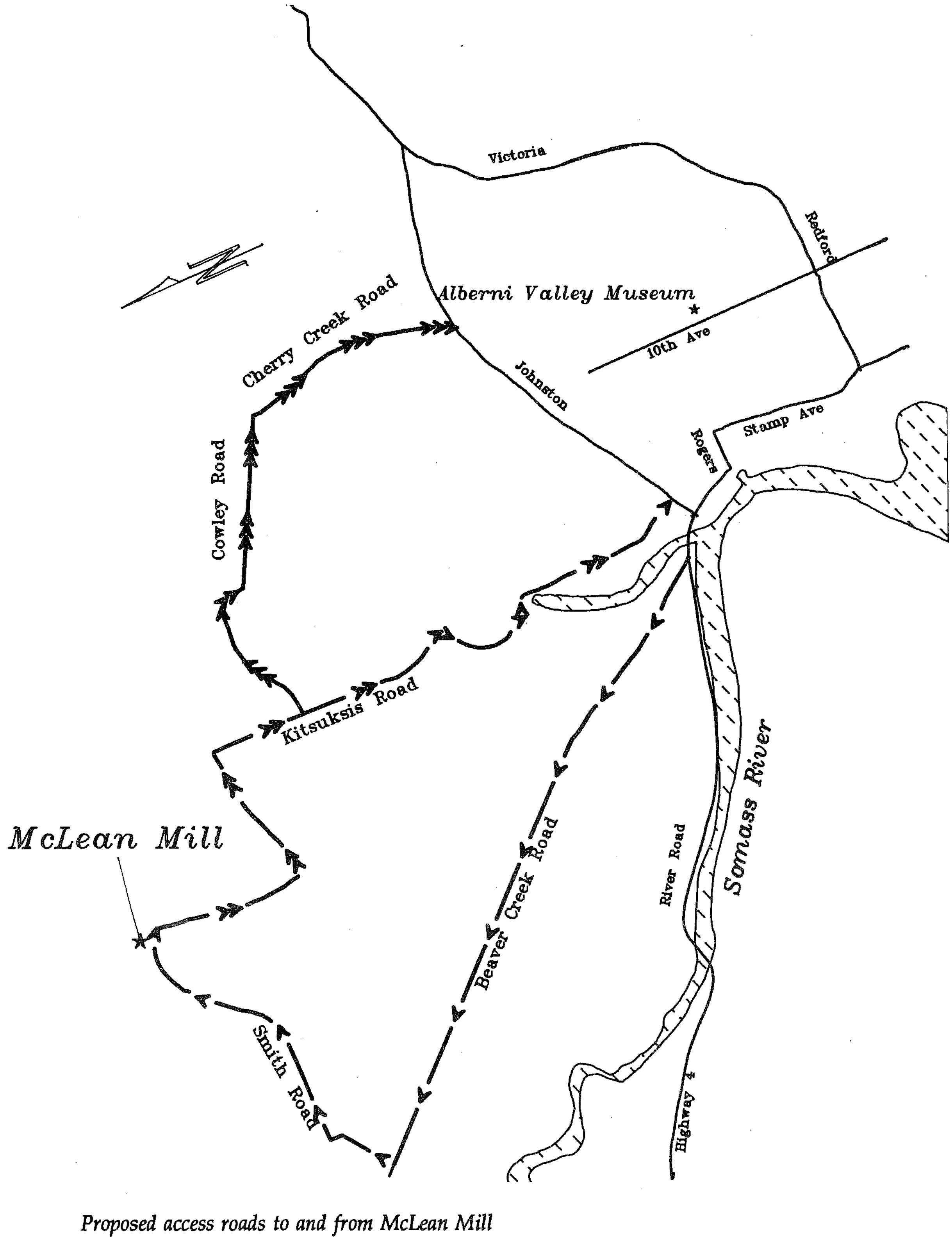
Other community groups have shown an interest in the proposed development, and have expressed their support and opinions through the public interview and meeting process. The people who have been consulted are identified in Appendix F.

Continued community involvement and ongoing support from the Western Vancouver Island Industrial Heritage Society and other organizations will be essential to the successful development and operation of the McLean Mill site. Already some volunteers are working on site, under the direction of City staff, to maintain and stabilize site resources. Volunteers are also active in the cataloguing of the site's archival resources. More volunteers will be needed to assist in the operation and interpretation of the site as development proceeds. This is a community project that must continue to deserve community support.

Recommended Action

- The City of Port Alberni and its development partners should continue to encourage the interest and support of community volunteers in all stages of development and operation of the McLean Mill site.

- Consideration should be given to forming a 'friends' organization that will provide ongoing support through volunteer effort and fundraising.



Proposed access roads to and from McLean Mill

7.4 Access

Description

There will be three ways to reach the McLean Mill site: by road, by rail, and by trail.

Road Access

Three roads lead from downtown Port Alberni to the McLean Mill site: Smith Road, Kitsuksis Road, and Cherry Creek Road. All three routes are approximately equidistant. In addition, there is the potential for new major roads in the area.

A key area of concern with regard to the development of the McLean Mill site is the potential negative impact on area residents from the expected greatly increased traffic levels. Planning site access requires a process that will address the concerns of neighbours, the planning intentions of the Regional District and the Provincial Highways Branch, the needs of visitors for clearly marked (and reasonably direct) access, and the access requirements inherent in the McLean Mill site plan.

The route along Beaver Creek Road and Smith Road has been the access route of choice, and should remain so. It is the most direct, has proportionately more of its route along a straight and major road (Beaver Creek Road), and requires the fewest turnings. Widening Smith Road is not desirable, because many of the existing houses are close to the road allowance. Therefore access planning should attempt to maximize arrivals in groups, rather than in single-family automobiles or RVs, in order to reduce the traffic impact. This can be achieved by running shuttle buses from downtown Port Alberni, and by supplementing rubber-tired traffic with the railway (see below). Nevertheless, a large percentage of visitors will resist grouping efforts. Another means of reducing traffic would be to direct visitors to exit the site along an alternative route, either Kitsuksis Road or Cherry Creek Road. Signage could be one-directional, serving only those who are driving towards Port Alberni.

Should the Region or the Province develop a new regional road and/or the Three Valleys Highway in the area, access routes will have to be re-planned as needed.

A long-term development objective is to enter the site from the east, near the present barn. In this event, a new road would have to be cut through from Smith Road (a short distance north of the present entrance) to the barn area. The best route would appear to be the former rail right-of-way, which is reasonably level and has been graded in the past.

Parking will be provided in a lot located near the entrance to the site. Private vehicles may not proceed further. Only service and emergency vehicles, and special vehicles for visitors with disabilities, will be permitted on the core site.

Rail Access

An alternative means of reaching the site will be by rail, along the Esquimalt & Nanaimo Railway tracks. The first portion of the route from Port Alberni is tracked with siding required to be constructed into the McLean Mill site. Permission for its use will have to be obtained from CP Rail. Once completed, it is intended that trains operate regularly between the Port Alberni Station and the McLean Mill site. This will provide visitors with an enjoyable journey, and will also form a very appropriate introduction to site interpretation.

The completion of the rail line from Port Alberni and the operation of the trains are not included as part of the site development for the McLean Mill National Historic Site. The project may be undertaken by other agencies, such as the Western Vancouver Island Industrial Heritage Society. It would contribute substantially to tourism development in Port Alberni, and to the McLean Mill site in particular. The McLean Mill National Historic Site management should co-operate with the Society, the City, and others in achieving this objective, and in marketing the service when it becomes available.

It is intended that travel between the City and a point near the McLean Mill site be powered by the Baldwin locomotive, which is capable of reaching adequate speeds to make the trip in a reasonable time. It is estimated that it will be feasible for the Baldwin to pull no more than two or three passenger cars up the grade. Assuming a capacity of 50 to 80 people per car, this would give it a capacity of transporting between 100 and 240 visitors about three times daily, for a maximum of about 300 to 700 per day. This is insufficient to transport all of the anticipated visitors to the site, although use of the railway for access will certainly reduce the volume of road travel.

The Baldwin should stop short of the site, at the parking lot, where passengers will have the option of being transferred to a shorter train, powered by the 2-Spot — a logging locomotive. Visitors who have arrived both by rail and by rubber-tired vehicles may travel in this way to the site in 'crummies' — former work cars. (Gasoline 'speeders' may be substituted at non-peak times.) Visitors will disembark and enter the VRC. Alternatively, visitors may walk from the parking lot and rail terminus to the VRC.

Hiking Trails

It is anticipated that a small percentage of visitors will walk to the McLean Mill site along the hiking trails on the Log Train Trail and other routes along the Beaufort Range. Proper signage and access trails to the site should be provided for them. They will enter from the east end of the site, even in the early stages of development, when most visitors come from the west, and so alternative directional signage and routing will have to be provided for them.

Barrier-Free Access

The provision of access for visitors with disabilities is discussed in Section 5.3.

Recommended Actions

- Beaver Creek Road and Smith Road should provide the principal access route for rubber-tired traffic. Signage should be installed at key points along the route, in co-operation with the City of Port Alberni, the Regional District of Alberni-Clayoquot, and the Ministry of Transportation and Highways.

- Consideration should be given to directing rubber-tired vehicles to return to Port Alberni along either Kitsuksis Road or Cherry Creek Road.

- The three government partners in the McLean Mill development should petition the Ministry of Transportation and Highways, pointing out the anticipated visitor numbers at the McLean Mill site, to request that the proposed Three Valleys Highway pass in the vicinity of the McLean Mill site and provide a marked exit to the site.

- All transportation planning should address and mitigate the potential negative impacts on residents from the increased traffic levels. This should include efforts to encourage visitors to leave their automobiles in Port Alberni and travel to the site by train or bus. It may be possible to make school buses available to transport summer visitors.

- Marketing and promotion should encourage visitors to assemble at a common area — perhaps the E&N Station or another downtown heritage attraction — to park their cars and travel to the site by either train or bus. In this respect, planning should be carried out in close co-operation with the Regional District of Alberni-Clayoquot.

- The operators of the McLean Mill site should support the efforts of the Western Vancouver Island Industrial Heritage Society and the Port Alberni community to encourage development of a rail link to the site, and the McLean Mill operation should market it aggressively when it is in service.

- The train from Port Alberni should stop short of the site, at the parking lot, and all visitors (including those who arrived by car or bus) should have the opportunity to make the final journey to the site in 'crummies' powered by the Two-Spot.

- Accommodation should be made for access to the site from the hiking trails along the Beaufort Range.

- Private vehicles should be excluded from the core site. Only service vehicles, emergency vehicles, special transportation for people with disabilities, and interpretive vehicles should be permitted.

8. ADMINISTRATION AND OPERATION

8.1 Management

Description

The McLean Mill National Historic Site is owned by the City of Port Alberni. It is currently operated by the City's Parks and Recreation Department. The Project Manager of the site reports to the Director of Parks and Recreation through the Director of the Alberni Valley Museum, who also reports to the Director of Parks and Recreation.

It is understood that this is an interim management structure, and that an appropriate organizational structure which will meet the needs of the development partners will be established.

Recommended Actions

It is proposed that the McLean Mill site be administered by an autonomous, not-for-profit *Society*, operating at arm's length from the City of Port Alberni. The Society would be constituted in a manner that would allow it to achieve status as a registered charity with Revenue Canada, thus facilitating donations to the development and operation of the facility.

The Society would be responsible for the stabilization, preservation, restoration, presentation, and ongoing operation of the site. It is recommended that the Society enter into a property agreement with the City to that effect. The City would retain ownership of the site and its assets, while the Society would be granted exclusive rights to develop and operate the site according to conservation and other guidelines typical to national historic sites as may be required by the development partners.

The Society would have a variety of types of memberships, including patrons, honourary life members, life members, active members, and special members. Active members would support the organization by paying annual dues and participating in the Annual General Meeting.

The Society would be led by a *Board of Directors* and an *Executive Committee*. The Board might include representatives appointed by the City of Port Alberni, the Regional District of Alberni-Clayoquot, the Province of British Columbia, and the Government of Canada, and such additional directors as may be appointed at an Annual General Meeting. The Executive Committee will be comprised of the senior officers of the Board, and such additional directors as may be appointed by the Board. The Board will establish committees as may be required.

An appointed *General Manager* would be responsible for supervising staff and managing the day-to-day operation of the site.

The underlying principle of the form of organizational structure is that it should result in a wide degree of co-ordination and co-operation aimed at achieving optimum effectiveness, efficiency, and economy of site operations.

8.2 Staffing

The staffing recommendations that follow are based on visitor estimates and information on comparative sites, and are provided for the purpose of developing first-level operating cost estimates. The proposals will be re-evaluated in the forthcoming business plan and operations plan, so as to achieve effective management of the site and care of the collection.

Five staff departments will be required:

- administration
- collections and research
- public programs
- marketing and promotion
- maintenance

The roles of these departments will include:

- *Administration:* to provide for administrative, executive, and policy-formulation functions. This office will cover personnel administration, budget development and control, and other financial services. The administration department will be staffed by the General Manager and a Secretary / Office Manager.

- *Collections and Research:* to fulfil the curatorial role of developing and maintaining the collections and all of the interpretive and educational exhibits. This department will administer and document the collections, work with donors, undertake research, care for artifacts, and prepare artifacts for display. The departmental staff will include a Curator, reporting to the Director, and an Assistant Curator and two Preparator / Technicians, reporting to the Curator.

- *Public Programs:* to develop and present innovative educational and interpretive programs. The department will be responsible for all public programs, including education, extension, exhibits, and special events. Anticipated staffing includes the Program Director, an Education Officer, a Volunteer Co-ordinator, a Chief Interpreter, and two or three Assistant Interpreters working on a seasonal basis.

- *Marketing and Promotion:* to develop and implement strategies for marketing and promoting the site, enabling it to constantly reach out to new and expanded markets. The department will be responsible for advertising and for developing co-operative marketing opportunities with other attractions in the Port Alberni Heritage Network, the region, and Vancouver Island. It will work closely with the Public Programs department to ensure that the community becomes fully aware of the activities and special events at the site. The staff will consist of a Marketing Director.

- *Maintenance:* to maintain the facilities and grounds and implement the required health, safety, and security programs. One year-round Maintenance Supervisor, with seasonal assistance, will be required.

A preliminary staffing plan has been prepared for planning purposes, which requires a total annual budget of $500,000 for salaries and benefits (estimated at 15% of total salaries). This budget provides for the following staff positions and salaries:

General Manager	$50,000	
Secretary/Office Manager	30,000	
Curator	40,000	
Assistant Curator	30,000	
Program Director	40,000	
Marketing Director	30,000	
Education Officer	30,000	
Volunteer Co-ordinator	30,000	
Chief Interpreter	30,000	
Seasonal Interpreters (2 or 3)	30,000	
Preparators (2)	40,000	
Maintenance Supervisor	30,000	
Seasonal maintenance staff	25,000	
		$435,000
Benefits (15%, rounded)		65,000
Total		$500,000

The staffing projections are based on a number of assumptions regarding the operation of the site. It is expected that all physical development will be undertaken and completed with a separate capital budget. Staffing costs for profit-centre operations, such as food services and souvenir shops, and for security services are considered to be funded separately.

It is anticipated that volunteers will participate in the delivery of visitor services and will support paid staff in site interpretation and in equipment maintenance and operation. The volunteer program will be organized by the Volunteer Co-ordinator, and should include recruitment, selection, training, evaluation, rewards, and discipline.

Conservation services are expected to be provided on an as-needed basis from private conservators, by volunteers, and/or by agreement with the Alberni Valley Museum or other museum services. The operation and maintenance of road and rail access into the site are not included.

8.3 Cash Flow Projections

To provide a comprehensive picture of the likely capital and operating cash flow implications of the development, the following cash flow projections have been prepared. This approach attempts to 'capture' all start-up project costs, in addition to capital outlays, and provides project planners with a financial project structure that can be used throughout the planning cycle as cost estimates are refined and revenue assumptions tested.

Implementation Cost Structure

The first step in the cash flow project analysis involved estimates of the costs of implementing site development. Cost items which were used in the analysis are shown in the chart on the next page, and include project management, planning and design, and start-up marketing, in addition to the normal capital costs (construction, site work, and exhibitry). A more detailed list is presented as the Work Breakdown Schedule in Appendix 6 of the *Interim Report*.

Project management activities include all aspects of implementation, from the construction process to start-up marketing activities. Planning and design comprise a significant cost in the implementation process and cover specification of:

- The development concept (in the form of a detailed plan suitable for the preparation of tender documents)

- Communications, operations, and marketing plans

The project approval process also must include some budgetary provision for the preparation of approval documents and the completion of an environmental impact (or EARP) statement. Construction and site work activities are typically considered part of the capital costs of a project. There will be costs associated with pre-construction research. Interpretative displays are treated as a separate budget item (defined and costed in detail as part of the planning and design interpretation plan activity). Finally, the implementation cost structure also includes provision for start-up marketing activity in the year prior to opening of the site to visitors.

Exhibit : McLean Mill: Project Implementation Cost Structure

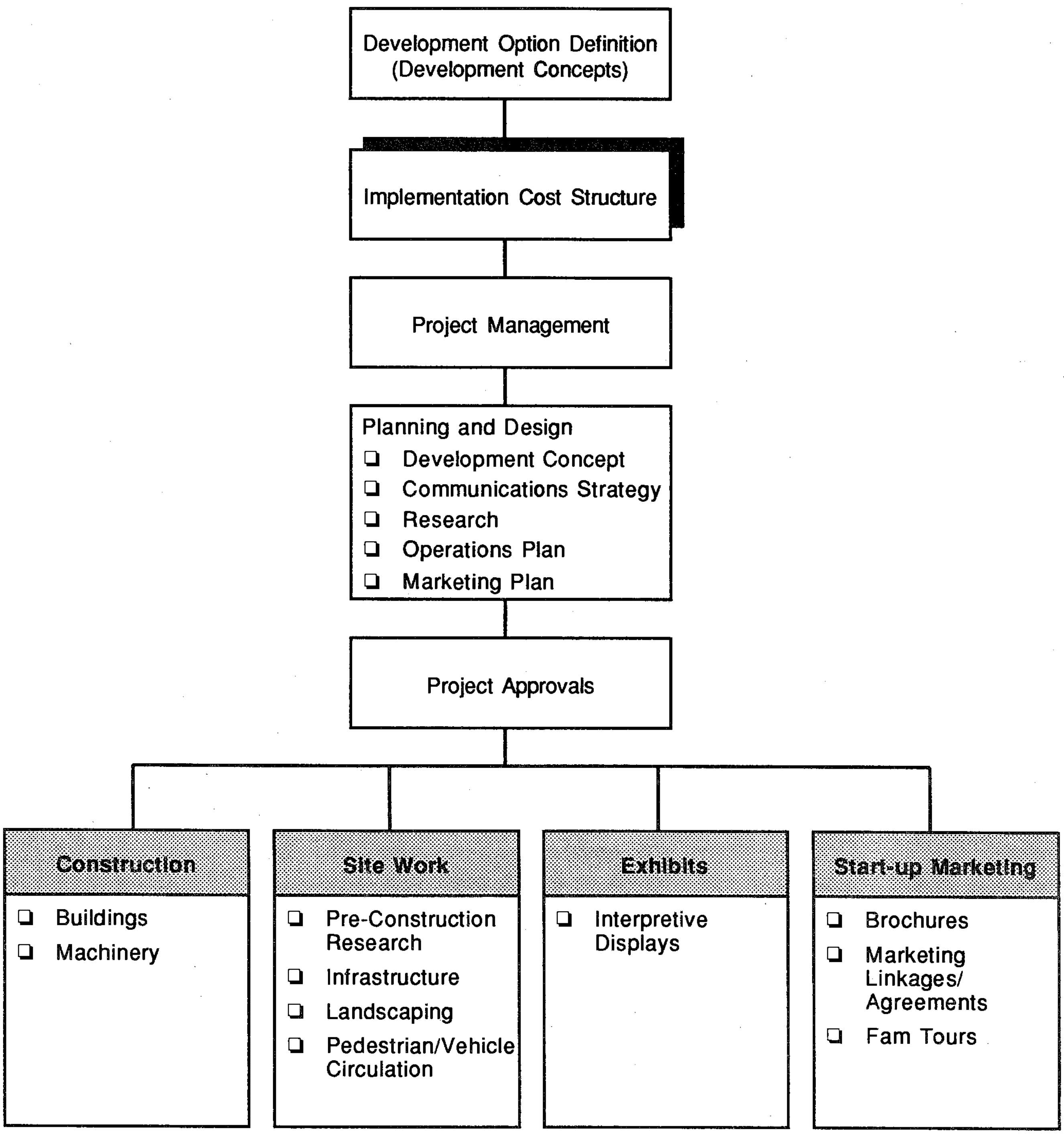
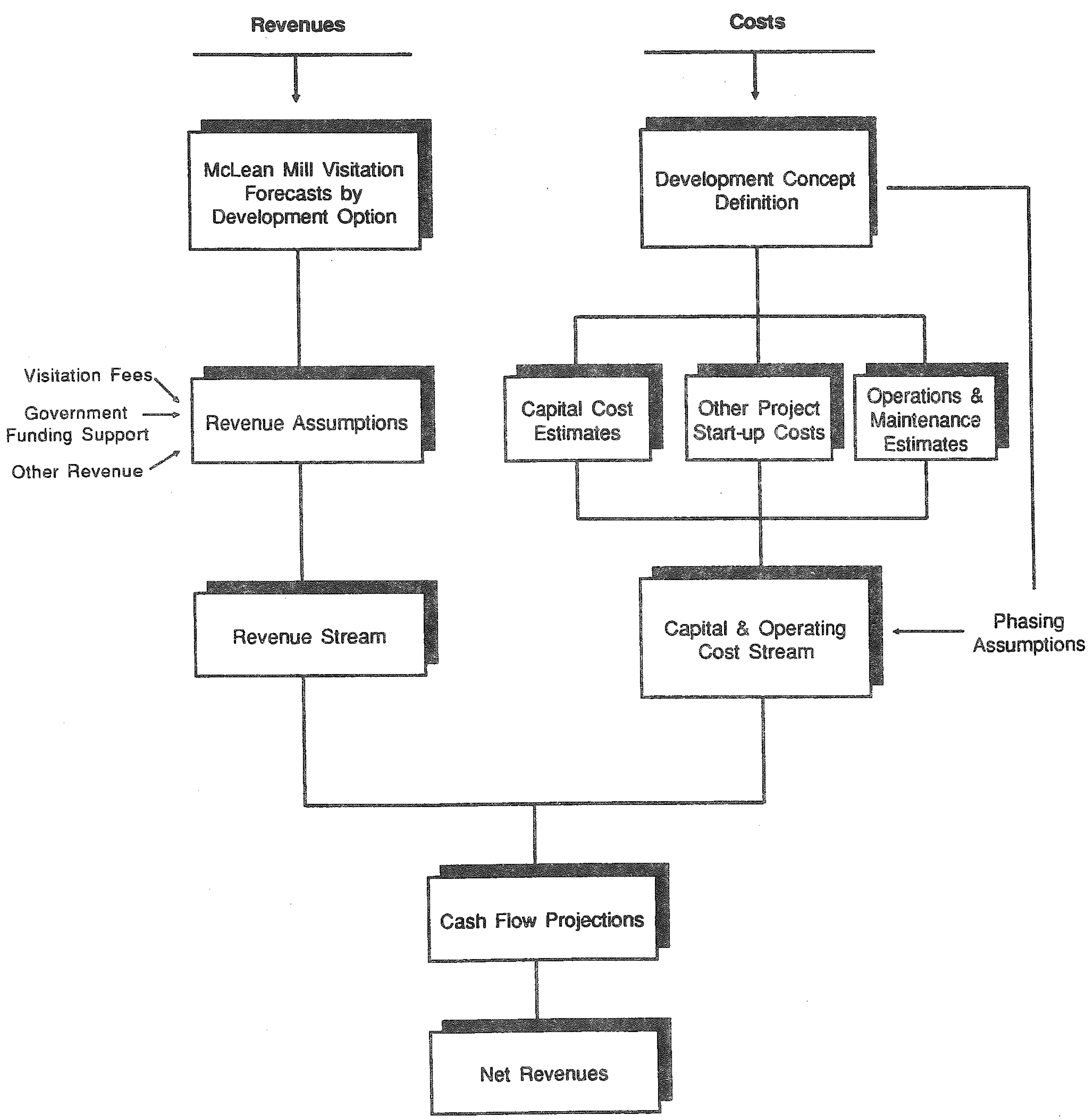


Exhibit : McLean Mill: Cash Flow Projection Approach



Cash Flow Projection Approach

The approach used in projecting cash flow for the development concept is shown in the chart on the previous page. In addition to the costs associated with the project (implementation costs and on-going operating costs), several revenue assumptions were made for visitation fees, government funding support (on an on-going basis), and other revenue sources such as memberships, product sales, concession/rentals, and fundraising/donations. Summary comments on each of the revenue and cost items are provided below, and the estimates are shown in the tables that follow. All projections are in April 1993 dollars.

Revenues

- *Visitation Fees.* This is the revenue generated by admission fees to the facility. Single adult admissions were estimated for visitors (excluding schools) based on comparables data. A lower, average admission was assumed to account for families and the lower admission charges that would be typically applied to children visiting the site. A separate admission fee was estimated for school trips. An average annual admission fee increase of 3 per cent has been incorporated into the cash flow projections.

- *Memberships.* This is the net revenue, based on the difference between receipts of membership fees and the costs of servicing memberships (newsletter, postage, discounts, services).

- *Sales of Products.* This is the net revenue, based on the difference between gross receipts and the cost of products, wages, and overhead. Rental of space is not included.

- *Concession/Rentals.* This consists primarily of net concession revenues for food sales. Minor revenues will also accrue from rentals of space and catering (e.g., for weddings).

- *Fundraising/Donations.* This includes on-going public fundraising (excluding a possible initial capital campaign) and donations from visitors.

- *Sources from Governments, Agencies, and Other Organizations*. It is assumed that all levels of government will commit funds to the annual operating costs of the site, and that funds may be committed as well by other agencies and organizations. The contributions from the city, region, and province are fees for providing an amenity service (similar to fees for library and parks services) as well as for providing a major stimulus to the local, regional, and provincial economies. The federal contribution represents ongoing support of a national historic site. The amounts shown represent initial assumptions, and are not based on any commitments from any level of government.

Costs

- *Capital Costs*. Costs for construction and site work are based on the capital cost estimates provided in Section 9.1. It is assumed that the cost of financing capital development will not be carried as an operating expense.

- *Administration*. This includes office expenses, staff travel, bank charges, etc.

- *Salaries/Wages*. This includes salaries and benefits for full- and part-time staff, as described in Section 8.2. It excludes those involved in the sales of products and concessions.

- *Programming*. This includes general programming and the net cost of special events.

- *Maintenance*. This refers to the maintenance of buildings and grounds.

- *Collections Maintenance*. This includes conservation to large and small artifacts, the periodic preparation of new exhibits, and a small budget for acquisitions of artifacts and published material.

- *Insurance*. No costs are shown for insurance. It is assumed that the site will become a component of the City of Port Alberni's insurance programme.

These assumptions, originally made in the *Interim Report*, have been reviewed with participants in the McLean Mill site development planning process. It was agreed to carry them forward into the Management Plan.

Cash Flow Projections

The cash flow projections are presented on the two pages that follow. The approach used here is to present the stream of revenues and capital and operating costs to identify the likely 'draw down' of funds to implement and maintain the facility on a ongoing basis. No attempt has been made to undertake present value analysis, pending a review of the project costing structure and revenue assumptions.

A management objective for the McLean Mill site is that its operation should be financially self-sustaining (see Section 2.3). The cash flow projections indicate that funding beyond that generated by site operations will be required on a continuing basis. This is consistent with the operation of virtually all historic sites in North America, which depend on sustaining revenues from government, foundations, and/or major corporate sponsors.

The revenues from the different levels of government and other sources should be considered to be *core funding commitments* that are provided in return for real services rendered. This is the manner in which governments finance other recreational and cultural services (e.g. parks and libraries) and public amenities (e.g. fire protection and roads). The services that will be provided by the McLean Mill site in return for these commitments include the ongoing management of a uniquely important cultural resource, the provision of cultural and recreational opportunities to residents of the governments' constituencies, and the attraction of visitors whose expenditures will have a significant impact on the local and regional economies (see Section 6.3).

Although the goal of financial self-sustainment has been recognized in planning for the site, it is generally accepted that the McLean Mill will require ongoing funding beyond the revenues generated directly by operations. This is consistent with similar operations on comparable sites; indeed, the McLean Mill will generate a higher proportion of operating costs than many other sites of this kind. The projected shortfall will have to be met through the core funding commitments (commensurate with the level of service) discussed in the previous paragraph. The establishment of the level of core funding indicated in the cash flow projections provides for meeting operating costs and establishing a reserve fund for on-going capital improvements to the site.

The cash flow projections will be examined in depth in the business plan, in order to determine ways and means of maintaining the operation and meeting future requirements for recapitalization.

McLEAN MILL CASH FLOW PROJECTIONS

McLean Mill Visitor Fees (average admission fees used for all market segments except schools)

		Annual Increase:		*3.00%*						
Market Segment	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Single Adult	$6.00	$6.18	$6.37	$6.56	$6.75	$6.96	$7.16	$7.38	$7.60	$7.83
Average Admission	$4.00	$4.12	$4.24	$4.37	$4.50	$4.64	$4.78	$4.92	$5.07	$5.22
School	$2.00	$2.06	$2.12	$2.19	$2.25	$2.32	$2.39	$2.46	$2.53	$2.61

McLean Mill Other Revenue Assumptions

	Revenue Item
$2,000	Memberships - Year 1
	Memberships Growth Rate (based on Year 1 proportion of 1st year memberships to no. of visitors; = rate of visitor growth)
$0.35	Net - Sales of Products per Visitor - Year 1
$0.51	Net - Sales of Products per Visitor - Year 2
$0.68	Net - Sales of Products per Visitor - Year 3
$0.84	Net - Sales of Products per Visitor - Year 4
$1.00	Net - Sales of Products per Visitor - Year 5
	(even growth rate in net sales per visitor to year 5 and constant therafter)
$0.10	Net - Concessions/Rentals per Visitor
	(constant net revenues per visitor over forecast period)
	Government Sources - Base Year
$0.15	Donations
$150,000	City
$32,000	Region
$75,000	Province
$50,000	Federal
2%	Government Sources - Percent Increase Per Year

McLean Mill Project Start-up Cost Assumptions

15% Planning & Design - Percent of Construction, Siteworks, and Exhibits
5% Project Management - Percent of Construction and Siteworks

All projections in 1993 dollars.

McLean Mill Cash Flow Projections

McLean Mill Capital Costs and Assumptions

	Total Cost	Capital Spending Proportion By Year 1 (1994)	2 (1995)	3 (1996)
Capital Cost Stream				
Construction	4,285,000	20%	40%	40%
Site Work	825,000	75%	25%	0%
Exhibits	1,000,000	0%	25%	75%
Project Approvals	50,000	100%	0%	0%
Start - Up Marketing	75,000	0%	0%	100%
Start-up				
Planning & Design	916,500	75%	25%	0%
Project Management	255,500	20%	40%	40%
Sub-total	1,172,000			

		Proportion of Operating Costs By Year To Full Operations Operating Year: 1	2	3	Percent Increase Per Year After Full Operations:
Operating Cost Stream					
Administration	60,000	80%	90%	100%	3%
Salaries/Wages	500,000	80%	90%	100%	3%
Programming	60,000	80%	90%	100%	3%
Marketing	75,000	80%	90%	100%	3%
Maintenance	100,000	80%	90%	100%	3%
Collections Maintenance	25,000	80%	90%	100%	3%

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Market Forecast:										
Resident	65,314	67,146	69,032	70,971	72,965	73,695	74,432	75,176	75,928	76,687
Non-Resident	26,322	27,272	28,258	29,280	30,340	30,667	30,998	31,332	31,671	32,013
Day-Trip	15,267	15,882	16,522	17,188	17,881	18,417	18,970	19,539	20,125	20,729
Sub-total	106,903	110,301	113,812	117,439	121,186	122,779	124,400	126,048	127,724	129,430
School	9,354	9,923	10,528	11,169	11,849	12,205	12,571	12,948	13,336	13,736
Total	**116,257**	**120,225**	**124,340**	**128,608**	**133,035**	**134,984**	**136,971**	**138,996**	**141,061**	**143,166**

McLean Mill Cash Flow Projections

McLean Mill Statement of Net Revenues

	Construction Period (Year)			Operating Period (Year)									
	1994	**1995**	**1996**	**1 (1997)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Earned Revenues:													
Visitor Fees				446,319	474,883	505,310	537,724	572,257	597,637	624,179	651,940	680,977	711,352
Memberships (net)				2,000	2,068	2,139	2,212	2,289	2,322	2,356	2,391	2,427	2,463
Sales of Products				40,690	61,615	83,929	107,709	133,035	134,984	136,971	138,996	141,061	143,166
Concession/Rentals				11,626	12,022	12,434	12,861	13,304	13,498	13,697	13,900	14,106	14,317
Fundraising/Donations				17,438	18,034	18,651	19,291	19,955	20,248	20,546	20,849	21,159	21,475
Total Earned Revenues				*518,073*	*568,623*	*622,464*	*679,798*	*740,840*	*768,689*	*797,749*	*828,076*	*859,730*	*892,772*
Government and Other Sources				*250,000*	*255,000*	*260,100*	*265,302*	*270,608*	*276,020*	*281,541*	*287,171*	*292,915*	*298,773*
Total Revenues				**768,073**	**823,623**	**882,564**	**945,100**	**1,011,448**	**1,044,709**	**1,079,290**	**1,115,248**	**1,152,645**	**1,191,546**
Costs:													
Capital Costs:													
Construction	857,000	1,714,000	1,714,000										
Site Work	618,750	206,250	0										
Exhibits	0	250,000	750,000										
Project Approvals	50,000	0	0										
Start - Up Marketing	0	0	75,000										
Start-up Planning & Design	687,375	229,125	0										
Project Management	51,100	102,200	102,200										
Total Construction Costs	*2,264,225*	*2,501,575*	*2,641,200*										
Operating Costs:													
Administration				48,000	54,000	60,000	61,800	63,654	65,564	67,531	69,556	71,643	73,792
Salaries/Wages				400,000	450,000	500,000	515,000	530,450	546,364	562,754	579,637	597,026	614,937
Programming				48,000	54,000	60,000	61,800	63,654	65,564	67,531	69,556	71,643	73,792
Marketing				60,000	67,500	75,000	77,250	79,568	81,955	84,413	86,946	89,554	92,241
Maintenance				80,000	90,000	100,000	103,000	106,090	109,273	112,551	115,927	119,405	122,987
Collections Maintenance				20,000	22,500	25,000	25,750	26,523	27,318	28,138	28,982	29,851	30,747
Total Operating Costs				*656,000*	*738,000*	*820,000*	*844,600*	*869,938*	*896,036*	*922,917*	*950,605*	*979,123*	*1,008,497*
Reserve for Capital Improvements				*75,000*	*76,500*	*78,030*	*79,591*	*81,182*	*82,806*	*84,462*	*86,151*	*87,874*	*89,632*
Net Revenues	**(2,264,225)**	**(2,501,575)**	**(2,641,200)**	**37,073**	**9,123**	**(15,466)**	**20,909**	**60,327**	**65,867**	**71,910**	**78,491**	**85,647**	**93,417**

McLean Mill Visitation Forecast by Market Segment

Market Segment	Base Year 1997	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Total Resident	65,314	67,146	69,032	70,971	72,965	73,695	74,432	75,176	75,928	76,687
Total Non-Resident	26,322	27,272	28,258	29,280	30,340	30,667	30,998	31,332	31,671	32,013
Area Population	15,267	15,882	16,522	17,188	17,881	18,417	18,970	19,539	20,125	20,729
School	9,354	9,923	10,528	11,169	11,849	12,205	12,571	12,948	13,336	13,736
Total	116,257	120,225	124,340	128,608	133,035	134,984	136,971	138,996	141,061	143,166

McLean Mill Cash Flow Projection Summary

Year	0 (1994)	0 (1995)	0 (1996)	1 (1997)	2	3	4	5	6	7	8	9	10
Earned Revenues				518,073	568,623	622,464	679,798	740,840	768,689	797,749	828,076	859,730	892,772
Revenues: Government and Other Sources				250,000	255,000	260,100	265,302	270,608	276,020	281,541	287,171	292,915	298,773
Total Revenues				**768,073**	**823,623**	**882,564**	**945,100**	**1,011,448**	**1,044,709**	**1,079,290**	**1,115,248**	**1,152,645**	**1,191,546**
Total Construction Costs	2,264,225	2,501,575	2,641,200										
Total Operating Costs	0	0	0	656,000	738,000	820,000	844,600	869,938	896,036	922,917	950,605	979,123	1,008,497
Reserve for Capital Improvements				75,000	76,500	78,030	79,591	81,182	82,806	84,462	86,151	87,874	89,632
Net Revenues	(2,264,225)	(2,501,575)	(2,641,200)	37,073	9,123	(15,466)	20,909	60,327	65,867	71,910	78,491	85,647	93,417

9. IMPLEMENTATION STRATEGIES

9.1 Capital Cost Estimates

This section provides order-of-magnitude capital cost estimates for the development of the McLean Mill National Historic Site, according to the development concept that has been described.

Cost estimates have been prepared by assigning unit costs to each work item (i.e. structural, exterior envelope, etc.) for each level of intervention. These base unit costs have been adjusted according to the area of the structure: increased for areas less than 500 square feet, and decreased for areas greater than 2,500 square feet. The tables on the next page indicate the unit costs and the adjustment factors.

Total capital costs are estimated to be:

Construction Costs		
Buildings and Structures:	$4,285,000	
Site Works	825,000	
Exhibits	1,000,000	
		$6,110,000
Project/Administration Costs		
Project Approvals	50,000	
Start-up Marketing	75,000	
Planning and Design (15%)	916,500	
Project Management (5% of first two)	$255,500	
		$1,297,000
Total Estimated Capital Costs		$7,407,000

(These costs have been used in the Cash Flow Projections.)

A number of assumptions have been made in the calculation of the cost estimates:

- All costs are in April 1993 dollars.
- GST is excluded.
- Off-site railway work from Port Alberni to the McLean Mill site is excluded.

- Planning and design have been calculated as 15% of the total of buildings and structures, site works, and exhibits.
- Project management has been calculated as 5% of the total of buildings and structures and site works.

The tables that follow provide the calculation of the cost estimates, structure by structure. Estimates have been provided as well for site work. The tables were prepared in June 1992 and revised in May 1993.

The unit cost matrix in the first table estimates costs on a per-square-foot basis, by intervention and by work item. A premium has been added for mechanical and electrical work for those facilities that will have particularly high mechanical demands: the Mill, the Boiler, the Cookhouse, and the Machinery Shed.

A more recent inspection of the structures, based on the experience of stabilization work already undertaken, was undertaken by the three participating agencies in June 1993. This inspection has indicated that for some structures the original estimates may be low, whereas for others they may be high. Also, a few minor changes were made to the recommended levels of intervention and this will affect the capital costs. For buildings that will undergo both exterior and interior restoration, it may be appropriate to use a higher percentage for contingency. However, for the purposes of this Management Plan, the original total estimate is considered to be valid.

McLEAN MILL N.H.S.

UNIT COST MATRIX

WORK ITEM	INTERVENTION: NONE	INTERPET SITE	PRESERVE	STABILIZE	RESTORE (STATIC)	REHABILITATE (OPERATIONAL)	RECONSTRUCT (STATIC)	RECONSTRUCT (OPERATIONAL)	DEMOLISH
STRUCTURAL			$5	$15	$20	$25	$27	$30	
EXTERIOR ENVELOPE					15	15	20	20	
INTERIOR IMPROVEMENTS					20	25	30	30	
CODE WORK					2	5	2	5	
FURNISHINGS & EQUIPMENT					3	5	3	5	
ELECTRICAL					5	8	5	8	
MECHANICAL					7	12	7	12	
DEMOLISH									2

BUILDING AREA ADJUSTMENT FACTORS

WORK ITEM	AREA: Less than 500 Sf	500 to 2,500 Sf	Greater than 2,500 Sf
STRUCTURAL	1.5	1.0	0.8
EXTERIOR ENVELOPE	1.5	1.0	0.8
INTERIOR IMPROVEMENTS	1.8	1.0	0.8
CODE WORK	1.5	1.0	0.8
FURNISHINGS & EQUIPMENT	1.5	1.0	0.8
ELECTRICAL	1.8	1.0	0.9
MECHANICAL	1.8	1.0	0.9
DEMOLISH	1.3	1.0	0.8

McLEAN MILL N.H.S.

COST MATRIX

	WORK ITEM	STRUCTURAL	EXTERIOR ENVELOPE	INTERIOR IMPROVEMENTS	CODE WORK	FURNISHINGS & EQUIPMENT	ELECTRICAL	MECHANICAL	DEMOLISH	OVERHEAD & PROFIT (15%)	CONTINGENCY (15%)				
	EXISTING BUILDINGS:											TOTAL	AREA (SF)	COST	NOTES
1	Mill	$23	$9	$9	$4	$0	$9	$11		$10	$11	$85.80	6175	$529,800	Area Scaled (Note I)
1A	Mill Deck	23								3	4	29.76	15000	446,300	Area Estmtd
2	Power Boiler	25	15	6	5	0	10	18		12	14	104.81	1130	118,400	Area Scaled (Note II)
3	First Aid Shack	30	23	30	3	5	8	11		16	19	142.83	120	17,100	Area Estmtd
4	Millwright & Genny	30	23	30	3	5	8	11		16	19	142.83	355	50,700	
5	Oil Shed	30	23	30	3	5	8	11		16	19	142.83	101	14,400	
6	Blacksmith Shop	30	23	30	3	5	8	11		16	19	142.83	480	68,600	
7	Bunkhouse	20	15	20	2	3	5	7		11	12	95.22	546	52,000	
8	Cookhouse	20	15	20	2	3	5	7		11	12	95.22	774	73,700	
9	R.B. McLean House	27	20	30	2	3	5	7		14	16	124.32	606	75,300	
10	Wood Shed & Storage	41	30	2	0	0	1	1		11	13	98.59	430	42,400	See Note III
11	Wood Shed	27	20	2	0	0	1	1		7	9	65.73	530	34,800	See Note III
12	Gas & Oil Shed	23								3	4	29.76	264	7,900	
13	Main Garage	15								2	3	19.84	1540	30,500	See Note 2
14	"A" Frame									0	0	Allow		15,000	
14A	Log Dump									0	0	Allow		15,000	
15	Machine Shop	20	15	20	2	3	5	7		11	12	95.22	692	65,900	
16	Small Parts Shed	30	23	2	0	5	4	5		10	12	89.27	171	15,300	See Note Iv
17	Small Parts Shed	30	23	2	0	5	4	5		10	12	89.27	41	3,700	See Note Iv
18	Green Chain	19					6	9		5	6	44.63	2600	116,000	Area Estmtd
19	Planer	45	18	19	8	0	18	23		19	22	171.59	400	68,600	Area Scaled (Note I)
20	Mill Office	30	23	30	3	5	8	11		16	19	142.83	252	36,000	
21	Arnold McLean House	20	15	20	2	3	5	7		11	12	95.22	915	87,100	Area Scaled
22	Bookkeeper's Hse & Office	30	23	30	3	5	8	11		16	19	142.83	480	68,600	
23	Wood Shed	30	23	2	0	0	1	1		8	10	73.80	200	14,800	See Note III
24	Millworker's House	25	15	25	5	5	8	12		14	16	125.64	820	103,000	Area Scaled

McLEAN MILL N.H.S.

COST MATRIX

	EXISTING BUILDINGS:	STRUCTURAL	EXTERIOR ENVELOPE	INTERIOR IMPROVEMENTS	CODE WORK	FURNISHINGS & EQUIPMENT	ELECTRICAL	MECHANICAL	DEMOLISH	OVERHEAD & PROFIT (15%)	CONTINGENCY (15%)	TOTAL	AREA (SF)	COST	NOTES
25	Arnold McLean Garage	20	15	1	0	0	1	1		6	6	49.20	645	31,700	See Note iii
26	Locomotive Shed	20	15	5	0	0	5	2		7	8	61.83	545	33,700	Area Scaled (Note v)
27	Loading Deck & Dip Tank	30	23	0	0	0	0	11		9	11	83.32	325	27,100	Area Scaled
28	Ice House	41	30	0	0	0	8	11		13	15	117.04	134	15,700	
29	Machinery Shed	27	20	8	0	3	5	7		10	12	91.91	1120	102,900	Area Scaled (Note vi)
30	Sand House	38	23	2	0	0	1	2		10	11	85.80	150	12,900	Area Scaled (Note iii)
31	Lumber Grader's Shed	30	23	2	0	5	1	1		9	10	79.75	40	3,200	Area Scaled (Note iii)
32	Original Locomtive Shed									0	0	0.00		0	
33	Original Bunkhouses (2)	30	20	30	5	5	8	12		17	19	145.48	1100	160,000	Area Estmtd (550 x 2)
34	Kirk's House									0	0	0.00		0	
35	Philip McLean House									0	0	0.00		0	
36	Walter McLean House	30	20	30	5	5	8	12		17	19	145.48	550	80,000	Area Estmtd
37	Matheson House									0	0	0.00		0	
38	Former Locomotive Shed									0	0	0.00		0	
39	Water Tower											Allow		25,000	
40	Building Floor								2	0	0	2.65	525	1,400	Area Scaled
41	Sven's House									0	0	0.00		0	
42	Wood Bin	30	23	0	0	0	0	0		8	9	69.43	325	22,600	Area Scaled
43	Sawdust Bin	5								1	1	6.61	375	2,500	Area Scaled
44	Scrap Burner	23								3	4	29.76	2165	64,400	See Note 5
45	Outhouse	23								3	4	29.76	20	600	
46	Shower	30	23	30	0	5	8	11		16	18	138.86	40	5,600	Area Assumed
47	Japanese House											Allow		1,000	Interpet Site
48	Japanese House											Allow		1,000	Interpet Site
49	Cinese House											Allow		1,000	Interpet Site
50	Boom Shack	30	5	5	0	0	2	3		7	8	58.85	650	38,300	Area Scaled (Note vii)

McLEAN MILL N.H.S.

COST MATRIX

WORK ITEM

		STRUCTURAL	EXTERIOR ENVELOPE	INTERIOR IMPROVEMENTS	CODE WORK	FURNISHINGS & EQUIPMENT	ELECTRICAL	MECHANICAL	DEMOLISH	OVERHEAD & PROFIT (15%)	CONTINGENCY (15%)	TOTAL	AREA (SF)	COST	NOTES
	EXISTING BUILDINGS:														
51	Previous Bunkhouse	27	20	30	2	3	5	7		14	16	124.32	750	93,200	Area Assumed
52	Transformer									0	0	0.00	175	0	Area Scaled
53	Japanese House											Allow		1,000	Interpet Site
54	Sumi House									0	0	0.00		0	
55	Japanese House											Allow		1,000	Interpet Site
56	Japanese House											Allow		1,000	Interpet Site
57	School									0	0	0.00		0	
58	Teacherage									0	0	0.00		0	
59	Jack Ladder	27								4	5	35.71	550	19,600	Area Scaled (Note viii)
62	Gin Pole/Donkey Engine											Allow		15,000	
													Total	2,932,300	
	NEW BUILDINGS:														
	Barn/Community Centre	14	6	14	4	4	7	11		9	10	78.36	12500	979,500	See Note ix
	New Vistor's Reception Centre											110	5000	550,000	
	Maintenance Shed											50	5000	250,000	
	Storage Facility											150	2500	375,000	Climate Cntrld
													Total	2,154,500	
	MACHINERY RESTORATION/REPLACEMENT:												Total	35,000	
										BUILDINGS & STRUCTURES				$5,121,800	

McLEAN MILL N.H.S.

COST MATRIX

	SITEWORK:					
	Landscape work		Allow		50,000	
	Drainage		Allow		5,000	
	Railway tracks	4500 Lf @ $50/Lf + $75,000 for switches & hardware			300,000	
	Parking/roads	200 Stalls @ 150 + 1250lf of Road @ $75			123,750	
	Improve main street	2500lf of Road @ $10			25,000	
60	New Dam Wall & Dredge Pond		Allow		80,000	
61	Fish Ladder		Allow		10,000	
	Services -- Fire Main	2800lf @ $17.50/Lf + 12 Hydrants + Pumps			75,000	
	Services -- Domestic Water	2500lf @ $5.00/Lf + filtration & pumps			25,000	
	Services -- Sanitary				15,000	
	Services -- Hydro				20,000	
	Site Fencing & Gates		Allow		75,000	
				Total	803,750	

Notes:

i Structure 125%, Ext. 80%, Int 50%, Elect 150% & Mech 125%.
ii Int. 25%, Elect 125% & Mech 150%.
iii Int 5%, Elect 10% and Mech 10%.
iv Int 5%, Elect 50% and Mech 50%.
v Int 25% & Mech 25%.
vi Int 25%.
vii Ext 25%, Int 15%, Elect 25% and Mech 25%.
viii Structure Only.
ix Structure 75%, Ext. 50% & Int. 75%.

9.2 Phasing Development

This Management Plan is a conceptual document that provides general direction for future planning and development. A number of more detailed planning and design tasks remain to be undertaken:

Planning and Investigation:

- Research
- Preservation and Maintenance
- Archaeology
- EARP Screening Report
- Communications Strategy
- Operations Plan
- Marketing Plan
- Maintenance Plan
- Business Plan

Concurrently:

- Design / Preparation of Tender Documents for:
    - Buildings and Structures (existing resources and VRC/new buildings)
    - Machinery and Equipment
    - Site Work and Landscape
    - Exhibits
- Start-up Marketing Activity

The Cash Flow Projections allow three years for planning, design, and construction, with the opening scheduled for year 4 (see Section 8.3). This schedule may be extended if necessary; in that event, the main impact will be the delay in the flow of revenues. The details related to cash flow, design, and construction scheduling will be the subject of a Business Plan, which will follow the direction given in this Management Plan.

APPENDIXES

APPENDIX A

PREVIOUS STUDIES AND REPORTS

Alberni Valley Museum. *Forest Industrial Collections*. Port Alberni, n.d.

________. *R.B. McLean Lumber Co. Museum Development: Management Study*. Port Alberni, 1985.

Bell, J. 'Heritage Recording Report: Initial Photo Record of R.B. McLean Mill, Port Alberni, British Columbia.' Ottawa: Architectural & Engineering Services for Environment Canada, January 1990.

Commonwealth Historic Resource Management Limited. *A Management Plan for the R.B. McLean Lumber Co. National Historic Site: Discussion Paper*. Vancouver, March 1992.

________. *A Management Plan for the R.B. McLean Lumber Co. National Historic Site: Interim Report*. Vancouver, July 1992.

________. 'A Management Plan for the R.B. McLean Lumber Co. National Historic Site: Options Analysis.' January 1993.

'Cultural Resource Management Policy (Proposed).' Part III of *Canadian Parks Service: Proposed Policy*, Ottawa: Environment Canada, Parks Service, n.d., pp. 97-110.

David Nairne & Associates Ltd. et. al. *Economic Feasibilty Study: R.B. McLean Lumber Co., City of Port Alberni*. Draft. North Vancouver, August 1986.

'Establishment Study: R.B. McLean Lumber Company National Historic Site, Port Alberni, British Columbia.' Environment Canada, Parks Service, May 1991.

[Hartley, J.] 'Canadian Parks Service Option Evaluation: R.B. McLean Lumber Co. National Historic Site.' [January 1992]

McIntosh, J. 'R.B. McLean Lumber Co. National Historic Site: Management Plan Interim Report: Option Selection.' 19 December 1992.

McLean Mill National Historic Site: Interim Protection Plan. Draft report. Public Works Canada / Canadian Parks Service, Western Region, 12 June 1990.

Mitchell, John. *Heritage 1990: Planning For The Future*. Port Alberni: Alberni Valley Museum, 15 March 1990.

Oberlander, Judy, Harold Kalman, and Robert Lemon. *Principles of Heritage Conservation*. Technical Paper Series 9. Victoria: British Columbia Heritage Trust, 1989.

________. *Restoration Principles and Procedures*. Technical Paper Series 10. Victoria: British Columbia Heritage Trust, 1989.

Taylor, C.J. *The Heritage of the British Columbia Forest Industry: A Guide for Planning, Selection and Interpretation of Sites*. Microfiche Report Series 300, Canadian Parks Service, n.d.

________. 'R.B. McLean Lumber Company Millsite.' Historic Sites and Monuments Board of Canada, Agenda Paper [1989].

________. *The Physical History of the R.B. McLean Lumber Company National Historic Site*. Environment Canada, Parks Service, Western Regional Office, January 1992.

[Taylor, C.J.] 'R.B. McLean Lumber Company National Historic Site: Historical Themes.' [January 1992]

Wilson, Ian R. 'R.B. McLean Lumber Company Millsite Heritage Resource Inventory and Assessment.' Prepared by I.R. Wilson Consultants Ltd. for Canadian Parks Service, Environment Canada, Western Region, 1990.

APPENDIX B

TABLES OF CONTENTS:

DISCUSSION PAPER AND *INTERIM REPORT*

DISCUSSION PAPER (March 1992)

TABLE OF CONTENTS

COMMONWEALTH HISTORIC RESOURCE MANAGEMENT LIMITED

220-1333 Johnston Street
Vancouver, B.C. V6H 3R9
(604) 688-7995

53 Herriott Street
Perth, Ontario K7H 1T5
(613) 267-7040

TABLE OF CONTENTS

APPENDIX C

OPTIONS ANALYSIS

Originally submitted January 1993

A MANAGEMENT PLAN FOR THE R.B. McLEAN LUMBER CO. NATIONAL HISTORIC SITE

OPTIONS ANALYSIS

Commonwealth Historic Resource Management Limited
January 1993

The Interim Report for Phase One of the Management Plan, submitted in July 1992, presented three options for the development of the R.B. McLean Lumber Co. National Historic Site:

Option 1: Preserved Sawmill Community (the passive option)
Option 2: Evolution of the Lumber Industry (the demonstration option)
Option 3: Operating Sawmill and Community (the animation option)

The steps leading to the development of these options have included:

- Workshop attended by representatives of the three client groups and the consultants, at which the options were developed at a preliminary level (January 1992)
- Investigation into management options for the resources (reported in Discussion Paper, March 1992)
- Working out the three options in more detail, including indicating the intervention required for every resource and capital cost estimates (described in Interim Report, July 1992)
- Testing the three options with market and cash-flow projections (Interim Report, July 1992)
- Presenting the options to the community-at-large and the principal stakeholders, and receiving comments from them (October 1992)
- Meetings among representatives of the three client groups and the consultant (December 1992)

This paper supplements that material by presenting a concise analysis of the impact that each option would have upon the conservation of the historic resources, and also the opportunities that each would provide for presentation and operation. It summarizes the relative advantages and disadvantages of each option with respect to preservation and presentation. Much of the material contained here was initially presented in either the Discussion Paper (March 1992) or the Interim Report (July 1992), and is collected for convenience. The options are described here as they were presented in the Interim Report, without addressing variations that have been proposed since that time.

OPTION 1: PRESERVED SAWMILL COMMUNITY

A. Resource Protection

Buildings and Structures: Over the *short term,* this option provides the highest level of protection for the physical resource. All structures that remain standing would be stabilized. Severely damaged and collapsed structures would be preserved as much as practicable. Missing structures would not be reconstructed. A few structures would be restored: these would include the A. McLean house, the cookhouse, the bunkhouse, the mill, the main garage, and the locomotive shed. A select few may be rehabilitated or reconstructed for active use, e.g. as public washrooms and the caretaker's house. Relatively few buildings would be in active use; most would be observed and not entered. It is proposed for all options that the dam and fish ladder be reconstructed, the millpond restored, and the water tower reconstructed and used.

Over the *long term,* the main threat to the physical resource is from natural causes: deterioration to the wood materials caused by the moist, temperate climate. This will require an ongoing program of maintenance and stabilization, which will surely ultimately involve the replacement of most, if not all, wood structural and non-structural members. The long-term rate of deterioration may be highest with Option 1, since most structures will not be used, heated, or maintained on a day-to-day basis. Although the historic *fabric* would change in the long term, the historic *design* would not, since this option would entail the least amount of intervention to design features for the purpose of accommodating interpretation and circulation needs.

> It is difficult to quantify the degree of intervention required, beyond the figures already determined by the Canadian Parks Service and the British Columbia Heritage Trust. To cite the mill as an example, about 10 per cent of the historic fabric has been replaced to date, and an additional 1 or 2 per cent will have to be replaced to achieve a satisfactory state of interim stabilization. It is estimated that about 30 to 40 per cent of the fabric would require replacement to make the building safe for interpretation in Option 1, and that maintenance and further replacement would be ongoing. In contrast, it might be necessary to replace 50 per cent of the fabric to operate the machinery in Option 3, again with ongoing maintenance and replacement. In the short term, then, Option 1 would retain 10 to 20 per cent more historic fabric. However, in the long term, the differences between the two options would be lessened and eventually eliminated, since all of the surviving historic fabric will ultimately require replacement.

Landscape Resources: This option would provide the highest level of protection in both the short and the long term, since it would have the lowest visitation level, and therefore the least amount of wear on landscape resources. Nevertheless, in all options it will be necessary to resurface (and probably widen) the paths and circulation routes.

In Situ Archaeological Resources: The most valuable archaeological resources are located (a) in the millpond and (b) outside the core area, and the impact on them would not be significantly different from one option to another. The lower visitation level in Option 1 - and consequently the lower likelihood of people wandering through the bush and damaging the resources - might provide a marginal advantage; but this could be counteracted by the larger staff complement - and therefore the higher level of supervision - in Options 2 and 3.

Machinery and Large Artifacts: Over the *short term*, this option would again provide the highest level of protection, since few machines or vehicles would be used, and therefore they will encounter little wear and tear. However, since disuse may cause more deterioration than continual use, lubrication and maintenance, the *long-term* rate of deterioration may be highest with this option.

Small Artifacts: There would be little difference among the three options, because it is anticipated that valuable small artifacts would be conserved under similar conditions in all cases, and would not be handled or exposed to undue risk.

Technologies: This option would provide the least opportunity for preservation of the historical technologies involved in logging and milling, since few, if any, historical machines would be operated.

B. Presentation Strategy

Relationship to Commemorative Intent: All three options provide the opportunity to present all of the identified commemorative themes: the principal themes of logging, lumber manufacture, and camp life, and the related themes of transportation, technology, and labour. Since it has not been determined whether in Option 1 the site would be presented as representing a single period of time (and what that period would be) or the continuity of the historic period, one cannot say whether or not certain themes might become somewhat anachronistic and therefore have less contextual opportunity for presentation. Any omissions in this respect would be compensated for in the presentation in the VRC, but the themes would lack the immediacy of being interpreted by on-site resources.

Effectiveness of Communication: Option 1 would present the themes in a passive manner, mainly by means of signage and static exhibits. Since the machinery would not be operated and animation would be limited, there would be relatively little opportunity for visitor interaction or for sensory experiences of the historic themes and technologies.

C. Operations

Direct Operations: Option 1 would be operated in a manner similar to many other national historic sites, with the Superintendent and interpretive, curatorial, and custodial staff. Additional operations may include food services and gift sales. The administration would be the least complex of the three options.

D. Capital Costs, Visitor Forecasts, and Cash Flow Projections

Capital Costs: The capital costs have been estimated to be approximately $4,400,000.

Visitor Forecasts: It is projected that the attendance during the first full year of operation will be approximately 38,900.

Cash Flow Projections: It is estimated that net revenues in Year 5 will be approximately $17,300. This option has little potential to become financially self-sustaining.

OPTION 2: EVOLUTION OF THE LUMBER INDUSTRY

Buildings and Structures: Over the *short term*, this option provides a reasonably high level of protection for the physical resource, less so than Option 1, but more than Option 3. The interventions will be similar to those for Option 1, although in addition a few structures will be restored and operated: these may include the mill, the cookhouse, and the log dump. Also, a few missing structures that are key to the story of the Mill, such as the R.B. McLean house and the lumber deck, will be reconstructed.

Over the *long term*, deterioration would require the same ongoing program of maintenance as for the other options.

Landscape Resources: This option would provide somewhat less protection than Option 1, since it would have a higher visitation level.

In Situ Archaeological Resources: This option would provide somewhat less protection than Option 1, since it would have a higher visitation level.

Machinery and Large Artifacts: Machinery and vehicles will be operated, although on a limited basis. Of the three options, on balance this may provide the highest level of protection, since there would be less wear and tear than in Option 3, and more day-to-day maintenance than in Option 1.

Small Artifacts: There will be little, if any, difference among the three options.

Technologies: This option would provide a good opportunity for the preservation of historical technologies, since historical machinery will be operated.

B. Presentation Strategy

Relationship to Commemorative Intent: This option provides the best opportunity to present all of the identified commemorative themes, since it is intended that the site interpret the historical evolution of logging, lumber manufacture and camp life, so that all phases in their development could be represented directly. As with the other options, the VRC is available for the interpretation of thematic issues in which the site may be deficient.

Effectiveness of Communication: Option 2 would provide excellent opportunities for broad variation in interpretive products. These might include static and interactive exhibits, limited animation, and the demonstration of operating historical machinery and vehicles. This option would operate machinery, which Option 1 would not; and it would not place the same emphasis on animation as Option 3.

C. Operations

Direct Operations: In addition to the responsibilities described in Option 1, this option would entail the operation and interpretation of historic machinery in a safe and historically accurate manner. This requires the administration of skilled operators, some of whom will be staff and some of whom may be volunteers, and the volunteer component (always an administrative challenge) might be largest with this option. In addition, it will require conforming to numerous health and safety regulations, including those of the Workers' Compensation Board and those relating to the use of steam boilers. These considerations will make the operation far more complex.

D. Capital Costs, Visitor Forecasts, and Cash Flow Projections

Capital Costs: The capital costs have been estimated to be approximately $5,800,000.

Visitor Forecasts: It is projected that the attendance during the first full year of operation will be approximately 62,700.

Cash Flow Projections: It is estimated that net revenues in Year 5 will be approximately $7,996. This option has the least potential to become financially self-sustaining.

OPTION 3: OPERATING SAWMILL AND COMMUNITY

A. Resource Protection

Buildings and Structures: Over the *short term,* this option provides a very good level of protection for the physical resource, although less so than either of Options 1 or 2. In the case of many buildings and structures, the level of intervention would be highest. Most extant structures would be restored or rehabilitated, rather than stabilized; and some would be reconstructed (reconstruction would be the same as in Option 2). The mill would be operated more intensively than in Option 2, possibly requiring additional structural reinforcement.

Over the *long term,* deterioration would require the same ongoing program of maintenance (and replacement of fabric) as for the other options. Long-term deterioration would, in fact, be less than in Option 1, because more buildings would be used and therefore would be heated and would benefit from housekeeping and maintenance on a day-to-day basis.

Landscape Resources: This option would provide somewhat less protection than Options 1 or 2, since it would have a higher visitation level. Furthermore, it would be necessary to provide broader and more durable circulation routes than in the other options.

In Situ Archaeological Resources: This option would provide somewhat less protection than Options 1 or 2, since it would have a higher visitation level. The use of the field by many picnickerss might threaten the remains of Japantown more than in the other options.

Machinery and Small Artifacts: Machinery and vehicles would be operated on a regular basis. This would provide the most wear and tear; however it would also lead to day-to-day maintenance. The machinery would therefore remain in a good state of preservation, although with the continual replacement of moving parts.

Small Artifacts: There will be little, if any, difference among the three options.

Technologies: This option would provide the best opportunity for the preservation of historical technologies, since historical machinery would be operated and under conditions that approximate those of the working mill.

B. Presentation Strategy

Relationship to Commemorative Intent: The site and its activities would be presented as they were in the 1950s. This would provide an excellent opportunity to interpret the commemorative themes as they relate to the third (final) period of operation of the McLean Mill. However, the appearance, activities, and technologies associated with the first and second periods of operation would not be presented directly. They would be interpreted passively, both on site and at the VRC. As with the other options, the VRC would be available for the interpretation of thematic issues in which the site may be deficient.

Effectiveness of Communication: This option would provide the best opportunities for animated and interactive products, and would offer the best sensory experiences. Historical machinery and vehicles would be operated on a continual basis, and there would be a high-quality program of personal interpretation. However, this option would offer fewer opportunities than the other options for static exhibits, which would therefore likely require that the VRC be used to a greater extent to interpret aspects of site development and operation.

C. Operations

Direct Operations: This option would be the most complex to administer and operate. In addition to the issues described with Options 1 and 2, the sawmill operation might be organized as a quasi-autonomous commercial custom milling venture. The milling, logging, and transportation operations and schedules would have to conform to both the mill's requirements and the site's interpretation and programming requirements, requiring a considerable amount of co-operation between the site superintendent and the mill manager. Furthermore, the health and safety requirements would likely be more stringent than with Option 2, because of the more extensive use of machinery and the larger number of visitors on site.

D. Capital Costs, Visitor Forecasts, and Cash Flow Projections

Capital Costs: The capital costs have been estimated to be approximately $7,100,000.

Visitor Forecasts: It is projected that the attendance during the first full year of operation will be approximately 114,600.

Cash Flow Projections: It is estimated that net revenues in Year 5 will be approximately $130,047. This option is the only one of the three to have the potential to become financially self-sustaining.

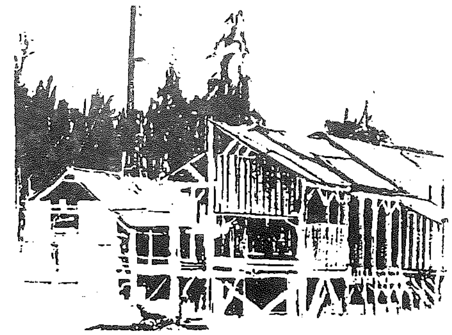
File: 390OP_AN

APPENDIX D

PUBLIC OPEN HOUSE:

QUESTIONNAIRE AND TABULATION

PUBLIC OPEN HOUSE QUESTIONNAIRE
R. B. McLEAN LUMBER CO.
NATIONAL HISTORIC SITE



City of Port Alberni
British Columbia Heritage Trust
Canadian Parks Service
Commonwealth Historic Resource Management Limited
15 October 1992

Purpose

The purpose of this Questionnaire is to provide public input into the planning process for the McLean Lumber Co. Site. The management plan has identified three options for site development, which are described and illustrated on Panels 5, 6, and 7. This Questionnaire requests your views on the relative merits of the options under consideration.

Objectives

A number of objectives for the development of the McLean Mill site were identified early in the planning process (Panel 3). The objectives are:

1. The ongoing operation will be **financially self-sustaining.**
2. The **management structure** should clarify the roles, responsibilities, and relationships of the partners.
3. Opportunities for **community involvement** in development, operation, and management should be maximized.
4. The **development plan** should have a clear phasing strategy, with the site being operational after the first phase.
5. The site should be **planned and marketed with other attractions** in the Alberni Valley that tell the story of the West Coast forest industries.
6. **Visitor services** should be provided without compromising the integrity of the site.
7. The interpretation should provide a **balance among the themes** of logging, lumber manufacture, camp life, transportation, technology, labour, and their interrelationship with the environment.
8. The **conservation of man-made. and natural resources** should also form a subject of interpretation.
9. Site development should be **consistent with the Canadian Parks Service's cultural resource management policy**.
10. The site should be **developed in an environmentally sensitive manner.**
11. The programming should **appeal** to both residents and visitors.
12. The project should **contribute to the economic diversification** of the region.
13. The **impact of development** on nearby land uses should be **minimized.**
14. Management should work with property owners and with local and regional governments to ensure the appropriate protection of a **buffer zone** around the site.
15. The **scale of development** should be appropriate to that of the site.

Questions

1. DO YOU GENERALLY AGREE WITH THE OBJECTIVES ESTABLISHED FOR SITE DEVELOPMENT? Yes ________ No ________

2. WHICH OBJECTIVES ARE MOST IMPORTANT TO YOU?

   1. ________________________________

   2. ________________________________

   3. ________________________________

   COMMENTS: ________________________________

   ____

   ____

3. Three distinct options for site development have been presented on Panels 5, 6, and 7.

   A. WHICH OF THE THREE OPTIONS DO YOU PREFER?

   Option 1 ________ Option 2 ________ Option 3 ________

   B. WHY DID YOU CHOOSE THIS OPTION? ________________________________

   ____

   ____

   C. HOW MIGHT THIS OPTION BE FURTHER IMPROVED?

   ____

   ____

   ____

   D. WHAT ARE YOUR COMMENTS CONCERNING THE OTHER TWO OPTIONS?

   ____

   ____

Questions (continued)

4. HOW IMPORTANT DO YOU THINK IT IS TO HAVE WORKING MACHINERY TO ATTRACT VISITORS TO THE SITE?

   Very _______ Somewhat _______ Not at all _______

5. DO YOU HAVE ANY OTHER OPINIONS OR SUGGESTIONS CONCERNING THE PLANNING AND OPERATION THE McLEAN LUMBER CO. SITE?

   ____

   ____

   ____

   ____

Please use the space below and/or the back of this sheet for any additional comments.

____

____

____

____

____

____

Thank you

Thank you for taking the time to respond to this Questionnaire. **Please return it before you leave, if possible.** If you do not have the time to complete your Questionnaire today, either return it to the Echo Centre or mail it, prior to 19 October 1992 to:

Mr. Eric McCormick, Director
Parks and Recreation Department
City of Port Alberni
4255 Wallace Street
Port Alberni, B.C.
V9Y 3Y6

R.B. McLean Lumber Co. National Historic Site
Questionnaires from Public Open House on 15 October 1992
Commonwealth Historic Resource Management Limited
5 November 1992

A. TABULATED RESULTS:

1. DO YOU GENERALLY AGREE WITH THE OBJECTIVES ESTABLISHED FOR SITE DEVELOPMENT?

   Yes __58__ No __0__

2. WHICH OBJECTIVES ARE MOST IMPORTANT TO YOU?

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	13		7	1	4	3	4			1	1	4			
2	2	2	7	4	8	2	6	1	1	4	1				
3	5		3	4	4	2	3	1	1	2	1	7	2		1

3. Three distinct options for site development have been presented on Panels 5, 6, and 7.

   A. WHICH OF THE THREE OPTIONS DO YOU PREFER?

   Option 1 __3__ Option 2 __9__ Option 3 __45__

4. HOW IMPORTANT DO YOU THINK IT IS TO HAVE WORKING MACHINERY TO ATTRACT VISITORS TO THE SITE?

   Very __52__ Somewhat __5__ Not at all __0__

B. COMMENTS:

NOTE:

- Remarks by Commonwealth Historic Resource Management Limited appear in [].
- Each response typed as separate paragraph.
- All responses typed as closely as possible to actual, including spelling and grammar.

2. WHICH OBJECTIVES ARE MOST IMPORTANT TO YOU?
COMMENTS:

Option 1 selected

[No third choice in Question 2.] Should provide a look at history as well as provide education of current forest situation.

I'm not a fan of tourism. I think the havoc it creates (environ & social) far outranks the minimum wage revenue generated.

Option 2 selected

[Objectives not specified per page 1 list in Question 2:]
The [?]upgraded integrated[?] mill site
Mill pond
Work done is of a good quality

[Objectives not specified per page 1 list in Question 2:]
1. Allowing visitors access to buildings
2. To view operations as they were: logs, saws, planing etc

A static display is just not enough. The site warrants more interaction. Stabilization and preservation urgently required.

[Objectives not specified per page 1 list in Question 2:]
[First two choices tabulated in Question 2]
3. Inter-relationship between logging/community etc.

Would like to see lots of community involvement

[Objectives not specified per page 1 list in Question 2:]
2. option 2 would be of more interest to visitors

The site should be restored - not completely operational - but enough to attract tourists.

The site should be restored - not completely operational - but enough to attract tourists.

<u>Option 3 selected</u>

This project will help to promote Port Albernie.

[Objectives not specified per page 1 list in Question 2:]
1. Preserve the history!
2. Access to the public!
3. Proper, local, contol!

not only should site appeal to both residents and visitors but there should be a strong emphasis on <u>education</u> regarding all the themes

[Question 2 - Objective 3:] #12, #4 to preserve site ambiance; should also include information on various wildlife, bird & fish habitats.

[Objectives not specified per page 1 list in Question 2:]
1. Restored to original plans as closely as possible.
2. Have the whole community involved

#11 is also very important to me - <u>i.e.</u> it should appeal to both residents and visitors. Too often we do not use and enjoy what is right here in our community.

To show future generations what occured during the lumbering process

[Objectives not specified per page 1 list in Question 2:]
1. Running mill
2. Create employment

Restore to best condition possible

[Objectives not specified per page 1 list in Question 2:]
Restoration (The bildings & meshenenry)

The options should be focused on and earlier time. When the McLean's were there.

R.B. McLean Lumber Co. National Historic Site
Questionnaires from Public Open House on 15 October 1992

[Objectives not specified per page 1 list in Question 2:]
1. To get the mill up and running
2. To attract potential tourists to the site
3. To integrate the McLeans mill in/to a destination site.

[Objectives not specified per page 1 list in Question 2:]
[3. checked indicating Objective 3 most important?]
I feel that thte amount of money involved would be more wisely spent in the restoration to an operational rather than a passive state.

[Objectives not specified per page 1 list in Question 2:]
1. working machinery and vehicles
2. railroad from town to bring people
3. facilities - restaurant, shops

[Objectives not specified per page 1 list in Question 2:]
1. Working Mill
2. Working Railroad hogging
3. Working Truck hogging

Tourist attraction with tourist facilities and dining

Impressed with the work done especially with the condition of the site before it was declared a historical site

[Objectives not specified per page 1 list in Question 2:]
[#3 circled, tabulated as most important]
If you do it do it right not half way --

The interest & commitment of this community can be maximiseded by continuing involvement. This is the volunteer capital of Canada!!

The educational value for school children held by a site such as this is incomparable.

[Objectives not specified per page 1 list in Question 2:]
1. preservation
2. restoration
3. economic development

excellent project - a real asset to the community

[Objectives not specified per page 1 list in Question 2:]
1. A Running Mill. A Running Railroad, etc.
2. All over Canada and the States Railroading (steam) is a Big drawing card for tourists. This is a costly project but the way things are going in the Forest Industry here in the valley we must have another industry to reley on, why not tourism.

The basic objectives are all important and are covered quite well

Also marketing with other attractions in the Valley - i.e. Harbour Quay - Forest Tours - Mill Tours - Railway transporation, etc.

The site should be made as environmentally sensitive as possible.
Should contribute economically to this area.

I also feel #12 is very important.

3.B. WHY DID YOU CHOOSE THIS OPTION?

<u>Option 1 selected</u>

This should form a basis for expanding to Opt 2 & 3 as finances and demand develop.

I'm not a fan of tourism. I think the havoc it creates (environ & social) far outranks the minimum wage revenue generated.

least expensive with a fair return. Can be expanded later on till we reach #3 option level.

<u>Option 2 selected</u>

I like demo's rather than steady production - visitor's should be able to talk with workers and get very close to machinery.

a balanced development of the site with opportunity to develop further as need arises

It would be nice to complete option 3 if funds could be made available

Option #3 too commercial; Option #1 does not offer enough to encourage visitors.

limited operation at first will gage what the future could be.

I feel the first would not attract as much interest and could possible lose interest and again fall into disrepair.

I think this would allow the site to operate/demonstrate logging practices without the intensiveness of full operation.

Economically would be better, although would still depict the era

Economically would be better, although would still depict the era

Option 3 selected

Will provide a more "real" presentation of sawmilling. Also will employ more during the "high" season.

It will generate more jobs for Port Albernie.

In spite of the high initial cost, the potential for > 100,000 visitors is very attractive. Also, a functioning mill is the only way to go.

It would contribute to the economic diversification of the region.

I believe that anything less would not be sufficient attraction to be feasible.

seems more practiable it's better to have some useful object rather than sitting idle

Restoration of the site should be such that it presents an accurate picture of how it operated.

There is no comparison between a "live" display and a static exibit.

It's the only option!

best opportunity to achieve all themes in an educational and fun atmosphere, finacially self-sustaining and incorporates working machinery.

Most interesting for visitors - also provides greatest visitors/$$'s for Alberni Valley. Probable destination for visitors.

The most gain in the diversification of our economy.

It seems to be the most workable and the most alive

In the long range planning the extra dollars expended will give the greatest return.

A working sawmill area will be best to show the process

Better return

I think it is the best option.

It provides the most exciting possibilities and I feel will become a very unique resource

It would be nice to see the mill and community operating as it once did. Having it support itself would be great.

Public attraction meaning more local business, higher return investments, jobs due to operational site.

This option should attract more tourists.

I feel that this option would present the best way to develop this site for a tourist attraction

Because the attraction to the site would be so much more interesting to visitors

Desires to smell sawdust, see the sawmill run, periodically. The "feeling" is important.

For tourist attraction - I feel this option would attract most tourists and employ the most people

After visiting many sites in the world this type of operations is self funding and an asset to the community and B.C.

Would probably attact the most visitors.

most viable option. greatest opportunity to show it.

It shows the true mill with it being operational

See above: If you do it do it right not half way --

This site is worthy of world wide recognition. It will get it with the best presentation possible. DON'T SKIMP!

At some point, allthough maintenance and operation are more costly, the site will generate a much greater profit

I feel full restoration adds the most to the project.

Would appeal to tourists more.

From a tourist's Point of View, when People are travelling they will Go out of their way to see something different.

Most structures restored so people can see that this mill site (and many like it now no longer) were small almost self contained towns.

Port Alberni needs economic diversification.

because it can help pay for improvements

It is the only option that creates an attraction of great enough magnitude to draw people to Alberni for that purpose alone and the only one that will keep them here long enough to require an overnight stay.
When McLean Mill was designated a National Historic Site I believe it was done so because it was the only steam driven mill in B.C. (and perhaps Canada) that could be operational again. Taped sounds and videos could be added to any derelict set of buildings!

Most general interest. Opt. 2 as first phase acceptable.

Number 1 is no option - Number 2 goes only half way: Number 3 is the dream and should be the goal.

I think it is a more "complete" plan - comprehensive. Why go half-way and end up changing it later! i.e. build arena & pool not quite up to size or an airport without facilities.

This option will attract the most visitors, stimulating interest in the area & will hopefully employ the largest number of people.

Operating displays are far more interesting. The additional people attracted by #3 are a big plus for the Alberni Valley.

It apears to have the greatest potential for success at start up and in the long term.

3.C. HOW MIGHT THIS OPTION BE FURTHER IMPROVED?

Option 1 selected

Would prefer an "open ended" process which allows development to meet demand.

some scheduled reliving of the logging days for special events

Option 2 selected

the site should provide for additional activities for the camper, hiker, trail biker and scenery buff, i.e. hiking trail to Beauforts etc. environmental interpretation
If necessary for production - perhaps after hours

In time, if Alberni becomes more tourist oriented, maybe option 3 would be economically viable.

Option 3 selected

Place as much emphasis for the entire operation to look, feel, and sound like a certain era of time, i.e. 1930's or 1940's.

"A Value Added" component to utilize any lumber produced similar to the boatworks which makes skiffs from lumber produced by the water powered mill at Serbrook N.S. This could be a furniture factory - out door chairs, tables, beds to name a few; rather than producing only 2x4's.

Not complete!!

Rail service to mill from town. - Forest walks with Q2. Comments - Possible future 3-day or weekend packages? Rail link from Victoria by steam train.

I believe it is very important to have the train running to help service the site and increase the attraction.

Not in a position to know.

Future sites for farmer's market and camping.

By insuring that interpretation of the site includes the earlier era of the mill

Don't put too much emphasis on the snack bar and other typical tourist stuff.

We should work with the merchants of Port Alberni to extend the theme throughout the community.

By a demonstration forest and emphasis on reforestation, environmental protection and other aspects of modern forestry.

Linking with rail to Harbour Quay. A total development like Knott's berry farm <u>start</u> out as before too much development.

With more money the project could be moving ahead faster.

Look at Upper Canada Village & copy

addition of other shops i.e. buttery & cheese etc. - hand crafted period products

The 2 Spot and Related train must be involved. We have accumulated a good base of Railroad stock and it would more than enhance McLeans Running mill.

Would keep the Railway within [?]corj site[?] (keep more 20's - 40's)

Some type of entertainment should be available. For example, dances at a community hall with the "Logger's" theam. Wood products should also be available for purchase as souveneers. People should have opportunities for "hands-on" experience.

I believe the transportation theme must be enhanced, particularly the rail link to the City. Option 3 does not even have facilities for offloading passengers. When the members of the Trust visited the site prior to National designation, one of their priorities was to maintain the pristine setting of the area. They did not want to see acres of parking lot, fast food outlets etc. Obviously some parking will be necessary, but bus tours and the public in general should be encouraged to arrive at the Harbour Quay/Station location, and ride the train to the Mill. Parking could be made available and concessions already exist.

By continually restoring & employing equipment of the eras represented. Also eventually employ peoples of all the complimentary trades, for deomonstration purposes, i.e. Black smith & carpentry.

A riding tour of the property by either wheeled or railed vehicle would give people ideas of the areas they would like to explore further.

3.D. WHAT ARE YOUR COMMENTS CONCERNING THE OTHER TWO OPTIONS?

<u>Option 1 selected</u>

1. [Option 1?] don't like "look only"

#3 may be too much too soon to start with. #2 at this time doesn't give as good a return for monies spent.

<u>Option 2 selected</u>

option #3 is a disneyland approach which can compromise its integrity; Option #1 does not provide enough restoration.

See [3]B [=] Option #3 too commercial; Option #1 does not offer enough to encourage visitors.

Option 3 is a second choice. Option 1 does not in my opinion help the community to a full extent.

With the present economy this could be too expensive and once started would be hard to back out of but if #2 is well received could be done at a later date.

#1 would be too static.
#3 would be exciting but will probably be too loud and busy for the profile of the visitor.

#1 is not enough to attract tourism. #3 would be too costly.

#1 is not enough to attract tourism. #3 would be too costly.

<u>Option 3 selected</u>

They don't bring as many visitors to the area. This project has the potential to be a key tourism marketing attraction. As such its benefits should be maximized. The concepts illustrated here serve to introduce visitors to the whole area.

Excellent options also but the more machinery operating (not passive) the better.

We would not attract the visitors that we should.

Lacking something as an attraction to tourists.

The other 2 options are static. I don't think they would be as attractive to visitors as an operational site would be.

The other 2 options could be phase 1 and 2 on the way to option 3, which has a pretty hefty price tag. It would require considerable support and largess from senior governments. However just think of the revenue from such a facility from G.S.T. and provincial sales tax. What I am saying is that there would be a return on their investment as opposed to a straight donation.

#1. not operational much like Duncan Forest Museum.
#2 no opportunity to incorporate other themes

Do not believe they would be interesting enough to attract visitors - only provide entertainment for visitors already in situ in valley.

They are too static.

Piece meal - do it right or don't bother

Does not return to operating mill

#1. If you don't know how a sawmill runs how can you imagine it.
#2. Would be OK. but if people have questions it would be nice to be able to ask someone.

Low investment return, no jobs, little or less interesting

They both cost a lot of money with limited opportunity for recovery

there is no comparison - for the extra amount of money the return on investment will be much higher

Difference in cost is not enough to make them an option. More jobs and self funding is best option.

Both are good if #3 not possible

sounds good but not enough people attracted to it. Too close knit.

#1 will not bring tourists back & #2 doesn't show the mill being operational as it should

Past is not what is wanted.

They are good but very difficult to add to later. Prepare for full development & phase in over a specific period. It's easier to shut down or put on temporary hold than build around what already exists - less expensive too.

They are, of course, more easily attainable but if we're going to do this for P.A., let's do it!

If funding is restricted Option 2 is next best - Option 1 does not offer as much.

People won't go out of their way to see a falling down mill site - option 1. Option 2 isn't much better.

Option 1 would attract few second time visitors. Option 2 - better than #1; however I would like to see visitors busy for 1/2 day. Meal or picnic on site. More chance of staying in town for other attractions. With lots to see & do more reason to come back.

Not enough tourist attractions.

I feel its better to show people who know nothing about sawmilling how one actually operates.

An absolute waste of time and money. I don't believe people will go out of their way to visit a static display such as either of the proposals in 1 or 2

Ph. 1 of no interest to me

See B.

The options each appeal only to a narrower range of interest.

No. 1 would attract only short term attention & low interest. No. 2 would attract more, as people would get more of the actual experience, but seeing the actual operation leaves a stronger impact. I was fortunate enough as a child to witness a working mill & was quite impressed by it.

They are good but do not offer the interest or economic benefit of #3

5. DO YOU HAVE ANY OTHER OPINIONS OR SUGGESTIONS CONCERNING THE PLANNING AND OPERATION THE McLEAN LUMBER CO. SITE?

<u>Responded to Question 5 only</u>

- Make the process of restoration the attraction
- Make up a narated slide show to be shown a Sproat Lake, Stamp Falls, Rath Trevor & other provincial parks in the area

<u>Option 1 selected</u>

Maintain close ties with forest around the mill site.

I hope that you are planning to expand the use of the site over the years to the #3 option level, depending upon the public interest of course. We need to develop the area to its fullest potential.

<u>Option 2 selected</u>

The McLean Mill interpretation should focus on an environmental impact assessment of man's activities. This would include animals, birds, fish, insects, etc. The forest as natural environment should be equal to forest as a resource

Continue with planning by community groups as well as levels of government at all levels.

It would be nice to keep all the original equipment as far as possible

Keep its flavor and appeal - most important

All employees dress in period dress. (Also the tour guides.) Unfortunately, more security.

I feel time will show what is needed in the future.

Option 3 selected

Try to tie Via Rail trip from Parksville - Harbour Quay - McLeans Mill. Parksville has a large number of tourists in their campgrounds who would love to take the day liner to Port Alberni for a day trip.

The train ride from E&N station is an absolute must! Also marketing the Mill site is imperative. Lack of the proper marketing is suicide.

I believe that this project should not stop; we have a rare opportunity to attract visitors from all over the world and really put Port Alberni on the map in a positive way.

Comments on question 3-d and Q2(1). [No option tabulated; comment:] The concept of a STEAM powered opperating sawmill would be a great attraction and tourist generator.

Have an operational train from downtown Port Alberni to the mill site!

3. restore Japanese Village
2. working donkey/spar tree operation.
1. demonstration forest
4. operate an Forestry Education Centre such as BCFA's - Green Timbers or World Forestry Centre

Rail/steam buffs would consider the trains (1055, 2 spot), plus a steam powered sawmill a major North American attraction (kids too). Interpretation of lifestyles of those ages provides interest

The spin off shopping - concession impact has been grosssly underestimated.

Let's do it right. Proceed slowly. Maintain the historical site but use it to encourage tourists to stop and spend their dollars here in Port Ablerni

Use the CPR and mill sites to sell the city re tourist destination.

None of the options emphasizes the initial development of the site and the McLean Family, as the eras focused on seem to be the later years.

I think having people in period costumes and pretending to live there is a great idea.

There is no doubt that the trend toward more responsible forest management on selected subjects are of growing importance. This project provides an opportunity to demonstrate factual information.

Since we have a unique opportunity I feel we should develop the site to the fullest.

Adjacent area to be developed as tourist attractions plus accommodations.

I think it would be excellent to have it fully operational. More interest to the public.

The "1055" locomotive should be done & the railway done as soon as possible as to transport visitors to the site as it is being restored.

a full time working mill and logging show would keep people away because of the danger so it would have to be a part time.

Stick with it! This will become a very important part of this community & help show the world what life was like. This is a rare find - this complete site.

The Railroad is a must to make this whole Complex come together. McLean's Mill, the logging trucks (not just McLean's) and 2 Spot running must be involved.

Would like to see a covered platform & small station to sell tickets to ride steam train to: 1) around mill site with small loci, 2) to E&N Station Port Alberni - then tour modern sawmill complex - A.P.D. or Somass. Suggest having property next door to McLeans Mill with W.V.I.I.H. Society. Steam, Railway & Logging equipment that could be toured (viewed) at the same time as mill visit. All objectives listed are important. With a shrinking forest industry job base & 500,000 people passing by to the west coast, it would be nice to secure a few jobs attracting tourists to a very unique site that was once common up & down the west coast and now is a memory.

Use as many local youth as possible. I.E. try and get them involved in this project. Youth in schools, the diversion program and other youth programs need to be more aware of program & given opportunities to participate.

To myself, and other members of the Industrial Heritage Society the rail link between the Station and the Mill has always been an integral part of the overall operation. Should that be so then the storage and maintenance facilities for that equipment should be at one end of the run. For economics of real estate and security reasons, part of the McLean site or property adjacent to would make sense. Furthermore a roundhouse facility would be an attraction in itself. Without a permanent home for the restored and restorable equipment (some of it from McLeans) the Industrial Heritage Society and the equipment could go the way of the Ladysmith group.
I have recently had contact with people at B.C.Rail and White Pass and Yukon Railway. The former has had a record year for passenger traffic between Vancouver and Williams Lake, running six car Dayliners daily in the summer, two of which are full with bus tours. This together with the Royal Hudson have made passengers one of the most profitable parts of their operation. The latter carried over 100,000 passengers in 1991 and expected to exceed that in 1992. It is their main source of revenue and they run a profitable operation. They took delivery of three new passenger coaches this year and will be ordering three more shortly.
If good service is provided the potential for a profitable rail operation to enhance an operating steam sawmill is a very exciting possibility for the Valley.

I believe it is important to recognize the work being done by the Industrial Heritage Society and that they be involved in the ongoing plans for the site. This will maintain a solid community base from which to work from.

I can see this site similar to Upper Canada Village in Ontario - where a family can travel by train to the site and spend a day back in history - include actual show at the mill site of logging also the various homes and how people lived and entertained themselves in those days.

I think a strong volunteer organization should be kept in place to work along with the paid staff. This will keep encouraging community involvement. Annual or semi-annual community days should be held at the site to keep up the local interest in the progress of the restoration. This would also give your volunteer groups a chance to encourage visitors to become involved.

R.B. McLean Lumber Co. National Historic Site
Questionnaires from Public Open House on 15 October 1992

Please use the space below and/or the back of this sheet for any additional comments.

Option 1 selected

Option 2 selected

This site must seek to determine how the people who go to Pacific Rim can be drawn to it. This appeal would probably involve environmental and natural features. Hiking up to Beaufort Mts and trail in an around site.

The McLean Mill site was an appealing place to work and to live according to the many former employees & residents. Commercialization of the site serve no positive purpose, in my opinion.

I feel there must be a lot of available transportation (train, bus, etc.) for the tourists. Limited working of the machinery would be beneficial.

Option 3 selected

I'm enthused and can hardly wait to see the project begin and when it is up and running.

Further to Q3-(b) My only concern about developing by phases is that "word of mouth" advertising might turn people away if they thought that they might skip the mill because people had told them it was just a derilic static display. I think an integral part of the plan would be a train ride pulled by a live steam locomotive. The CPR might have to leaned on to aquire running rights on their track. It should be noted that crew of the "2 spot" have passed the CPR rules of the road exam. There should be no problem with traffic control given the communication equipment availablilty.

- management should work closely with the community, local and regional governments and industry
- when dealing with other themes there is a need for balanced presentations not just politically correct.
- work closely with fisheries re creek
- what about parking
- should be no on-site or strictly controlled retail outlets
- VCR should be designed with facilities for school programs and educational seminars
- adult education i.e. Elderhostel

Similar to Victorian town in the provincial museum. - Trails through the 2nd growth forest with details of forest flora/fauna + marsh habitat/fish around mill pond, dam, & fields downstream.

A great addition to our regional district - lots of luck & best wishes.

I believe we can maintain the integrity of the McLean Lumber Co. site and also use it as a resource to generate badly needed dollars into our community. Good luck with this most important project!

The living history type of site is most exciting especially when interpreters are trained to speak in the first person and in costume

There should be something done on the McLeans time at the mill. If the 1950's are the years the options are aimed at the McLeans had already left. It should be a time when the McLean's lived and worked there.

The old technology preserved here provides an opportunity to see the "Way it Was" which will be of increasing interest as the future develops. The educational and historic opportunities are almost unlimited.

- prepared to have lots of [?]visitors to the community. Note steam enthusiasts.

There are many millwrights and loggers and businessmen in P.A. that should be involved in this developement if Option 3 were chosen - myself included.

I think this is an excellent opportunity to show people how logging was done at that time in history and how far we have advanced.

I would like to see more federal & provincial money coming into the restoration of the site. I think some of our local taxes should go towards this project.

with people still alive who remember what it was like. Also having a complete record of transactions helps. Make use of what is here, the talents within the community & share it with the world.

As a Complete Package. If their is any friction the whole concept is Doomed. Right now their is an undercurrent of friction and distrust. Let's Stop It Now Before everything falls apart. This is not "heresay". This is the truth. Most of everything here is volunteer oriented. Let's keep it harmonious.

Very commendable project

People could be dressed in the style of the day and acting out various roles.

APPENDIX E

GUIDELINES FOR NEW CONSTRUCTION

Originally submitted with *Discussion Paper* (March 1992)

Guidelines for New Construction

In keeping with the principle of distinguishability, new construction 'should not impair the aesthetic integrity or coherence of the whole.' Where new structures or buildings are required for visitor services, staff facilities, maintenance, storage, or other purposes, their location and appearance should not have a detrimental impact on the historic site, its landscape, or its structures.

The following principles should guide the siting and design of new construction:

1. *Site location.* Wherever possible, new buildings or structures should be sited so that they are not visible from the historic core of the McLean site. They may be concealed by mature trees or newly planted landscape screens. It may be possible to further reduce their impact by combining new service functions in a single building or a closely related group of buildings.

2. *Size and form.* Every attempt should be made to keep new construction small in size and scale. Where it is necessary to accommodate a large floor area, roof forms can be broken up into small components to reduce their mass. It would be advisable to use traditional shed and gabled roof forms compatible with those of the historic buildings.

3. *Exterior materials and finishes.* As most of the materials used in the original buildings are readily available and commonly employed in contemporary construction, all new buildings or structures should incorporate these materials. Interior finishes and furnishings should be contemporary in design, which will help to distinguish them from the historic buildings.

Prepared by Nicholas Bawlf, Bawlf Cooper Associates;
and Harold Kalman, Commonwealth Historic Resource Management Limited

APPENDIX F

PERSONS CONSULTED

City of Port Alberni
- Gillian Trumper, Mayor
- Henry Nedergard, Alderman
- Tommy Simmons, Alderman*
- Donovan R. Walker, City Manager
- Eric McCormick, Director of Parks and Recreation*

Regional District of Alberni-Clayoquot
- Hans Irg, Director
- Mike Kokura, Director*
- Robert Harper, Administrator
- Jim McManus, Planner

Alberni District Historical Society
- Judy Carlson
- Bob Hastie
- Anne Holt
- Valentine Hughes
- Dorrit MacLeod
- Jan Peterson
- Anne Rudy
- Lillian Swanson
- Susan Watson

Alberni Harbour Quay
- Mike Carter, Manager

Alberni Marine Transportation (*M.V. Lady Rose*)
- Dale Ballard

Alberni Valley Chamber of Commerce
- Rob Nichele (also representing the Tourist Bureau and the Travel Info Centre)

Alberni Valley Museum
- Jean McIntosh, Director*

Economic Development Commission, Regional District of Alberni-Clayoquot
W.M. (Bill) Ellwyn, Economic Development Officer (also representing the Alberni-Clayoquot Development Society)

Friendship Centre
Wally Samuel, Executive Director

MacMillan Bloedel Limited
R. Dale Tuckey, Vice-President, Alberni Region
Dave Blake*

Maritime Heritage Society
Ken Hutcheson

Museum Advisory Committee, City of Port Alberni
Bob Hastie
Barry Lynd*
Simo Nurme*

North Island College
Simo Nurme*

Port Alberni and District Labour Council
Henry Nedergard, President

Port Alberni Commercial Enhancement Society (PACES): Business Improvement Area
John Mooney, Manager/Co-ordinator

Port Alberni Harbour Commission
Denis J. White, Port Manager/C.E.O.*

School District 70 Alberni
R.F. (Bob) Kanngiesser, Secretary-Treasurer

West Vancouver Island Industrial Heritage Society

Gordon Blake
K.G. (Soup) Campbell*
Steve Drybrough
Pete Geddes
Hugh Grist
Kevin Hunter
Rick Lord
Dave Lowe*
Les Stevens
Vic Walkland

* Denotes a member of the McLean Mill Steering Committee

APPENDIX G

PROJECT PARTICIPANTS

The preparation of the Management Plan has been guided by a Client Group, made up of representatives of the three partner agencies; and by a local Steering Group, comprising interested members of the Port Alberni community.

The following people served on the Client Group:

PARKS CANADA, WESTERN REGION
Jim Hartley, Management Planning (Chair)
David Whiting, Architecture and Engineering Services for Parks Canada, Public Works Canada

BRITISH COLUMBIA HERITAGE TRUST
Mark Bawtinheimer, Architect

CITY OF PORT ALBERNI
Eric McCormick, Director of Parks and Recreation
David Lowe, Project Manager, R.B. McLean Lumber Co. N.H.S.
Jean McIntosh, Director/Curator, Alberni Valley Museum

A number of other members of the Parks Canada and Public Works Canada staff have participated in various stages of the project; they include:

C. James Taylor, Historian
Kevin VanTighem, Interpretive Planner
Greg Husband, Planner
Andrew Powter, Architect
Brian Woolsey, Long-Range Planner
Susan Hum-Hartley, Engineer
Alex Barbour, Marine Restoration Expert
Ron Hooper, Superintendent, Pacific Rim National Park
Alison Manley, Superintendent, Gulf of Georgia Cannery N.H.S.

The following people served on the Study Team:

Principal Consultant and Project Manager

COMMONWEALTH HISTORIC RESOURCE MANAGEMENT LIMITED
Harold Kalman, Principal, Project Manager, and Heritage Resource Planner
John J. Stewart, Principal, Landscape Architect, and Site Planner
Marta Farevaag, Community Planner
Meg Stanley, Historian
Kirtlye Woodruff, Office Manager
Craig Dixon, Cartographer

Associated Consultants

BAWLF KEAY ASSOCIATES, ARCHITECTS LTD. (formerly Bawlf Cooper Associates)
Nicholas Bawlf, Principal and Architect

THE ARA CONSULTING GROUP INC., Economic and Management Consulting
David Russell, Principal and Economic Planner
Nicole Beissner, Tourism Planner

QUOIN PROJECT AND COST MANAGEMENT LTD.
Euan McLean, Principal and Quantity Surveyor

LORD CULTURAL RESOURCES PLANNING AND MANAGEMENT INC.
John Nicks, Principal and Cultural Resource Planner

MILLENNIA RESEARCH
Morley Eldridge, Principal and Archaeologist

TERA PLANNING LTD., Environmental and Social Planning
Timothy Bekhuys, Natural Resource and Wildlife Ecologist

HISTORICA RESEARCH LIMITED
Christopher Andreae, Principal, Industrial Historian, and Industrial Archaeologist

Resource Consultants

Robert Turner, Chief, Historical Collections, Royal British Columbia Museum; specialist in transportation and industrial history

John Mitchell, Director, Burnaby Village Museum; former Director, Alberni Valley Museum

Robert Griffin, Head, History Unit, Royal British Columbia Museum; specialist in the history of the sawmill industry

Photographs used in this report were provided by Parks Canada, Public Works Canada, the Alberni Valley Museum, and Commonwealth Historic Resource Management Limited.

APPENDIX F.

3.2.6 McLean Mill National Historic Site, Draft Document - Condition Assessment, Feasibility Study and Conservation Plan for the Mill Complex. 1994. Public Works and Government Services Canada

Machinery
Assessment

Section 7

Note: some of the assumptions made re interpretation of which machinery will not operate are misleading. These decisions have not necessarily been made

McLEAN MILL NATIONAL HISTORIC SITE

DRAFT DOCUMENT
HCP (A&ES) PC/EC
9. MAY 1994

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Machinery –

Section 7

McLean Mill National Historic Site
Condition Assessment, Feasibility Study and Conservation Plan for the Mill Complex

(including the mill building, power house, planer mill, related structures and insitu equipment and machinery)

CONTENTS

DRAFT

Machinery - A&E Cond'n Assessment

Section 7 ...

DRAFT
EBAUCHE

2. INTRODUCTION

2.1 Purpose:

i. This study limited to the main mill building

ii. The mill building is the principle building on the site and is central to its national historic significance and its presentation.

iii. The purpose of the work is to provide to the City of Port Alberni and its partners with:

. a detailed assessment of the condition of the main mill building and directly associated machinery and structures;

. an assessment of the implications and impact of the proposed plan concept as described in the draft management plan; and

. a multi-year plan for recording, investigations, studies, assessment, design and construction.

2.2 Project Team:

Heritage Conservation Program (HCP), A&ES(PC):

Alex Barbour, machinery
Lyse Blanchet, engineering
Jean-Pierre Jerome, heritage recording
Kathleen Murphy, machinery
Rebecca Ott, architecture
Andrew Powter, architecture

Architecture and Engineering Services, Western Regional Office
David Whiting, McLean Mill Project Leader

City of Port Alberni
David Lowe, Project Manager

Other staff from Parks Canada, Western Regional Office and the City of Port Alberni provided valuable background information and input.

2.3 Methodology:

Preparation for site work included a review of existing record drawings , various reports concerning the development of the mill as an historic resource including the *Management Plan for the McLean Mill National Historic Site* by the Commonwealth Historic Resource

Management Limited, all provided by David Whiting. The precision of the existing architectural and structural documentation proved to be inadequate therefore it was necessary to carry out additional recording as part of the on-site analysis. Selected additional heritage records were provided after the field work to support preparation of theis report.

On-site investigation by both architects and engineers included visual inspection, comparison with historic photographs, and diagnostic techniques such as measurement of moisture levels and sounding of materials. Wood and mortar samples were taken and submitted for analysis.

Engineering analysis included review of existing structural drawings; a thorough visual inspection; verification of structural aspects and observation of the as-found condition of members and connections; comparison of load effects as prescribed by BCBC/NBC with strengths and resistances from CAN/CSA-086.1-M89 Engineering Design in Wood (Limit States Design).

Engineering analysis also included a review of expected deformations due to load effects and analysis of statistically indeterminant roof systems carried out with the aid of P-Frame, a structural analysis program employing the stiffness method.

Results from the theoretical computer analysis were compared with site conditions and deformations of the structure wherever visually accessible. Further inspection was devoted to areas in the analysis indicating high stresses as compared to acceptable code values. Recommendations are based on the results of the analysis and condition assessment.

Post-site work to finalize the Report included interpretation of laboratory findings and additional technical research as required, meetings among all disciplines to develop and analyze options, and the production of graphics to support findings and hypotheses.

2.4 Site Location and Description

The McLean Mill National Historic Site, located on 32 acres near Port Alberni, British Columbia is situated within a clearing in the midst of a dense second-growth forest at the foot of the Beaufort Range. The forest edge provides an authentic backdrop to the site, and limits views except where the mountain tops can be seen above the treetops. The forest surrounding the site plays an important role in expressing the isolation of the McLean Mill from Port Alberni. Three roads lead from Port Alberni to the site: Smith Road, KitsuksisRoad, and Cherry Creek Road.

The site itself contains more than 35 extant structures, including the steam-powered sawmill. The site operated between 1926 and 1965, and has been donated to the City of Port Alberni by MacMillan Bloedel Limited. The buildings erected during the Mill's operation are utlilitatian frame structurs, built for the present with little thought to permanace. Most are constructerd of conventional wood framing, resting on sleepers on grade. those that are enclosed have a variety of exterior cladding materials, including board and batten, and vertical and horizontal siding of different dimensions and profiles. Roofs are typically wood shingles or corrugated metal.

Machinery –
A&E Condn. Assessment

Section 7

Wood is the main material used in construction of the mill and surrounding structures; the wet conditions of the Alberni Valley region provide a difficult climate for long term protection of this material. At the time of this report, progressive decay and some structural failure in the mill building and in surrounding buildings was noted which highlighs the need for expeditious stabilization and preservation.

A programme of interim stablilization was begun in 1991, following the rcommendations in the Iterim Protection Plan. Technical and financial support have come from all three parnters, after MacMillian Bloedel donated the land. Most of the work has consisted of replacing rotted wood elements in kind, securing cladding, adding bracing where required and improving drainage.

2.5 Designation and Commemorative Intent

The national significance of the lumber industry in Canada was first recognized in 1943 by the Historic Sites and Monuments Board of Canada (HSMBC). It was commemorated by the erection of a plaque in Port Alberni. In 1976, HSMBC recommended that the British Columbia forest industry is of such national significance as to merit commemoration beyond the level of a plaque.

In June 1989 the HSMBC recommended that:

> The McLean Mill site, at Port Alberni, British Columbia, with its collection of extant resources relating to logging, sawmilling, transportation and labor in the British Columbia Forest Industry and with its close association with the significant aspects of that Industry, should be declared to be of national significance.

The Board also recommended that:

> ...the Program contact the Province of British Columbia, MacMillian Bloedel, the City of Port Alberni and the Alberni Valley Museum in order to determine their interests in co-operating with it in the immediate stabilization of the surviving in situ resources at the McLean Mill site and in the future restoration, preservation and interpretation of those resources as a major commemoration of the national significance of the British Columbia Forest Industry.

In August 1989 the Minister of the Environment declared the McLean Mill as a National Historic Site for its association with the forest industry in British Columbia.

It is intended that the site be developed by the City of Port Alberni, in cooperation with the Government of British Columbia, the federal Department of Canadian heritage, and others who may benefit from its development.

DRAFT

A&E Condn Assessment

4. BUILDING CONDITION ASSESSMENT

4.1 Introduction:

The individual resources at the McLean Mill site can be considered as quite ordinary if taken out of their context; it is however the unique combination of these 'ordinary' resources that determines the McLean Mill site so representative of the British Columbia forest industry, and so a superb candidate for commemoration.

From the perspective of the history of technology, the McLean Lumber Co. resources milling and logging operations portraying not only different aspects of logging and sawmilling technology, but also the integrated nature of the forest industry. They also reveal the differences between the local, rail, and export trades; changes in technology and organization; and the life and work of the people involved in sawmill and logging operations.

4.2 Site:

Description: The site slopes from a generally high area at the south west corner toward the north and the log-pond area to the south.

Observations: During this site visit large quantities of water were constantly running through the building. This condition is apparently usual except during long periods without precipitation. In several locations water appeared to flow out of the ground or disappear again into the ground. A number of wood culverts were observed in the areas of greatest volume. A number of channels have been excavated to guide and divert this flow through the building and out the other side (*). The major channel, along the north side of the mill, is deep and runs close to a concrete pier (insert grid number). Although these piers are said to rest on the hard-pan, the danger of undermining should be considered and investigated.

Conclusions: The drainage situation along with regular replacement of piers, installation of new foundations and modifications to the equipment indicate that this area is highly disturbed. Archaeological investigation might be required for specific information such as drainage patterns, earlier equipment locations.

4.3 Mill Building (D-1):

General Description: The mill building is a long two storey structure oriented on an east-west axis. It is constructed in heavy trimber, both natural round and sawn. Wood is the predominant material. Structural steel does not appear in the building. The main level is supported by post and beam construction. The beams generally run the length of the building with all joints being located over posts. The roof structure is supported by separate posts, plates which run the length of the building and truss/ rafter assemblies. All joints are simple, butt connections but are usually bolted or pinned with steel rods. All metal structure is in the form of bolts, pins, tension rods and spreader plates. The roof of the building is a simple low-pitch gable clad in corrugated iron.

The construction is utilitarian and reflects a history of pragmatic responses to requirements.

DRAFT

regular alteration, addition and adaptation of the building and its equipment over time for repair and to accomodate changes in logging operations, sawing operations, mill products and changes in the loads imposed by relocation and updating of machinery. Among the building's strongest characteristics are its ability to document its own evolution, changes in plan, massing, arrangement, design and material.

- footings plain, concrete pier or wood pad (refer photo)
- beams sawn on two sides or on four sides (refer photo)
- diagonal bracing placed in the vicinity of lateral loads and randomly, various dimensions, length and joints (refer photo)
- once regularly placed, first floor posts now random, single, double
- early posts pass through the floorboards and bear on beams below-
- others bear on plates laid on the floor
- trusses of various sizes and designs have been introduced to create clear spaces and openings
- most graphic evidence of evolution is in the original south wall and the roof structure
- roof structure contains 8 different arrangements from the original roof truss of 1926 to the last extension (west) in 1955)
- very little plate steel or iron is used in the building.
- connections made with steel pins and bolts with nuts, washers and various spreader plates

Lower level:
Description:
The foundations consist of wood posts on concrete bases or wood pads. The posts are all heavy timber construction and are located on grid which is generally regular although it changes at several points along the building. In addition several specific posts are placed off the grid in locations of particularly concentrated loads probably due to the presence of machinery or other applied loads. The posts are supported laterally by various diagonal braces. The post and pad systems are:

Type A: - natural round posts, approximately 12-14" diameter, in the grade, depth unknown
- this is apparently the original foundation type of which 3 are considered to be extant. (*)

Type B: - sawn posts, approximately 14-16" square in section, on tappered concrete piers, depth unknown, a building felt separates the concrete and the wood post.
- the concrete piers are believed to have been installed along with new posts c 1946. (*)

Type C: - sawn posts, approximately 14" square in section, on wood pads at or just below the surface. (*)

Lateral bracing is provided in one or two directions in the form of a diagonal brace between the post and beam. (*) Three large diagonal braces are located in a north-south orientation(*).

The floor structure consists of heavy timber beams which run in an east-west direction and joists in the north-south direction. Like the posts the arrangement and spacing of these

DRAFT
DRAFT

Machinery -
A&E Condn Assessment

Section 7

elements is not entirely regular. Various supplementary beams and joists are located in areas of particular need.

All connections are made with simple joints such as butt joints and half-notches. There is no evidence of more complex structural joinery. All connections are made with iron pins, bolts and spreader plates. Spreader plate types include several designs and sizes of cast-iron plates, large washers, flame cut iron plate, and miscellanious machine parts such as gears, cams and ratchets(*). Steel or iron structural sections or reinforcing plates do not occur.

Overall, although the construction at this level is to a generally consistent pattern although it is characterized by inconsistency and irregularity, a responce to changing needs over time.

Various elements of the machinery, constructed in wood, are integrated with the building at this level. These include elements of the waste disposal system, particularly that located under the log deck and the power feed for the sawdust, and wood conveyors. These elements are addressed in section, Waste Conveyor (D9).

Observations:
At the west end of the building most posts have recently been replaced with new material. At the west end the age of the posts varies. Three "original " posts are apparently extant (*). A number of other posts were replaced in the late 1940's (concurent with the installation of the concrete bases) and others have been recently replaced, in some cases with recovered material.

Lateral bracing has been removed, pressumably during previous remedial work, from the top of some posts. These should be reinstated.

Based on visual inspection, the foundation timbers, concrete bases and pads appear to be in good condition with the exception of the "original" posts and several posts located along grid line C. Here the bases of C3, C4 and C5 exhitibt superficial decay at the surface of the base. A significant carpenter-ant attack was located in the beam where it rests on the top of the post post at B2. The top of the column has accumulated a lot of debris which is is holding moisture. It is not clear if this old or active attack.

The type of construction, exposure and deterioration patterns indicate that the posts should be investigated internally to determine the extent of internal decay at both the top and bottom and to ensure minimal replacemnent of fabric. This work should be done in 1994-5 or 1995-6 prior to commencing operations.

Deterioration of the beams and posts is varied. Although several beams have been replaced recently two beams located under the log deck between grids A4 and A5 are heavily deteriorated for approximately 2.0M of their length. Full replacement of these beams is required. Although most of these elements pass visual inspection remedial work to-date has indicated that the most common pattern of deterioration is at the core of these elements, out of site. Moisture is trapped at the interface of joists and beams, beams and posts and joists and floor boards. The deteriration is uniformly fungal in these locations although carpenter attack is evident in the building in selected locations.

Conclusions: It is evident that remedial work to date has placed the building out of damger of catastophic collapse, however, further testing and remedial work is required prior to beginning operations. A program of internal investigation should be carried out to determine the extent of internal decay in these members and to ensure minimal replacemnent of fabric. This work should be done in 1994-5 or 1995-6.

Main level:
Description

Observations

Conclusions:

Roof level:
Description:

Observations:

Conclusions:

***
Attic level
Roof cladding
Walls and cladding
Other features
Conclusions and Issues:
- site drainage
- weather shedding: roof, eaves, sidewalls
- heavily deteriorated components
- etc.

DRAFT
EBAUCHE

4.4 Boiler House (D-2):

General Description: The Boiler House has two components, the fuel storage bin and the boiler building shelter.

Fuel Storage Bin:

Description: The Fuel Storage Bin is a gable-roof structure built in crib or "grain-bin" construction. It is raised on timber piers, the floor being approximately the height of the mill

Machinery
A&E Condn Assessment

Section 7

building floor level. The walls are constructed of double 2"x4" laid-flat, with 4"x4" vertical stiffeners. A system of chutes is configured to deliver sawdust to the bin from the main saw or directly to the boiler as required. A cyclone unit was mounted on this building to draw waste from the planer. Early photos show a similar bin on the present site although there are some discrepancies from the building shown which suggests the existing building might be a replacement for an earlier one possibly on the same foundation. Photographic evidence indicates that the "Cyclone" unit which was present on the roof in the 1960's was preceded by a square unit constructed in wood.

Observations: The Fuel Storage Bin is in a general and advanced state of deterioration. The wood fabric is extensively decayed and the structure has deformed or failed in numerous areas. The roof cladding was removed in 1992 to reduce snow-loads, the south wall is braced to prevent collapse and the building is supported on temporary cribing and beams. The transverse support beams are deteriorating and are showing signs of crushing. The sawdust delivery chute system is mostly extant.

Conclusions: Preliminary recording (measured drawings) has been completed by the site in 1993. These records document the configuration, design, and detailed construction of the building in an undeformed state. The general configuration and much of the construction can be documented from the building. The existing records and extant components should a

The Management Plan concept recommends replacement of the Fuel Storeage Bin with an "operational" unit. It has been suggested that a rebuilt "fuel-bin" would lend itself to housing a modern "flash boiler" or other steam supply.

Boiler Building:
Description: The Boiler Building consists of a gable roofed shelter over the masonry and iron boiler. The shelter and upper floor is supported on natural round posts and the roof and upper side walls are clad with corrugated iron. The building upper floor is approximately the height of the mill building floor level. The boiler is mounted in a masonry firebox. The masonry firebox is experiencing several types of deterioration - deformations, cracks, errosion of the masonry units and effloresence. The masonty was reinforced at an unknown earlier date with railway iron and channel iron. An iron chimney rises from the boiler.

Observations: The Boiler Building has been rebuilt in 1992. With the exception of the boiler, its masonry frebox and much of the roof structure, most elements of the building were replaced at that time.

The Management Plan concept recommends thet the Boiler Building be rehabilitated and made operational along with the fuel-bin.

Conclusions:

Recommendations:

DRAFT

1. The fabric and structure of the Fuel Storeage Bin building is deteriorated beyond repair.

The walls and foundations of the building should be monitored for further collapse and all efforts made to retain the building in place in a stabilized condition. No additional intervention action can be recommended at this time.

2. Recording: Available measured drawings should be reviewed for completness and additional detailed recording completed as required and to ensure that they are sufficient to support replacment of the building in the future. Particular attention should be given to recording the sawdust chute system.Recording of this feature is Priority A for 1994-95.

3. Only minimal intervention to the firebox brickwork should be attempted. Dismantling should not be considered.,

4.5 Green Chain and Lumber Grader's Shed (D-5):

Description: The Green Chain consists of a long low structure fabricated of heavy timber and dimension lumber. Designed to move sawn lumber from the mill for grading and sorting, this structure is equiped with 2 electric motors, reduction gear units, their controls and the necessary chains, power transmission shafts and other metal fittings (*). The green chain was constructed in ________. The Lumber Grader's Shed is a small frame shelter located at the south-west corner of the Main Mill Building and the edge of the Green Chain (*).

Observations:

The Green Chain, a substantial, well built structure, is now in a state of advanced deterioration due to biological deterioration. The structure is at the point of progressive collapse and all wood componenets are disintegrating. The metal components apopear salvageable but salvage will soon be necessary if distorion of the components is to be avoided. The cause of the deterioration is apparent, the Green Chain has been fully exposed to the weather since being built.

possible conservation approaches

. replacement in-kind matching material, design, dimensions, operation

. replacement with unlike material, design and finish; matching general arrangement and operation.

- deterioration of

- general configuration and much construction detail is salvagable;
- preliminary recording has been completed in 1993

Conclusions:

4.6. Planer Shed (D-6)

Description:

Observations:

DRAFT ÉBAUCHE

Machinery -
A&E Condn Assessment

Section 7
...

Conclusions:

4.7 Wood Bin (D-7)
Description:

Observations:

Conclusions:

4.8 Sawdust Bin (D-8)
Description

Observations

Conclusions

4.8 Waste Conveyor (D-9):
Description:

Observations:

Conclusions:
- heavy timber (8x8) and dimension lumber and railway iron bents connected by wood and iron conveyor chute;
- few metal assembly fittings;
- structure is in advanced state of deterioration of fabric and structural failure due to biological decay;
- no records have been made to date;
- recording of the general arrangement, construction details and the mode of operation of this feature is Priority A for 1994-95;
- the Management Plan concept does not identify the waste conveyor for a specific treatment.

4.9 Waste Burner (D-10)
Description:

Observations:

Conclusions:

- rough constructionof irn pipe, cable, iron and corrugated iron shets;
- management plan identifies replacement with an operational unit;

4.10 Lumber Deck (D-11):

DRAFT
EBAUCHE

Description:

Observations:
- archaeological resources only
- some remaining surface debris
Conclusions- only sub-grade elements of this feature are extant, the remainder was removed in ? ;
- documentation to date consists of identification and survey of posts and the short mud sills

Conclusions:

4.10. Log Haul:

Description:

Observations:

Conclusions:

Machinery - A&E Cond'n Assessment

Section 7 ...

5.1 Structural Analysis- Introduction

(Background)

Following the recognition of the R.B. McLean Mill as a National Historic Site, in 1990, the Minister of the Environment instructed the Canadian Parks Services (CPS) to provide technical assistance to the Alberni Valley Museum in order to identify specific guidelines for interim protection of the in-situ resources. The report - Interim Protection Plan, June, 1990 - was prepared by the Western Regional Office with the support of the Heritage Conservation Program of the CPS.

In 1992, Western Regional Office requested that a preliminary review of the existing McLean Sawmill structure be undertaken by a Consulting Engineering firm. In 1993, the Western Regional office and the Heritage Conservation Program were identified as technical and professional resources to perform a condition assessment, investigation and recording of the historic structure. A preliminary visual inspection was performed in the fall of 1993. Terms of reference for a thorough investigation were prepared (refer to Appendix _). In March 1994, the team was sent on site.

(Purpose)

The purpose of the structural investigation is to define all implications and requirements raised by the development plan which involves rehabilitating the mill structure to operating condition again.

(Objective)

The main engineering contribution is to provide a detailed evaluation of the condition of the McLean Mill building, to introduce a conservation approach to the work to be done on site and to give technical assistance and advice on the kind of work the structure requires. A second objective will be to impart a better understanding of the structural behaviour of the mill in order to select appropriate interventions for the implementation of the development plan.

(Context-Scope-Methodology)

The structural modifications performed, the level of decay of the materials and the distinctive weather conditions at the McLean Mill raise some structural and preservation concerns. Effects of the "non-activity" and lack of maintenance of the mill during the last thirty years increased the rate and the level of deterioration of the structure. Thorough structural investigation and analysis are then required to identify the "causa causam" of the structural deficiencies observed.

Structural interventions required for the mill rehabilitation will be based on the structural analysis performed on the structure in conjunction with the heritage character statements prepared for the mill. Past performance of the structure will also be considered in the structural analysis. It should be noticed that various structural systems, components and materials found in the mill are addressed neither by the structural design standards referenced by NBC part 4, 1990 nor the Wood Design Manual, 1990.

Terms of reference defined for this project (refer to appendix ...) combined five engineering services to be performed:

DRAFT

DRAFT

a. Building Condition Assessment : This activity will summarize all possible types of decay/defects or deterioration or malfunctions of all structural components and identify possible causes of such problems followed by recommendations for remedial work - their impact on the cultural resources will also be assessed;

b. Complete Structural Analysis : This activity will focus on detailing the structural behaviour of basic structural systems and components which were found as having possible structural deficiencies, and will confirm the reliability of some others. Since no adequate recording of the Mill was available at the time of the investigation, analysis of any global or differential settlement, displacement or deformation which may have occurred could not be performed.;

c. Assessment of the Building's Structural Capability based on their results from activities a and b: this activity will involve the selection of the most critical structural elements for which a structural capability assessment will be performed - adequate recording will be required for the assessment to be performed;

d. Recommendations for the building protection, stabilization and long term conservation: this activity will include identification of required remedial work based on the analysis and diagnosis performed in activities a, b and c, and on their impact on the historic structure; development of operational standards for maintenance, monitoring and repair for the mill; and provision of a class "C" cost estimate.

e. Guidelines for interim actions: this activity will involve development of recommendations for studies and investigations required in preparation for the design activity, and a class "C" cost estimate.

In order to fulfil this mandate five steps were identified. Steps 1 and 2 have been completed and their results are presented in this report, steps 3, 4 and 5 will be completed when sufficient adequate recording of the building and technical information on machinery will be available:

1. site visit to gather general information;
2. building condition assessment and lab testing of materials to determine properties and condition;
3. structural analysis to understand the structural behaviour of the complex timber structure
4. structural capability assessment;
5. site visit to confirm results from the theoretical analysis and modelling, and to complete the structural recording for activities c,d,and e - site visit is scheduled later this summer, 1994.

DRAFT
ÉBAUCHE

Arachaelogy - A&E Condn Assessment

Section 7

5.2 Structural Analysis- Building Condition Assessment

The major objective here is to provide a complete condition assessment of the structural components: condition, analysis/diagnosis and recommendations for interim protection. Based on this assessment, recommendations for a complete maintenance and monitoring program will be developed for the long-term conservation plan for McLean Mill .

4.1 Condition Assessment:

4.1.1 The mill

Observations -

- very high relative humidity during the winter season;
- leaks in the roof and the walls;
- lack of maintenance and non-activity for the last thirty years;
- the overall level of wood deterioration on site is very high.
- accumulation of water on timber;

Analysis & Diagnosis

In Port Alberni, on a yearly basis, temperature, (T°C) varies from -7°C to 31°C and relative humidity, (RH%) from 40% to 90%. Year after year, wood will expand and contract to reach its equilibrium moisture content. At the time of the investigation, weather conditions and moisture content of wood, were measured: 53°F (12°C) and 85RH%, and 22-30MC%. Same conditions can be found during the whole winter season which raises the moisture content of wood from 7% in the summer season to above the fibre saturation point of the wood (24%MC).

Leaks in the metal roofing and walls allow water to accumulate at specific locations on wood elements such as floorboards, rafters, and purlins which consequently increases the MC% level to 35-40% for sound wood. This situation also, causes rusting of wrought iron nails and steel fasteners (tie rods and bolts) and allows the decay process to start in sound wood elements.

So, during the winter season, even if the leakage problems are controlled, moisture content in the wood stays around the fibre saturation point. In such a situation, infestation of fungi or insects and oxidation or rusting of corrosive fasteners are eminently expected.

Recommendations -

Interim work will not be required at this time. Weather conditions can not be controlled, leaks in the roof and the walls will be part of the long-term conservation plan, and no wood preservative treatments can be applied on site.

4.1.2 The fasteners

Observations -

- rusty metal fasteners in contact with the wood;
- tie rods bolted vertically and diagonally through the wood without any protection against water infiltration;

DRAFT

DRAFT

3. Site Visit

The mill was investigated following a well defined rational. A three-day structural investigation was conducted in March 1994 by the project engineer, Ms. Lyse Blanchet, under the supervision of Mr. Andrew Powter, Chief, Period Architecture. Equipment used to perform the survey consisted of: a moisture-meter kit, a pin injecting pilodyne, a sample corer and a measuring tape. Colour slides and prints were taken to show specific aspects of the mill which will be useful for the understanding of technical comments reported in this report.

The investigation was scheduled for three days, and was executed as follows:

1: Tour of the mill in order to get acquainted with the structure and its environment.

2: Visual inspection to gather the following information :
- general condition assessment of timber and other structural components;
- identification of different structural systems displayed in the Mill;
- identification of different failure modes, over-stresses and malfunctions in the structure;
- identification of previous interventions done on the structure;
- identification of the reasons and the extent of failed and deteriorating conditions, and their effects on the structural behaviour of the Mill;
- identification of all needed recordings for structural analysis purposes;
- selection of various wood samples for analysis of rot, infestation, wood species, and mechanical properties identification;
- selection of useful photographs owned by the staff on site;
- pertinent information and documentation regarding previous remedial work in terms of cost of labour and materials, and amount of historic material replaced or repaired.

3: Discussion with the site project manager, Mr. Dave Lowe, and the regional co-ordinator, Mr. David Whiting, to collect all information relating to the operation and the maintenance of the mill.

DRAFT
EBAUCHE

Machinery – A&E Condn Assessment

Section 7

Analysis & Diagnosis
All steel fasteners (except for nails) and rods were installed during the 1940's. The most deteriorated wood elements were located where corrosive fasteners were in contact with wood, mostly at wood to wood connections. Since 1940, no prevention work against water infiltration have been undertaken.

Recommendations -
Interim work will not be required at this time.

4.1.3 The wood

Observations -

- greenish coloration on several timber elements;
- different dampness conditions (MC% readings) at different locations in the mill;
- tunnelling in some timber elements;
- excessive index of growth characteristics such as checks and wind (or twist) were noted on several timber elements;
- different wood species at specific locations;
- extremities of timber elements are not protected against water;

Analysis & Diagnosis
The service life expectancy of wood as a biological material was studied because of the climatic conditions, the use of corrosive fasteners, and because of the imperative rule of using untreated wood on site.

It was observed that specific locations in the structure was more affected by deterioration than others. To address more precisely the problem of decay, Pilodyne and moisture content readings were taken, and wood samples were sent for analysis. Appendix 1 - Readings from NDT Equipment - presents for selected wood members readings recorded on site during the inspection. Appendix 2 - Analysis of Wood Samples - summarizes the results.

The diagnosis was then performed based on the following statements which are the results of the analysis:

- The green coloration is caused by lichen. The growth of lichen will not damage the wood; it is merely a result of a combination of a high moisture content in the wood and a high level of natural light at the same location;
- The decay process begins when the wood is damp; i.e., MC% reaches 35-50%, and when spores are present in the air, dormant in the wood itself, or nearby;
- Fungal activity is present at an optimal temperature of 25-32°C;
- Growth will be minimal if MC% is below the fibre saturation point, 24%, and temperature is not optimal for fungal growth. At freezing point, the fungus is dormant and at above 65°C is killed;
- Tunnelling in some wood elements were the result of powder post beetle larvae feeding - deathwatch beetles - infestation from such insects is only possible if the wood is well-seasoned and if the wood species are Douglas fir or spruce lumber;
- An estimate of the service life to be expected of these wood elements when exposed

above ground in high and moderate-decay hazard locales with their associated fungi - white and brown cubic rot - was performed and the results are:

Species	Service life	Resistance to decay
Douglas-fir	15 years	moderately resistant
Western Red Cedar	20 years	very resistant
Alaska Yellow Cedar	>20 years	very resistant
Sitka Spruce	8 years	slightly resistant

The most deteriorated wood areas were located where corrosive fasteners were installed through the wood and at the extremities of the wood elements.

Four causes have been identified as responsible of the level of deterioration on site:
1. weather conditions
2. non-activity and lack of maintenance
3. type of connectors
4. leaks in the roof and the walls

The analysis/diagnosis pointed out that *leaks in the roof and the walls* were the main cause responsible for such a situation in conjunction with the others causes. Without any leaks, the decay will still process but will start later and grow much slower.

Recommendations -
At this time, no interim work are required but recommendations call for prudence and patience until the conservation plan be developed. Decayed timber are being changed on a regular basis. At some locations, the level of decay of many elements is so high that no other reasonable possibility to address the actual decay problems at the mill can be raised. The human and financial resources needed to perform these interventions are available and sufficiently qualified. Hopefully, documentation of most of the replacement work has been detailed to a high standard by the on-site project manager, Mr. Dave Lowe.

The main concern here is the condition assessment of few timber elements which do not present visual evidence of deterioration. Their identification for replacement was performed based on the best of the team-worker knowledge and experience. The rate of success in selecting the right elements is actually 50%. This rate will be increased with the use of more reliable technic and tools.

Machinery - A&E Cond'n Assessment

Section 7 missing

C. Remedial Work Plan for the Next Four Years based on a Conservation Approach

Life span expectancy for wooden material in such weather conditions is difficult to control, but as shown in this report can be predicted. One should accept and tolerate the fact that high operational standards for maintenance, assessment of the condition, choice of proper fabric and repair activities are essential in order to postpone the irremediable *replacement* of each structural component. Time, money and specialized expertise should be considered to meet these requirements - to ensure that proper action will be taken at the right time by competent personnel.

To improve the conditions on site, the following remedial activities should be undertaken:

- Wind in timber at bearing areas should be taken out;

- Leaks in the roof should be prevented for the long term conservation of the mill building. Consideration should be given to the idea of entirely or partially closing walls facing dominant wind to prevent excessive water accumulation on structural elements. However, interior ventilation should remain optimal.

- Member to member connections should receive special attention against water trapping and infiltration, so should member extremities.

- All connections should be secured and strengthened in such a way that:
  . thermal, expansion and shrinkage movements of wood are permitted and not restrained,
  . rate and level of decay of wood be decreased substantially;

- Iron and steel fasteners or connectors should be plated with a galvanized coating and designed to avoid drilling into the wood to fix them. As an example, corrosive metal bolts going through timber elements should be replaced by galvanized metal clamps;

- Timber elements to be replaced or repaired within the next four years were identified. Appendix 2 : Table 4 - Remedial Work - presents the type of element, its species and section, its accessibility, and the remedial work required.

DRAFT

5.3 Structural Analysis

This section deals with the structural capability of the mill structure to withstand the loads prescribed by its operational activities:

A. Structural Assessment will be detailed;
B. Structural Analysis;
C. Recommendations will be prepared for remedial actions where required.

A. Structural Assessment

Structurally speaking, the original mill was built with a definite rational in terms of dimensions, quality of material and technique of erection. The time period during which the Mill was built is characterised by a typical technique of construction - heavy timber construction framed with post and beam with wrought nails and metal tie rod connectors.

Over the years, the mill building has experienced transformations which have affected the original structural concept. As part of the transformations, stabilization, consolidation and reinforcement work have taken place.

Documentation of most of the replacement work has been detailed to a high standard by the on-site project manager, Mr. Dave Lowe. Other specific documentation was made available for study and use. The following items are part of the overall documentation:

- recording requirements specific to engineering issues - mostly not available in a sketch form;
- ma nagement plan concept for the Mill;
- recorded cost estimate which includes detailed description of the work done and the material ordered;
- interim Protection Plan - McLean Mill, National Historic Site
- set of plans of part of the Mill, recorded in 1984
- engineering report from McGill & Associates Engineering Ltd.

It is obvious that the climatic conditions on site contribute greatly to an on-going process of deterioration of the timber material; however, no adaptation to this specific situation, well known at the time of construction, was included in the structural design and concept. The following observations refer to the condition reported on site in terms of structural components and systems.

<u>Observations:</u>

- timber material on site presents a high standard of quality and strength.
- most of the original connections and supports are not adequate and surely not appropriate for the climatic conditions;
- some pillars are resting directly on or into a damp soil most of the year;

Machinery - A&E Condn Assessment

Section 7

- a variety of roof structural systems are present;
- evidence of structural deficiencies such as over stressed members and missing members;
- longitudinal and lateral bracing systems are not continuous
- excessive deflection of collar beams
- typical joints used to lengthen members are not adequate and surely not appropriate for their location
- addition of members to secure and support other members;
- addition of members to enlarge bearing areas or support for platforms;

(figures and photographs will be referred to here to show structural systems and components) -

<u>Structural Systems</u>

- heavy timber components:
  - columns (Red Cedar), rectangular and circular sections;
  - beams (Douglas-fir), rectangular and circular sections;
  - joists (Douglas-fir), rectangular section;
  - tension and compression members, (Red Cedar) rectangular section;
  - foundation wood pads (Yellow Cedar) rectangular section;
  - knee braces (Sitka Spruce);

- roof trusses:
  - six-panel Queen truss (also known as double Howe) with steel tension members, approximation of 45 foot span;
  - three-panel Flat Howe truss, approximation of 20 foot span;
  - six-panel Flat Howe truss, approximation of 45 foot span;
  - conventional roof structure with common rafters (25 foot span), tie beam (22.5 foot span), collar tie (10 foot span) and struts or braces (5 feet);

- roof structure:
  - roofing material (metal sheeting), purlins (approximately 25 feet), truss or conventional roof structure (30 foot span);

- floor systems - diaphragms :
  - supporting posts, beams or binders, joists and flat edge floorboards;

- wall systems:
  - wall plates(8"x8"), top plates(9"x10"), sills(10"x10"), wall posts (9"ø), knee braces or typical bracing elements;

- foundation systems:
  - soil, concrete piers, anchor rods, wood pads, foundation posts, ~~knee braces~~ or any bracing system;

- overall structural system:

DRAFT EBAUCHE

- roof, walls, floors, foundations;

. connectors and fasteners:
  - steel rods, nuts, washers and bolts;
  - nails;
  - brackets, metal plates.

Load Conditions at McLean Mill, Port Alberni, B.C.

. snow loads, (unbalanced and balanced):
. dynamic loads, (earthquake and machinery engine loads):
. dead loads, (machinery, roofing and structural components self weight):
. live loads, (lateral loads such as wind loads):

Load factors and combinations

For structural analysis purposes:
. the NBC, 1990 was used to obtain global and internal deformations of different structural systems selected for their unknown behaviour or for confirmation;

For design purposes:
. the BCBC along with the NBC, 1990 were used to obtain the maximum stress effect envelopes on each structural system;
. load factors are based on BCBC/NBC, 1990 and commentary N of NBC, Fall, 1993;

Dry design strength in exterior construction for the assessment of the structural capacity may be used in cases where:
  . wood has an equilibrium MC% of not more than 15%; and
  . for short periods only

These criterion are not met at McLean Mill as the structure is not completely "sheltered" and the weather conditions can not be controlled.

B. Structural Analysis

Structural behaviour of the Mill under prevalent climatic conditions was analyzed in order to identify the extreme conditions suffered by the structure. Timber reacts to changes such as temperature and relative humidity in the air which will directly induce stresses into the material and mechanical properties will hence be affected. The following table presents the relationship between weather conditions at Port Alberni and the associated strength and size of the materials

DRAFT
ÉBAUCHE

Machinery -
A&E Condn Assessment

Section 7

Analysis & Diagnosis

Since the most important element in engineering is the quality of fasteners and connections, it is imperative to address the problem as such. Improvement of connectors should be looked at in terms of strength and being less destructive for the fabric in contact with them. On the other hand, preservation concerns with regards to the historic fabric should help focusing on finding a more appropriate way to connect structural components. Life span expectancy of timber is far more reasonable when well maintained even under wet service conditions.

Various structural systems displayed are listed below with pertinent information regarding the load conditions prevalent on site. For a better understanding of the stability and condition of the Mill, the author presents a detailed description of the structural systems and condition, which makes reference to the Appendix of "McLean Interim Protection" report, 90-06-12, section 4.3 - Condition Assessment Reports - Mill.

(figures and photographs will be referred here to show structural systems and components) -

damage caused by repeated cycles of expansion causes the wood to fatigue and the fasteners to break the wood at the point of contact and consequently to lose holding-power - loss of power due to the drying of the wood is associated with the shrinkage across the grain of the broken wood which lines the nail-hole at the top and bottom. Furthermore, if MC% increases the resistance of timber decreases.

Here again, a loss in holding-power with changes in moisture content is expected. When wood becomes wet the nail in seasoned wood loses holding-power in great part due to the enlargement of the nail-hole that accompanies the swelling of the wood as it absorbs moisture.

Recommendations

A single piece of timber secured to the underside of a beam at the centre is a simple and effective mode of increasing its strength.

The straps should be imbedded into the sides of the collar beams and rafters. They will thus form keys to prevent the different elements from slipping on each other. Contrarily, when the wood becomes wet the straps increase their holding power; this is in great part attributed to the swelling of wood as it absorbs moisture.

A scarf joint is required when a joint occurs in the span of a beam. Joints should be made to have flush top and bottom.

(figures and photographs will be referred here to show structural systems and components) -

Documentation of the condition of the structure in terms of deformation, failure and displacement is required to allow identification of the structural behaviour of each individual structural system displayed and for the overall structure.

DRAFT
EBAUCHE

A complete linear and non-linear structural 2D&3D analysis and design/verification will be performed of the in-situ resources using SAFI 2D&3D structural analysis software.

Also, appendix 2, Table 3 - Moisture Movements - gives the changes in size and length for the different structural components;.

- deformations, displacements and failures;
- Recommendations will be prepared for structural upgrading where required;

Part of the second site investigation plan, the percentage and condition of sound material remaining in a structural element will be assessed. This analysis will give a more precise estimate on the residual strength of the element. In addition, results of this analysis will allow for the development of criteria for the maintenance and monitoring program. Furthermore, the condition and performance of connections will also be required and will be carefully assessed.

Recommendations based on the structural assessment and analysis of structural components and systems will be selected from the following five levels of intervention:

- Level 1: Leave as is
- Level 2: Stabilization work
- Level 3: Consolidation work
- Level 4: Reinforcement work
- Level 5: Replacement work

DRAFT
EBAUCHE

Machinery -
A&E Cond'n Assessment

Section 7

6.0 MACHINERY CONDITION ASSESSMENT

Kathleen Murphy arrived on site 8:00 am February 22, 1994, and spoke with David Lowe about the work he had already done on the machinery, and the work which he planned to do. He had been unable to proceed with process flow, steam flow, electrical system diagrams etc. due to a lack of building drawings.

The work of this field trip was also slowed down by a complete lack of drawings upon which to make sketches, notes and comments. In other words, the first step should be to back and properly record the building to a level we would normally expect at this stage in the process and upon which to build a set of record drawings encompassing the machinery layout.

The on site staff is working very hard and should be congratulated for the work they are doing.

The machinery was examined on an individual machine-by-machine basis, with the exception of the blower (not accessible), the re-saw and the planer (neither expected to operate). The entire line shaft system was also examined, numbered and some measurements were taken for calculation rather than heritage recording purposes. The electric motors and associated gearboxes (where applicable) were itemized and the nameplate data recorded.

6.1 Generalities

David Lowe keeps a record of all work that has been done to the machinery by means of a file card system (one card per machine) showing what actions have been taken. Most of this work has taken place in the first two months of 1994.

The inspection information is based on the site visit of February/March 1994. These comments consist of both recommendations for interim protection, and recommendations for future work to bring the machinery into complete operating condition. Most of the recommendations fall into the latter category.

The Site is quite aware that there is more work to do, they have simply been focussing on the first step, which is to get the machinery un-siezed. This they have accomplished both rapidly and to a high level of quality.

None of the machinery appears distressed at the present time. What deterioration exists is a result of a combination of wear during the operating life and corrosion as a result of inactivity over an almost 30-year period.

DRAFT
EBAUCHE

6.2 Power Machinery

6.2.1 Main Steam Engine

Work to Date

January 1994 -- Cleaned all rods and guides. Lubricated all bearings and governor. Freed and lubricated all valves. Turned engine over two complete revolutions.

Operation Under Air Pressure

I witnessed the main engine operated under air power four times. The belt system to which the engine is connected also worked at this time, with the exception to the drives to some of the conveyors. Power to any collapsed or otherwise inoperable conveyor had been disconnected by taking the belt off the drive pulley.

By way of information, at the time of start up, the engine runs at 90 RPM, but the speed decreases continuously and reaches a steady state speed of 50 RPM. The original operating speed of the engine was 180 RPM (information from retired sawyer Kermit Green). Through the line shaft system, this speed was transformed to 600 RPM on the head saw. In order to ensure that the saw cuts properly and does not overheat, this speed will have to be reproduced during the demonstrations.

Inspection February 1994 -- Observations and Recommendations

Install new belt for governor, storing old one. Overhaul governor.

Overhaul main steam valve and all drain cocks. Opened steam valve drain cock and a small amount of rusty water drained out. Re-pack all glands. Leave all cylinder drain valves in open position, to ensure cylinder and valves do not fill up with water.

Oil holes clogged with dirt. Clean all of them.

Overhaul Manzell lubricator and associated tubes.

The top end of the engine is held up with a jack. It is cantilevered over the concrete foundation by a small amount (about 12") .

Take off cylinder cover and pull piston. Ensure there is no scoring. If there is, the cylinder must be re-ground to prevent damage to the piston rings, which will cause even more damage to the cylinder, *ad infinitum*. Upon re-installing cover, wait until engine is hot to fully tighten nuts on tension bars.

Crosshead slide and lubrication points have been cleaned and lubricated, but oil used is water-emulsifying and is running out. Use a non-emulsifying oil.

See Figures M-A and M-B.

6.2.2 Carriage Engine

<u>Work to Date</u>

Disassembled piston and valve rods, checked bearings, cleaned rods and lubricated. All in good shape. Steam valve disassembled, cleaned and lubricated -- in good shape. Engine turns over easily. Needs gasket and stem packing on control valve.

<u>Inspection February 1994 -- Observations and Recommendations</u>

Pinion has two keyways at 90 degrees, one has key missing.

Oil is washing out from where it had been applied. Re-oil using a non-emulsifying lubricant.

Cotton waste in oil slots is wet and dirty. Disassemble bearings and clean inside. Provide new cotton waste in all oil slots.

Overhaul reversing gear, and all valves including drain cocks. Install new packing in all glands, and new gasket material all around. Ensure steam lines are tight.

Clean out the debris from beneath the winch.

Crosshead slides now free of rust and coated in grease, but it is washing off. Re-grease using a water wash resistant product.

Different cylinder covers on different sides of the winch: is this a repair after an accident? Resolve by historic research, if possible.

An incomplete portion of small diameter tubing is hanging down over the engine: cannot determine what it is for, overhaul and re-connect.

Overhaul control lever, checking all bearings and ensure that the bolts from which the bearings are hung are going into sound wood.

Guard over gear on winch drum shaft is askew. Bend it back to shape.

Small (0.5" diameter) tube runs from steam inlet line to atmosphere. Supply and install new valve on end to replace missing one.

See Figure M-C.

DRAFT

6.2.3 Steam Piping and Valves

Pipes -- Observations and Recommendations

Trace piping system (all piping systems, not just steam) and ensure all sections are complete. If not, supply and install missing lengths of pipe.

All steam piping and valves will have to be checked for steam-tightness. Blank off flanges near engines and near boiler to isolate the pipe, and pressure test in sections. Replace or repair any damaged pipes or valves.

Provide new (non-asbestos) insulation on steam lines.

Main Engine Emergency Shut-Off Valve -- Observations and Recommendations

Site has dismantled and freed up valve, and reports it needs new steam packing. Valve must be overhauled completely.

Carriage Engine Emergency Shut off Valve -- Observations and Recommendations

Inspected visually, but not dismantled. Valve must be completely overhauled.

6.2.4 Line Shaft System

Work to Date

This system has been inspected by the Site crew, and all bearings are greased. In some cases, they have slipped belts off of pulleys to disengage some machine they do not want to operate under air due to its poor condition (usually collapsed sawdust conveyors), and in other cases they have removed the bolts from couplings to the same effect.

Inspection February 1994 -- Observations and Recommendations

Most of the large machinery in the Mill is powered by the steam engines through an extensive line shaft system running throughout the plant. This system was examined in its entirety, with the exception of those shafts located in positions where ladder or climbing apparatus would have been necessary to access them, or which were hidden by other machinery and would require disassembly of certain portions of the Mill to access.

Section 7
[illegible]

Sketches were made and dimensions were taken which would be necessary for power and RPM calculations, but this should not be taken as being "recording" in any formal sense. The centrelines of the shafts must be located within the Mill as part of the recording process.

In general, the condition of the line shaft system is excellent. The vast bulk of it is very close to being level, and little or no further adjustments would have to be made.

Some of the system had been disconnected by Site forces in order to cut power to those machines which were not free to move. This was in order to be able to move all the freed machinery under air power. To do this is not very difficult, involving usually the disconnection of a belt, or the removal of bolts from a coupling. See Figure M-L.

6.3 Process Machinery

6.3.1 Head Rig

No longer extant. See Figure M-D.

See Section on Missing Machinery below.

6.3.2 Edger

<u>Work to Date</u>

January 1994 -- Cleaned main saw arbour and freed saw blades. Lubricated and freed central levers. Checked and lubricated all bearings on infeed and outfeed. Checked main shaft bearings: these need to be repaired and machined due to heavy wear.

<u>Inspection February 1994 -- Observations and Recommendations</u>

I witnessed this machine operating under air power, and it runs smoothly.

The lifting lever for the upper press roll is located in the mezzanine level. Overhaul this, ensuring especially that the connection to the roof truss above is secur, and ensure the truss itself if in good condition.

Controls for kickback fingers are missing. Supply and install new controls, following occupational health and safety guidelines.

DRAFT

DRAFT

Sawblade shaft on side opposite drive belt has circumferential scores in it. Also, the clearance with the top of the journal bearing is excessive. Remove this shaft and overhaul bearing. Build up shaft with metal and re-machine to proper diameter. Other bearing and journal should be checked at the same time.

Clean out all bearings: there is quite a bit of debris in some. Supply and install clean cotton waste in oil slots.

Overhaul control levers for adjusting location of sawblades and ensure blades are free to be controlled.

Supply and install new V-belts.

Some small diameter piping (perhaps remote oiling?) are disconnected. Overhaul, and re-connect to wherever they should be going.

See Figures M-E, M-F and M-G.

6.3.3 Trim Saw

Work to Date

January 1994 -- Removed steam cylinder piston. Lubricated and freed up rings. Cleaned piston rod and greased. Re-installed piston. Lubricated saw arbour bearings.

Inspection February 1994 -- Observations and Recommendations

Sawblade itself is belt driven off of pulley Q-2. There is no clutch to turn it on and off, therefore it would spin all the time.

Saw is mounted on a swinging arm. Power to the arm to go forward and cut or back into position is given by one double-acting steam cylinder positioned so that the piston stroke is horizontal. Could not get bore and stroke, but the outside dimensions of the cylinder are 30" long and approx 6" diameter. Steam is not allowed to expand, but is admitted to the cylinder for the entire length of stroke.

The cylinder is pivoted on two short shafts in order to compensate for the angle when the saw arm swings. The cylinder pivot bearing on the control lever side is unevenly worn. Overhaul both bearings, building up and re-machining shafts if necessary.

Steam to the cylinder is controlled by a linkage at the operator's station going to a valve chamber on top of the cylinder. Steam can be delivered to either end or exhausted to atmosphere through a rubber hose pointed outside the building. The control lever is free to move.

Section 7
[illegible]

Site forces have freed the piston, which may now be swung with muscular force.

No manufacturer's name appears on the cylinder, although one short word is cast into the cylinder's top cover, but this word is not legible. The cylinder has been numbered 32075 in white paint.

Work still to do on cylinder:

overhaul valve;
ensure piping is steam tight, and re-pack gland if necessary;
pressure test cylinder; and,
remove white grease currently on piston shaft (and probably inside cylinder) and replace with Black Cylinder Oil.

Sawblade itself is surface rusted, but not pitted -- no wastage of metal. Teeth are non-renewable. Wrench exists for special nut on hub. Sawblade 42" diameter, 3/16" thick. Shaft is 27" long.

Sawblade shaft supported by two journal bearings hanging down from the underside of the wooden frame. Both bearings appear nice and tight, but should be overhauled and fresh lubricant provided. Also, ensure wood around bolts is still sound.

Note: Work in this area is hampered by waste pit on the front left of the saw, and inadequate floor planking in the rear. Also, the parts are located above head hight, and the working space is slightly awkward. Allow extra labour time.

See Figures M-H and M-I.

DRAFT
EBAUCHE

6.3.4 Re-saw

General Comments

Working the re-saw was very labour-intensive due to its location (no roll cases, so one person had to bring the planks over by hand and carry the cut lumber away by hand). This is one of the most recent machines, having only been installed in the mid 1950s. Until then, all cutting down to size was done on the edger.

This will be too awkward to use for an interpretive demonstration, and not very interesting anyway. Since it will not be used during the animation, it was not inspected. However, the machine must be statically conserved in good condition.

Work to Date

February 1994 -- Lubricated all bearings and chains, and freed them up. Dismantled and lubricated all air cylinders: piston rods need re-chroming, rod seals need replacing.

Work Still to be Done to make Operable

Re-chrome the air cylinder piston rods and replace piston rod seals.

Work to be Done for Interim Stabilization

Provide a plastic sheet over the re-saw to keep roof leaks off. Ensure that it does not touch the metal, and make it angled so that condensation does not drip onto the machine: a wooden frame at the right angle would work. Provide something similar for the other machines which are getting leaked on.

See Figure M-FF.

DRAFT
EBAUCHE

6.3.5 Planer

Work Done to Date

February 1994 -- Freeing up seized mechanisms, cleaning shafts and worm gears, tightening loose belts.

Work Still to be Done

Machine is not completely bolted down, no motor, condition of blower (in rafters & inaccessible except by ladder) unknown, cyclone not installed, requires all new belts (flat and V), piping from blower to cyclone not complete (ends at ridge of roof).

Inspection February 1994

Because this machine is not anticipated to run, it was not inspected. It must, however, be conserved for the future and could always be inspected and made operable at a later date if so desired.

See Figures M-J and M-K.

6.4 Transfer Machinery

Section 7 missing HQP.

6.4.1 Log Haul Winch

Work To Date

January 1994 -- Lubricated all bearings. Turns over easily.

Inspection February 1994 -- Observations and Recommendations

Key missing where drive pulley connects to shaft. Two keyways are at 180 degrees, but only one has a key.

Material (leather? rubber?) present between halves of journal bearing on inboard side of drum shaft (side nearest saw).

Extremely long keyway (close to 24" long) in pinion shaft. Should be examined for stress concentrations.

Brake band has transverse cracks in outer surface -- replace.

Clutch control mechanism and sliding bearing next to the rubber clutch to be overhauled, repairs and new parts if necessary.

Brake control mechanism needs overhauling, possibly new wire rope.

The winch rests on timbers: these are an important part of the machine structure. Check for rot and replace if necessary.

Inboard bearing on pinion shaft seems to be askew, shifted towards log haul. Is it worn unevenly? Dismantle and check, overhaul if necessary. Angle reading 2.4 degrees.

Several broken fibres on galvanized brake weight cable. Replace this cable.

Outboard bearing on brake wheel shaft is solid, not the split journal bearing seen elsewhere. Has dogs on top, purpose unknown. Investigate when overhauling.

Evidence of recent lubrication.

See Figures M-M, M-N and M-O.

6.4.2 Haul Back Winch

Work to Date

DRAFT
ERASE

January 1994 -- Removed bearing caps, cleaned and lubricated. Unit turns freely.

Inspection February 1994 -- Observations and Recommendations

About 0.25" of wear on the radius of the fibre clutch.

Everything looks good, no comments. See Figure M-BB.

6.4.3 Log Deck

Description

There are two separate machines on the log deck: the log roll, and the chain conveyors themselves. These are dealt with separately:

Log Roll (Railway Tracks) -- Observations and Recommendations

There are three short sections of railway track set in the floor of the log deck. Each is pivoted on the log deck on one end, while the other end extends outside the mill, and is connected to a cable. See Figures M-P and M-Q.

The tracks run underneath and at right angles to a log on the log deck.. By means of the small winch located in the mezzanine level, these three tracks are made to lift up in unison, pivoting at their bottom ends and thereby rolling the log onto the chain conveyors. The whole assembly encompasses a simple wheel, axel and lever assembly.

The three tracks themselves are bent, which indicates that they were not quite strong enough to do the task of rolling the logs and remaining un-deformed. Though bent, they cannot be considered to have "failed", since they were apparently quite operable in that condition.

Pivot pin of the one nearest the log haul appears to be a period repair, but not one which inspires confidence. It consists of a long bolt passed through the piece of track and held to the floor near its head by a short section of strapping. The other two pivot pins are much more secure.

The wire rope connected to the outside ends of the track must be replaced for operation. It is quite rusty, and several of the fibres have broken.

The connections where the wire rope fastens to the ends of the track appears to be in good condition.

Section 7
missing H.Q.

Log Deck Winch (Mezzanine Level) -- Observations and Recommendations

Check operation of clutch mechanism, overhaul if necessary. Less than 0.5" of wear on clutches. Keys present in both clutches.

Key does not seem to be present in power pulley: should be checked (too much debris in keyway).

Evidence of fresh greasing on bearings. Oil slots on most bearings full of dirt and debris. Disassemble and clean bearings, and provide clean cotton waste etc. in slots. Some cotton waste present in oil slot of bearing beside clutch plate: shaft was nice and shiny inside.

Bearing nearest pinion gear had gasket material about 0.25" thick on one side of bearing, but not on the other. This could be evidence of really bad wear on the white metal. Check this bearing carefully when it is opened up for cleaning.

Overhaul brake mechanism. Ball bearing near Sawyer's station is rusty and squeaky, but operates: pack with grease or replace.

Roof leaks are quite severe above this winch. Provide temporary protection for the machinery (plastic sheets, not touching machinery and angled so that condensate does not drip) until the roof is fixed.

Review clutch control mechanism -- is there a handle missing? Operator's control seems to be in an awkward location. Check with old-timers or historian. Overhaul mechanism and lubricate well. May need new wire rope.

See Figure M-R and M-S.

Log Deck Conveyor -- Observations and Recommendations

The Site reports that they lubricated bearings and chains in January 1994, and the conveyor operates easily.

The power source for this conveyor is an electric motor and gear box located immediately beneath the deck on a beam shelf. See Figure M-V.

The conveyor chains themselves ride in troughs which are bolted to sleepers on the log deck floor. These sleepers are quite rotten, and are actively disintegrating. They should be replaced prior to re-activation, as the weight of a log may well cause them to collapse, possibly damaging the chain.

DRAFT
EBAUCHE

6.4.4 Nigger (Log Turning Device)

Note on Nomenclature

The period name for this device is "nigger". Nothing derogatory is intended or implied in the use of the period nomenclature.

Work to Date

January 1994 -- Cleaned and lubricated bearings. Runs freely.

Inspection February 1994 -- Observations and Recommendations

February 22, 1994

When the main engine was operating under air in the afternoon, the nigger was operated twice.

February 23, 194

Nigger itself is metal, and appears to have been painted. Get paint colour samples NOW before there is no paint left. After that, paint with rust converter to arrest corrosion, and repaint to original colour.

Evidence of recent greasing of bearings.

Grease cup caps covered with tin cans. Believe this may be historical material: check with old hands.

See Figure M-T.

6.4.5 Carriage

No longer extant. See Figure M-U.

6.4.6 Head Rig Roll Case

Work to Date

January 1994 -- Greased and oiled all chains and rollers. Operated unit with auxiliary power.

Scotson / missing H.P.

Inspection February 1994 -- Observations and Recommendations

This machine is lightly loaded, does not appear distressed, and was not examined in detail. It has been freed up and operates. The site should continue to lubricate on a regular basis. Can be inspected more closely prior to overhauling in the future.

6.4.7 Edger Transfer Deck and Chains

Work to Date

January 1994 -- Lubricated and freed up all chains. Operated unit with auxiliary power.

Inspection February 1994 -- Observations and Recommendations

This machine is lightly loaded, does not appear distressed, and was not examined in detail. It has been freed up and operates. The site should continue to lubricate on a regular basis. Can be inspected more closely prior to overhauling in the future.

6.4.8 Green Chain Roll Case

Work to Date

February 1994 -- Lubricated all chains and operated.

Inspection February 1994 -- Observations and Recommendations

This machine is lightly loaded, does not appear distressed, and was not examined in detail. It has been freed up and operates. The site should continue to lubricate on a regular basis. Can be inspected more closely prior to overhauling in the future.

6.4.9 Green Chain

DRAFT
EBAUCHE

Work to Date

None.

Inspection February 1994 -- Observations and Recommendations

This structure is so rotten it may be considered to be decomposing. Nameplate data was recovered from the electric motors and gearboxes still extant. We recommend that the green chain be given priority salvage recording treatment -- see section on Recording below.

See Figure M-W.

6.5 By-Product and Waste Product Machinery

6.5.1 Main Waste Chute Drive Mechanism

Work to Date

None listed.

Inspection February 24, 1994

Powered by Pulley G-3. Belt almost completely off.

Control mechanism (linkage) has missing bolts, ropes. Needs repair. Sliding bearing needs overhaul and freeing up. Current wear on rubber disk clutch is less than 0.5".

Remote oil tube for bevel pinion gear bearing may be broken. Remove, clean, overhaul or replace if necessary.

Some evidence of recent greasing of bearings.

Teeth on gypsy pinion may be loose. Remove and examine, replacing bolts if necessary.

Oil slots on all journal bearings are filled with dirt. Open up all bearings and clean out. Provide cotton waste or similar to keep dirt out of slots.

Bevel gears do not engage. This could be due to collapsing rotting wood either under the bearings or on the columns to which the beams are connected. Repair wood and re-set machinery.

There is a lot of heavy timber of the Mill structure around this machinery which will make work difficult. Allow extra time for labour.

See Figure M-X.

6.5.2 Far Chop Saw (Beside Trim Saw)

Work to Date

None listed.

Inspection February 1994 -- Observations and Recommendations

Blade and swing arm both electrically driven. Power wires to both motors have been cut.

Four V-belts from motor to blade, all present, only minor wear.

Chains on swing arm drive complete, in place, in good condition.

V-belt from motor to gear box of swing arm mechanism complete and unbroken, but off pulleys. Swing arm powered by eccentrically driven linkage. It would swing back and forth all the time, automatically, whenever the motor was on.

Saw motor too high to read without ladders. Swing arm motor and gear box name plate data recorded.

Metal frame of saw frame painted rusty red colour, some of it coming off with a little light rust underneath. Frame, bracing, etc. all solid, no wastage of metal.

See Figures M-Y and M-Z.

6.5.3 Near Side Chop Saw (Beside Re-saw)

Work to Date

None recorded.

Inspection February 1994 -- Observations and Recommendations

Swinging arm mechanism is belt driven from shaft P above. No pulley, belt is just looped around shaft. This belt broke during one of the air-operations and is currently lying amongst the chop saw machinery. Runs continuously. A gear and pinion with a linkage mounted eccentrically on the hub of the gear provides the swinging mechanism.

Saw blade powered by shaft P pulley 3 -- runs continuously. Saw blade 37" diameter with solid, non-renewable teeth.

The bearings have been freshly greased, but there is a lot of dirt in the oil cups. Clean bearings and provide clean cotton waste in the oil cups.

Pivot points for the swinging arm have hollow shafts. This detail does not appear anywhere else in the Mill.

Ensure sliding collar of swing arm mechanism is free to slide. Grease the shaft.

See Figure M-AA.

APPENDIX F.

3.2.7 Oil Spill Clean Up- National Historic Mill Site, Port Alberni, B.C. 1994. HBT AGRA Limited Engineering & Environmental Services (AGRA)

26250-20/McLEAN-PORT

HBT AGRA Limited
Engineering & Environmental Services

694 Sumas Street
Victoria, B.C.
V8T 4S6
Tel (604) 382-5141
Fax (604) 382-3103

14 April, 1994
IE00570

MAY 10 1994

RECEIVED
APR 25 1994
PARKS & RECREATION

City of Port Alberni
Parks and Recreation
4255 Wallace Street
Port Alberni, B.C.
V9Y 3Y6

Attention: **Mr. Eric McCormick, Director, Parks and Recreation**

Dear Sirs:

RE: OIL SPILL CLEAN UP - NATIONAL HISTORIC MILL SITE, PORT ALBERNI, B.C.

1.0 INTRODUCTION

The City of Port Alberni (the City) engaged HBT AGRA Limited (AGRA) to provide environmental consulting services during the clean up of a heating oil spill at the McLean Mill National Historic Site in October 1993. This letter report outlines the work under taken at the site and provides recommendations for additional work relating to the treatment/disposal of the excavated soil and resultant excavation.

2.0 BACKGROUND

The City is currently restoring a number of structures at the McLean Mill National Historic Site just north of Port Alberni. During this work a gravity feed copper fuel supply line to a oil stove in one of the houses on the site was unknowingly damaged. The problem was not discovered until the oil stove stopped working due to a lack of fuel. Based on fuel records,the City estimated that the tank (450 litre capacity) had been 50% to 70% full when the line was damaged and that approximatly 225 to 315 litres of stove oil had been released. The leak occurred within the crawl space under the house. Visual observations indicated that the bulk of the oil had been contained in a depression in the earth floor of the crawl space and had been absorbed by a silty loam overburden material.

3.0 SCOPE

The scope of services to be provided by AGRA were outlined in a proposal to the City dated October 25, 1993 (Appendix A). These services included:

- Providing direction to the City's work crew for construction of a containment cell, excavation of the contaminated overburden, and storage of the material in the containment cell;

- Collecting a maximum of fifteen soil samples from the base and sidewalls of the excavation and the stockpiled soil for laboratory analysis;

- Analyzing the soil samples for MO&G, to assess the level of contaminant concentration;

- Preparing a report detailing the sample locations and sampling protocols, summarizing and interpreiting the results of analysis with the "Criteria for Managing Contaminated Sites in B.C.", and providing recommendation for remediation options and additional work if required.

4.0 FIELD WORK

On October 24, 1993 a representative of AGRA collected four soil samples of the silty loam material directly beneath the damaged section of fuel line. The four samples were submitted to Zenon Environmental Laboratories for Mineral Oil and Grease (MO&G) analysis. One of these four samples was also submitted for Total Extractable Hydrocarbons (TEH) analysis. All sampling conducted during this project was carried out following AGRA's standard protocols attached as appendix B. The results of these analysis, illustrated in Table 1 indicated that three of the four samples exceeded the special waste threshold of 30,000 ppm of oil & grease and that this soil should be excavated and stored for future treatment or disposal.

Clean up operations commenced on November 22 1993. Prior to entering the crawl space where the spill occurred, the skirting was removed in two locations and two smoke removal fans were placed in these openings to ventilate the air space. The ambient air within the space was monitored for explosive hydrocarbons before workers were allowed to enter the crawl space and at regular intervals while work progressed. This monitoring was conducted using a Gastechtor Explosimeter Model 1238 which measures vapour on a hexane equivalent scale. The results of this monitoring are shown in Table 2. These results indicated that the ambient air concintration remained well below the manufacturers recommended Occupational Exposure Limit (OEL) during the November 22 excavation work. As an added safety measure all workers within the space were required to wear half mask respirators with organic vapour filters and disposable coveralls.

Approximately 1.1 m^3 of the silty sand overburden and underlying hard pan was removed from the crawl space on November 22, 1993. This soil was excavated using a vacuum truck wih two men in the crawl space guiding the vacuum hose. This method worked well in the top loose loam layer however it proved to be quite slow. The lines on the truck became blocked regularly when moist soil froze to the walls of the vacuum hoses resulting in a buildup which plugged the line. Clearing the line resulted in considerable delays and it was decided that alternate methods would be employed to remove any additional material if this was required. On completion of excavation activitities undertaken on November 22 it appeared that the bulk of the spill had been recaptured, although residual odour and vapour concentrations in closure samples retrieved from the excavation suggested that contamination was likely still present at levels greater than the Criteria for Managing Contaminated Sites in B.C. (CMCS B.C.) Level B. CMCS B.C. Level B is the remediation criteria for recreational/residential land use.

Five closure samples, one from each wall and one from the bottom of the excavation, were retrieved from the excavation and submitted to Zenon Environmental Laboratories for MO&G analysis. The results of these samples indicated that the special waste level silty loam had been removed but four of the five samples exceeded CMCS B.C. Level B for MO&G. Sample S-6 from the east wall of the excavation was less than the Level B criteria for MO&G. The results of these analysis are presented in Table 3.

The soil removed during this operation was stockpiled in a polyethylene liner and covered with additional polyethylene sheeting to prevent rain from infiltrating and leaching out contaminants. This soil should be remediated to reduce the hydrocarbon contaminants to less than the CMCS B.C. level B, or disposed of at a facility licensed to handle special wastes.

Based on the above results the City removed approximately 1 m^3 of additional soil from the excavation's north, west and south walls and from the bottom of the pit on December 20, 1993. The soil was stored in the same liner as the previously excavated special waste soil. AGRA visited the site on December 23, 1993 to collect new closure samples from these three walls and the floor of the excavation. These four samples were submitted to Zenon for MO&G analysis. The results indicate that the MO&G concentrations were less than

CMCS B.C. Level B except in the floor of the excavation where concintrations still exceeded this criteria. These results are also presented in Table 3.

Near the end of January the City excavated an additional 1 m^3 of soil from the centre of the pit. This material was stored with the first 2.1 m^3 of soil removed. It is understood that the resulting excavation is approximately 1.5 to 1.8 m deep in the centre and 0.6 to 0.9 m deep at the walls. It is further understood from discussions with the City's project manager at the site that the excavation has approximately 0.6 to 0.9 m of water collected in it. Although there is a slight hydrocarbon odour present within the soil at the base of the excavation it is not possible to remove any more soil due to the accumulated water and the proximity of the building footings. Based on earlier observations and discussions of current site conditions with the site project manager it is believed that the existing excavation could be unstable if left in its current condition. Undermining of the foundations, caused by ground loss into the excavation may result. It is therefore recommended that the excavation be lined with a filter fabric and then backfilled and moderatly compacted with clean granular fill to grade.

5.0 SPILL RECAPTURE

The following calculations are an estimate of the quantity of oil recaptured during the clean up work conducted by the City's crews. Approximately 1.1 m^3 of silty sand overburden was excavated from beneath the cracked line fitting on November 22, 1993. The concentration of oil in this material is estimated to be 65,000 ppm based on the average of four samples (S-1 to S-4) collected from this material on October 24, 1993. The estimated density of the sand used in these calculations is 1,850 kg/m^3. The estimated mass of oil recaptured in the material removed on November 22 is therefore 132.3 kg as shown below.

$$1.1\ m^3 \times 1{,}850\ kg/m^3 = 2{,}035\ kg$$
$$2{,}035\ kg \times 65{,}000\ mg/kg = 132{,}280{,}000\ mg, \text{ or } 132.3\ kg \text{ of oil.}$$

The estimate for oil recaptured in the soil excavated on December 20 is 11.8 kg and was calculated using the above methods but with an estimated oil content of 6,370 ppm based on results of the samples collected after removing the first 1.1 m^3 of soil. The soil excavated in January is estimated to have contained 13.0 kg of oil using 7,000 ppm as estimated from samples S-10 through S-13, collected on December 23, 1993.

The total oil recaptured is estimated at 157.1 kg. The manufacturer supplied specific gravity for the stove oil is 0.85 g/cc. This results in 157.1 kg of oil being equivalent to 185 litres. The percent recaptured is therefore estimated to be approximately 58.5% to 82.2% of the oil spilled.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the above estimate it is believed that much of the oil spilled has been recaptured. Approximately 40 to 130 litres of stove oil may still be present in the soil beneath the house where the leak occurred. Due to the water table levels at the site and the proximity of the foundations it would not be possible to undertake further excavation to recapture the remaining oil without providing additional structural support and/or moving the house. It is understood that a general assessment is planned for the site which will include producing a groundwater contour map and gradient determination. Once the gradient is determined a monitoring well could be installed down gradient of the spill site and monitored at regular intervals to assess potential migration of the remaining oil.

The existing excavation should be lined with a filter fabric and backfilled with clean granular fill to original grade as recommended in Section 4.0 of this report.

7.0 CLOSURE

The findings and conclusions in this report are based on the interpretation of data from a limited number of test pits and analytical tests pertaining specifically to hydrocarbon contamination. The evaluation and conclusions do not preclude the existence of chemical substances other than those identified therein, or the possibility that contaminant conditions can vary between the areas of investigation. Hence this report should be used for informational purposes only and should not be regarded as a certification of the actual chemical character of the site.

We trust that this information meets your immediate requirements. Please call if you have any questions.

Yours truly,

HBT AGRA Limited

Per:

T. Stemp, B.A., C.Tech.,
Environmental Consultant

Per:

R. Forsyth, P.Eng.,
Manager, Victoria Office

Reviewed by:

J. Lambert, P.Geo., C.E.G.,
Head Audit, Environmental Division

TS/ts:mm

Enclosures

M2:IE00570R.TS1

Table 1. October 24, 1993 Soil Samples Beneath Cracked Fitting

Sample	S-1	S-2	S-3	S-4	Level B	Level C	Special Waste Criteria
MO+G	85,000	70,000	29,000	75,000	1,000	5,000	30,000**
TEH	-	-	-	62,000	400*	2,000*	-

Results are expressed in parts per million (ppm)

* These criteria are not provided in the CMCSBC document but are recommended criteria from a 1991 Ministry of Environment Contaminated Sites Unit, Memo.

** The Special Waste Criteria uses total oil + grease values as opposed to mineral oil and grease. Total oil and grease values for these samples would likely be greater than the results obtained as they would include naturally present vegetation and animal oils.

Table 2. Ambient Vapour Concentrations within the Workspace on November 22, 1993

Reading No.	Time	Value	Manufacturer's OEL	Comments
1	8:15	15 ppm	100 ppm	fans not in place
2	9:00	2 ppm	100 ppm	fans operating for approximately 15 minutes
3	9:30	1 ppm	100 ppm	fan on
4	10:00	1 ppm	100 ppm	fan on
5	10:30	0 ppm	100 ppm	fan on
6	11:00	1 ppm	100 ppm	fan on
7	11:30	0 ppm	100 ppm	fan on
8	1:00	2 ppm	100 ppm	fan on
9	1:30	1 ppm	100 ppm	fan on
10	2:00	2 ppm	100 ppm	fan on
11	2:30	0 ppm	100 ppm	fan on
12	3:00	0 ppm	100 ppm	fan on
13	3:30	1 ppm	100 ppm	fan on

Table 3.

Sample	Date	Location	MO+G
S-5	November 22, 1993	South wall	16,000 ppm
S-6	November 22, 1993	East wall	350 ppm
S-7	November 22, 1993	Centre floor	6,300 ppm
S-8	November 22, 1993	North wall	2,100 ppm
S-9	November 22, 1993	West wall	7,100 ppm
S-10	December 23, 1993	North wall	230 ppm
S-11	December 23, 1993	South wall	‹100 ppm
S-12	December 23, 1993	West wall	710 ppm
S-13	December 23, 1993	Centre floor	7,000 ppm
CMCS B.C. Level B			1000 ppm

APPENDIX E.

3.2.8 McLean Mill National Historic Site, Port Alberni, B.C. Contamination Assessment. 1994. Envirochem Special Projects Inc. (Envirochem)

McLEAN MILL
NATIONAL HISTORIC SITE
PORT ALBERNI, B.C.
CONTAMINATION ASSESSMENT

Prepared for:

Mr. Eric McCormick, Director
Parks and Recreation Department
City of Port Alberni

Prepared by:

Envirochem Special Projects Inc.
North Vancouver, B.C.

October, 1994

TABLE OF CONTENTS

TABLE OF CONTENTS CONT'D.

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Envirochem Special Projects Inc. (Envirochem), on behalf of the City of Port Alberni, has completed a Phase II environmental site assessment for the McLean Mill National Historic Site located approximately 15 km northwest of Port Alberni, B.C.. The City of Port Alberni requested the contamination assessment for the historic McLean Mill property in order to identify potential environmental liabilities associated with continued operation of the site as a public tourist attraction.

The overall objective of the environmental assessment was to determine the presence, severity, and extent of contamination in soils and groundwater at the site, and to identify and inventory all hazardous materials on the site, such as chemical and fuel storage tanks. The environmental assessment program developed by Envirochem was based on information provided in the Request for Proposal, a preliminary soil sampling program conducted by MacMillan Bloedel and a limited site visit.

1.1 Objectives

The specific objectives of the contamination assessment were to:

- characterize soil and groundwater conditions at the site to determine the nature, concentration and extent of any chemicals in soils and groundwater which exceed regulatory limits for residential and industrial land use, and determine the potential for on-site and off-site contaminant migration;

- determine the potential for environmental concern related to the presence of controlled, hazardous and designated substances and operational practices at the site;

- establish the scope and nature of any environmental or human health concerns associated with past or present industrial activity on the property; and,

- determine whether remedial action or further investigation would be required to mitigate any present or future environmental concern at the site consistent with the proposed land use as a operating mill open to the public.

The environmental assessment report provides details of the field investigation program, including: the geophysical survey, test pit excavations, drilling and monitoring well installations, and all sampling work undertaken; and, presents the analytical results of the chemical testing carried out on soil and groundwater samples recovered during the field investigation. A discussion of the soil and groundwater quality characteristics, potential environmental impacts and recommendations for further investigation and/or remedial action are also included.

1.2 Background

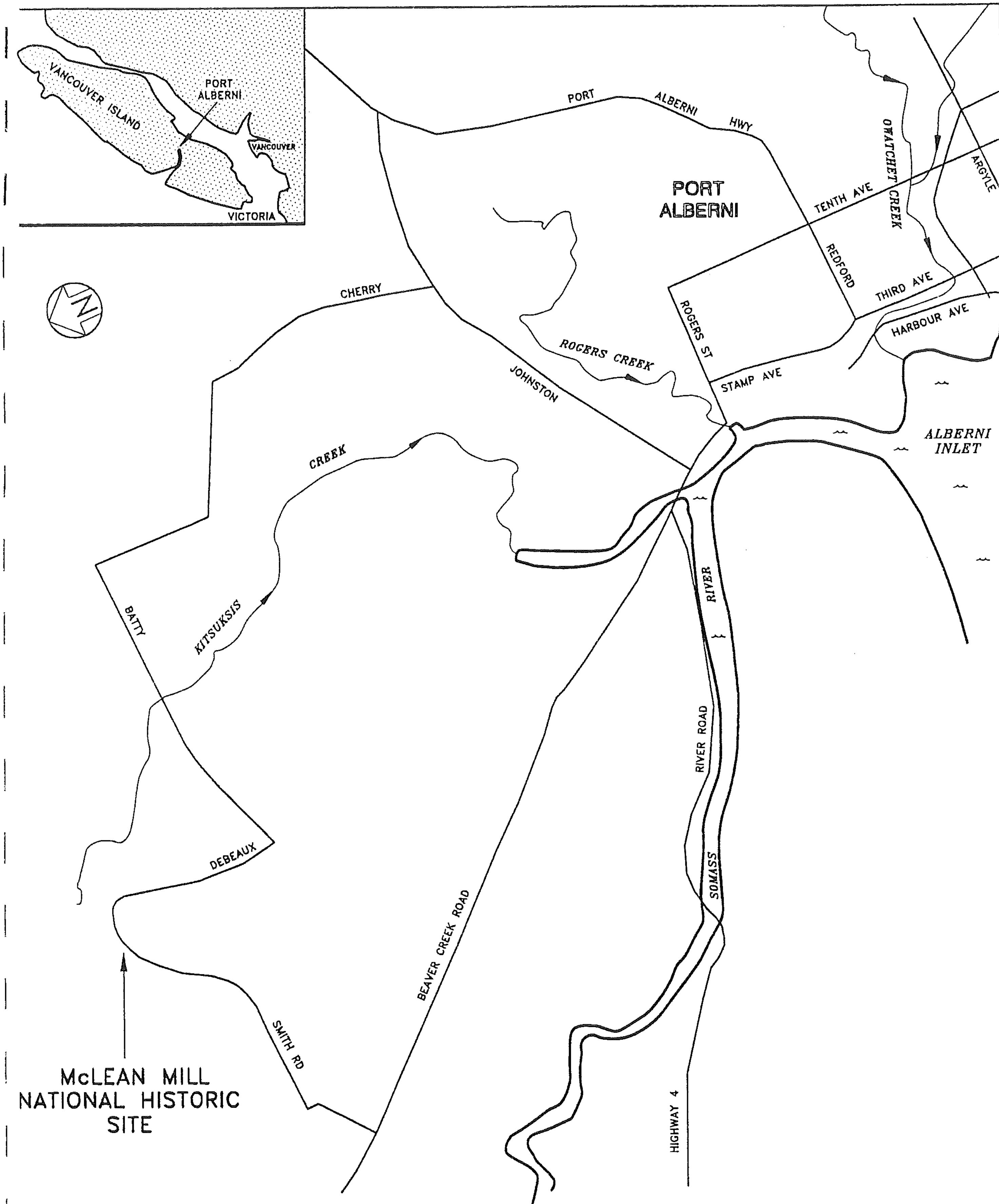
The McLean Mill National Historic Site is located approximately 15 km northwest of Port Alberni, B.C. in the municipality of Beaver Creek as shown in Figure 1. The site encompasses an area of 12.81 hectares and is bounded by lands which appear to be used predominantly for rural purposes. Kitsucksus Creek flows in a southeasterly direction through the site and eventually discharges to the Alberni Inlet. The steam-powered sawmill facility operated at the site from 1926 to 1956 and continued to operate on a limited basis through the mid 1960's, but has been inactive since that time. Development plans by three cooperating agencies - the City of Port Alberni, British Columbia Heritage Trust and Parks Canada, include preservation and restoration of the site's historic resources as a heritage tourist attraction. This would entail restoration and operation of the sawmill on a demonstration basis.

The sawmill operation, although inactive for several decades, was never decommissioned. The industrial activities which occurred at the site would have included the handling, storage, and possible on-site disposal of various petroleum hydrocarbon products (lubricants, fuels, solvents), antisapstain wood protection chemicals, and other hazardous, controlled or designated materials.

Under the current regulatory framework (CCME, 1991[1]), development of an industrial property for recreational use requires the preparation and implementation of a comprehensive decommissioning and clean-up plan to ensure that the site does not contain unacceptable levels of contaminants, does not pose a risk to human health and safety or the environment, and is in compliance with all applicable laws and regulations.

---

[1] CCME. 1991. National Guidelines for Decommissioning Industrial Sites. CCME-TS/WM-TRE013E.



Envirochem

SUPERVISOR:	LJE	DATE OF WORK:	1994	TITLE: LOCATION MAP
DRAWN BY:	PW	DATE DRAWN:	13-MAY-94	PROJECT: McLEAN MILL NATIONAL HISTORIC SITE
REVISED BY:		DATE REVISED:		FIGURE: 1
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-03	

Information regarding the site history and operational practices at the site was obtained from several sources including: information provided in the Request for Proposal, discussions with Dave Lowe - Project Manager of the McLean Mill restoration project, and historical photographs and anecdotal documentation available at the McLean Mill office.

In addition, a limited surface soil sampling program was conducted by MacMillan Bloedel to determine the presence of contamination at the site at the request of the three development agencies. Based on the historical review, the results of the preliminary soil sampling program, and observations made during a site visit, several areas of the site with potential for environmental concern relating to past industrial activities were identified, including:

- the diptank area
- the sawmill building and greenchain
- power boiler
- locomotive shed locations
- generator building
- transformer platform and other areas with electrical equipment installations
- blacksmith shop
- gas and oil shed and pump station
- maintenance garage
- machine shop

The areas of potential environmental concern represented potential point sources of contamination at the various locations across the 12.81 hectare property. Areas of potential non-point source contamination were also identified and included: the vicinity of the scrap burner, the treated lumber storage area and the former mill pond.

2.0 SITE DESCRIPTION

Prior to initiating the field program, Envirochem conducted a detailed site reconnaissance comprised of a walk-through building and property inspection. The purpose of the inspection was to establish whether any hazardous, designated or controlled materials were present within or in close proximity to the buildings which could pose a potential source of environmental concern. Accordingly, the buildings and surrounding property were inspected for the presence of PCBs, asbestos, chemical and fuel storage tanks and any other hazardous materials.

A visual inspection of the site was conducted for obvious signs of contamination such as soil staining, odours, phytotoxic stress, potential spill areas, discharge areas, drainage patterns, and any other sources of contamination which may have occurred through storage and handling of materials of environmental concern.

Observations made during the site inspection are summarized below. The existing site features are shown in Figure 2.

The occupied portions of the site are predominantly grass covered with gravel roadways and parking areas. Large portions of the site are covered with trees and dense vegetation, particularly to the south in vicinity of the former mill workers residences. The site generally slopes gently from north to south and is bisected by Kitsucksus Creek which flows from north to south into the Somass River and into Alberni Inlet. The site slopes southwest near the edge of the property west of the diptank. A rail spur traverses the site in a north-south direction in vicinity of the locomotive shed and the dip tank. Surface drainage was observed to be poor, as evident by the presence of numerous swampy areas, particularly to the southwest of the diptank.

General observations along the banks and bottom of Kitsucksus Creek showed no signs of environmental degradation. No visible signs of contamination were observed on the property beyond the limits of the mill operation (i.e., portions of the site unoccupied by buildings or machines).

All of the buildings on the site are constructed of wood with no insulation. Many of the structures have collapsed or are unstable. Incandescent lighting is used in the buildings and

EXECUTIVE SUMMARY

Envirochem Special Projects Inc. (Envirochem), on behalf of the City of Port Alberni, has completed a contamination assessment for the McLean Mill National Historic Site located approximately 15 km northwest of Port Alberni, B.C.. The contamination assessment was conducted to identify potential environmental liabilities associated with the continued operation of the site as an operating historic mill open to the public. The overall objective of the environmental assessment was to determine the presence, severity, and extent of contamination in soils and groundwater at the site, and to identify and inventory all hazardous materials on the site such as underground fuel storage tanks.

A detailed site reconnaissance and review of historic information was carried out prior to initiation of the subsurface field investigation to identify potential concerns related to operational practices at the site.

A field investigation program was conducted to characterize subsurface conditions and collect soil and groundwater samples for chemical analysis. The field program consisted of: a geophysical magnetometer/gradiometer survey to identify any subsurface anomalies related to the presence of buried ferrous materials, judgemental surface soil samples, test pit excavation, borehole drilling and monitoring well installation.

The geophysical survey identified magnetic anomalies in the mill pond area and in vicinity of the dip tank which suggested the occurrence of small quantities of buried metal at a very shallow depth. The limited lateral extent of anomalies in both of these regions suggest that magnetic objects are relatively small and do not likely represent drums or tanks. The anomalies were further investigated during the test pitting program.

The field investigation resulted in the excavation of 16 shallow test pits, with monitoring wells installed in 3 of the test pits; drilling of eight boreholes using a hollow stem auger rig, and the installation of 4 monitoring wells; the drilling of 20 shallow borings using a solid stem auger rig; and, collection of surface soil samples using a hand-auger or trowel. A total of 167 soil samples and 7 groundwater samples were collected during the field investigation at the McLean Mill site. Soil samples were submitted for chemical analysis to determine concentrations of: metals; gross petroleum hydrocarbon screening parameters, mineral oil and grease and total extractable hydrocarbons (TEH); specific petroleum hydrocarbon parameters, including: halogenated and non-halogenated volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs); and chlorinated phenols. Groundwater samples were submitted for analysis of dissolved metals; total extractable hydrocarbons (TEH); volatile organic compounds (VOCs); polycyclic aromatic hydrocarbons (PAHs); and, chlorinated phenols. Creek water samples were submitted for total metal and TEH analysis.

The local site stratigraphy consists of approximately 0.5 to 1 m of red-brown silt to sandy silt underlain by compact till generally described as grey-brown silt with abundant gravel and cobbles. There is a 0.2 m thick layer of crushed rock fill over the western portion of the site in the vicinity of the dip tank and loading dock.

Groundwater level measurements indicate that the general direction of groundwater flow at the McLean Mill site is southeast toward Kitsucksus Creek, with the exception of the western portion of the site, in vicinity of the dip tank, where groundwater flow appears to discharge to the swamp area to the southwest. The shallow, intermittent groundwater table intercepted during the drilling program likely represents a perched water table overlying the glacial till unit.

Assessment of contamination at the site was based on assessment and remediation criteria for industrial and commercial land use as specified by the Canadian Council of Ministers of the Environment (CCME) *Interim Canadian Environmental Quality Criteria for Contaminated Site* (CCME, 1991). For some parameters such as mineral oil and grease and total petroleum hydrocarbons, for which CCME criteria are not specified, the B.C. Environment *Criteria for Managing Contaminated Sites* (CMCS, 1989) have been used. In addition, the *Special Waste Regulation* has been used to evaluate contamination at the site, where applicable.

The results of metal analysis of surface soil samples indicate that concentrations in excess of the CCME industrial land use criteria were found in samples obtained from the following locations: below the grease rack adjacent to the small parts shed (copper and lead); blacksmith shop (lead, tin and zinc); and, north of the power boiler beneath one of two oil dispensing drums (arsenic). Elevated concentrations of metals were not found in soil samples obtained at depth from test pit excavation and drilling. Analytical results from soil samples submitted for a leachate extraction procedure as specified by the B.C. Special Waste Regulation indicate that the soil samples do not contain leachable toxic waste.

The results of gross petroleum hydrocarbon screening analysis of surface soil samples indicated that samples obtained from below the grease rack adjacent to the small parts shed and in vicinity of the secondary steam boiler contained a mineral oil and grease concentration in excess of the B.C. Environment Special Waste Level of 3 per cent. Mineral oil and grease and TEH concentrations in excess of the CMCS Level C industrial criteria were found in the following sample locations: surface soil samples obtained from within the maintenance garage and beneath two oil dispensing drums north of the power boiler; one surface soil sample obtained in a test pit located in vicinity of the gas and oil shed; and, one borehole soil sample located adjacent to the oil shed. The soil samples did not contain elevated concentrations of VOCs and PAH compounds.

Chlorophenol concentrations in soil samples did not exceed the CCME industrial criteria of 5 mg/kg and therefore do not pose an environmental concern at the McLean Mill site. Chlorophenols concentrations in excess of the CCME residential/parkland criterion of 0.5 mg/kg were found in several soil samples in vicinity of the dip tank area.

Groundwater at the McLean Mill site is not used for drinking water purposes. Therefore the CCME assessment and remediation criteria for protection of freshwater aquatic life was used to evaluate groundwater quality at the site.

The results of metal analysis of surface water samples indicate that copper concentrations in excess of the assessment and remediation criteria for protection of freshwater aquatic life are present in both upstream and downstream samples of Kitsucksus Creek. However, based on the results of soil analysis, the elevated copper concentrations likely reflect background concentrations for the area.

The results of TEH and VOC analysis of groundwater samples shows that all groundwater samples contained less than detectable concentrations of TEH and two groundwater samples, obtained in vicinity of the gas and oil shed contained one or more of the BTEX compounds (benzene, toluene, ethylbenzene, xylene) at concentrations in excess of the CCME assessment criteria, but well below the remediation criteria for protection of freshwater aquatic life.

Chlorinated phenols were not present at detectable concentrations in groundwater samples or in a downgradient swamp water sample at the McLean Mill site.

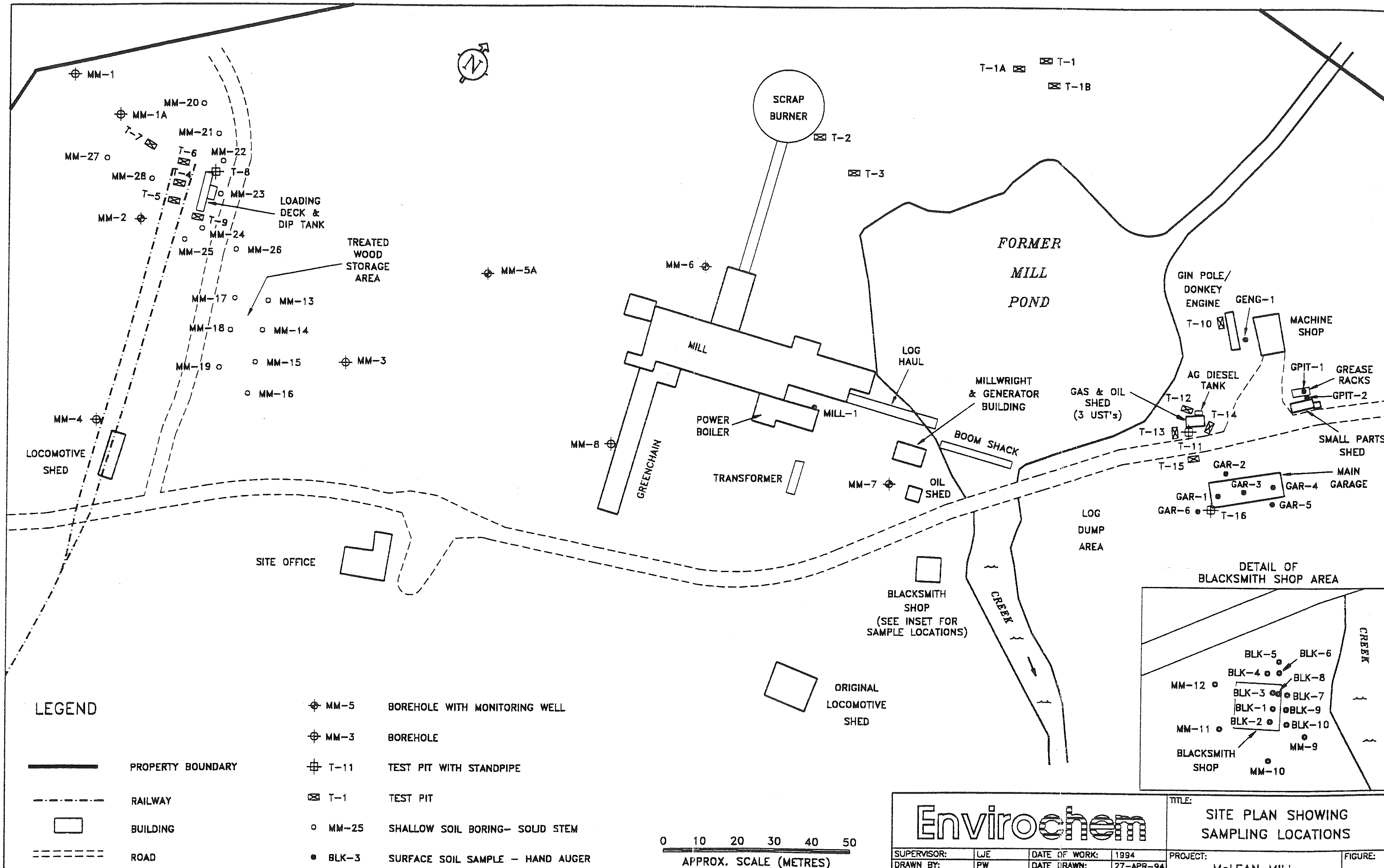
Based on the soil sampling results, soil contamination at the site which would require remediation is limited to: areas where petroleum hydrocarbons were used at the mill and maintenance areas, particularly in vicinity of the secondary steam engine and beneath the grease racks adjacent to the small parts storage shed; and, metal contamination of surface soils in vicinity of the blacksmith shop. The petroleum hydrocarbon contaminated soil is limited to the upper 0.2-0.3 meters and is associated with visibly stained soil. Excavation and proper disposal of this material is recommended. The soil would classify as a fully regulated Special Waste and would therefore require disposal at a secure landfill or treatment at a special waste facility. The estimated volume of petroleum hydrocarbon contaminated soil requiring remediation in the mill area is approximately 150-200 m^3. The volume of contaminated soil beneath the grease racks is approximately 20 m^3. Estimated costs for disposal of Special Waste "hydrocarbon contaminated soil" are approximately \$ 150-200/m^3 depending on the final disposal destination.

Remediation of metal contamination in surface soils in the vicinity of the blacksmith shop is also required. The estimated volume of material requiring scraping and disposal is estimated at approximately 25 m^3. Estimated costs for disposal of metal contaminated material in excess of industrial criteria are approximately \$ 125-175/m^3.

Other petroleum contamination identified at the site includes weathered diesel contamination in vicinity of the gas and oil sheds, minor oil contamination within the maintenance garage and elevated levels of oil in the surface soils in vicinity of the power boiler. However, these areas of contamination do not represent a potential environmental risk. As the site will be used as an operational mill and minor oil staining will likely continue to occur it is recommended that these minor contaminated areas be left in place.

Chlorophenol contamination in soils at the site was not detected at concentrations above the remediation criteria for industrial land use and therefore should not be a source of environmental concern at the site, and further investigation is not considered necessary.

Based on the water sampling results, groundwater and surface water at the site has not been significantly impacted by the historic sawmill operational activities at the site and further investigation is not required.



Envirochem

TITLE: SITE PLAN SHOWING SAMPLING LOCATIONS

SUPERVISOR:	LJE	DATE OF WORK:	1994	PROJECT:	FIGURE:
DRAWN BY:	PW	DATE DRAWN:	27-APR-94	McLEAN MILL NATIONAL HISTORIC SITE	2
REVISED BY:	LJE	DATE REVISED:	04-AUG-94		
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-02		

therefore PCB-containing lighting ballasts are not a concern. Transformers on the site have been tested and do not contain PCBs. No evidence of asbestos was noted during the inspection and none is reported or suspected.

The results of the detailed site reconnaissance identified several areas of the site with potential for environmental concern. Observations made during the site walk-over are described below.

Mill

Energy at the mill was supplied by the power boiler which was fuelled with sawdust rather than coal or diesel fuel. The power boiler generated two steam engines to run the lumber conveyors, saws and other machinery. Minor areas of oil stained soil were evident beneath various sections of the mill. However, extensive oil staining was visible in vicinity of the secondary steam engine indicating the possibility of an historic spill or leak. The oil resembled a heavy black lubricating oil. Black oil coating the machines is present throughout the mill but would likely not require cleanup as the oil contamination is historic and immobile. In addition, the public will not have direct contact with the machinery.

The mill deck was originally used for lumber storage. The mill deck which formerly extended from the northwest corner of the mill had collapsed and the rotten wood of the collapsed mill deck had been burned in two piles in its former location.

Logs for the mill were obtained from the adjacent forested mountainside to the north and transported to the mill either via road or Kitsucksus Creek. Lumber and wood chips were produced at the mill during its operational life and scrap wood debris and bark was sent by conveyor to the scrap burner for open burning.

Mill Pond

The former mill pond is now completely filled and overgrown with the exception of water flowing through the creek channel in the middle of the former pond. During the years since mill abandonment in 1965, the pond was gradually filled with silt deposits from the creek to a depth of approximately 1.5 meters. As part of the proposed restoration and operation of the sawmill on a demonstration basis, the mill pond would be restored by removing the log debris and dredging the mill pond.

Small Parts Shed

The small parts shed contains fire fighting equipment such as cables, shovels and other equipment. Several empty 5-gallon oil pails and 1-gallon antifreeze containers have accumulated around the exterior of the building. Scrap metal parts were found in the surrounding bushes including abandoned cars and machines.

Grease Rack/Pit

An elevated grease rack is located adjacent to the small parts shed. Vehicles were presumably driven onto the rack in order to gain access for maintenance and repair work. The soil below the grease pit and in the area between the grease pit and the small parts shed is visibly stained with oil and grease.

Machine Shop

The machine shop formerly housed a lathe, drill presses and grinders. The building could not be entered as it was not stable. Therefore, inspection of the machine shop was restricted to observations made through the window. No potential environmental concerns were observed in the building which is now used for parts storage. The building has a concrete floor. Scrap metal is stored adjacent to the machine shop on a wooden deck. There are two 45-gal drums in front of the machine shop which are unlabelled and full. The drums are likely filled with oily rainwater.

Gin Pole/Donkey Engine

There is a small above ground storage tank of hydraulic or lubricating oil within the donkey engine. The tank capacity is estimated to be approximately 100 gallons. Very minor soil staining was observed beneath the engine.

Garage

A service pit is located at the south end of the maintenance garage. Timbers line the bottom of the pit and the garage floor. Oil stained patches were observed throughout the garage floor area. There is some scrap metal located behind the garage beneath an overhang. No evidence of oil staining was observed on the ground exterior to the maintenance garage. There is also an abandoned heating oil tank behind the garage which appeared to be partially full with oily rain water.

Oil and Gas Shed

Three gasoline storage tanks of an approximate capacity of 500 gallons are located beneath the oil and gas shed. One or more of the tanks may have contained kerosene at one time. Measurement of the liquid levels in the tanks indicated that they were essentially empty with only a few centimetres of product remaining. There is also a 500 gallon empty above-ground diesel tank behind the oil and gas shed. Approximately five 45-gallon drums are located beneath the overhang on the outside of the oil and gas shed. One of the drums is new and four of the drums are used. All of the drums are unlabelled and are partially full most likely with rainwater.

Blacksmith Shop

The blacksmith shop was used for producing babbitted bearings and filing saw blades. A box of gravel was used for forging metal but is no longer there. A work bench stained with oil is present within the building and a slag pile (approximately volume of 10 m^3) is located under a roofed but un-walled portion at the rear of the building.

Diptank

A wooden diptank, approximately 2 meters wide, 3 meters deep and 8 meters long, is situated 2 meters from the railway spur such that the eastern top edge of the diptank is flush with the loading dock and the western bottom edge is located at ground level parallel to the railway spur. There are several centimetres of rainwater at the bottom of the diptank. The valves of the tank are open and some evidence of leakage was observed.

Site Office

The former Arnold Mclean house is presently being used as a site office. Historically this building and others in the immediate vicinity were used only for residential purposes; however the site office is presently the subject of an environmental investigation and cleanup effort due to an accidental release of stove oil from an above ground tank located at the rear of the house. Information regarding the accidental release and subsequent cleanup efforts and verification sampling is contained in correspondence from HBT AGRA, the consultant retained to conduct the work, and the City of Port Alberni. The information has also been provided to the regional B.C. Environment office in Nanaimo, B.C.. Due to the ongoing investigation and cleanup efforts, this area was not further investigated during this study.

3.0 FIELD INVESTIGATIONS

3.1 Geophysical Survey

A geophysical survey, conducted by Associated Mining Consultants Ltd. (AMCL), was used to initiate field investigations. A limited geophysical magnetometer/gradiometer survey was conducted to identify any subsurface anomalies related to the presence of buried drums, underground storage tanks, or other ferrous debris. Survey areas were confined to areas of low cultural noise (minimal surface metal) and suspect locations of buried ferrous debris. The two areas surveyed included the loading dock in vicinity of the dip tank, the mill pond area and its extension along the downstream creek bank as shown in Figure 3. The magnetometer instrumentation is more sensitive to steel (eg., from a buried drum) than other geophysical instrumentation such as electromagnetic resonance (EM) or radar.

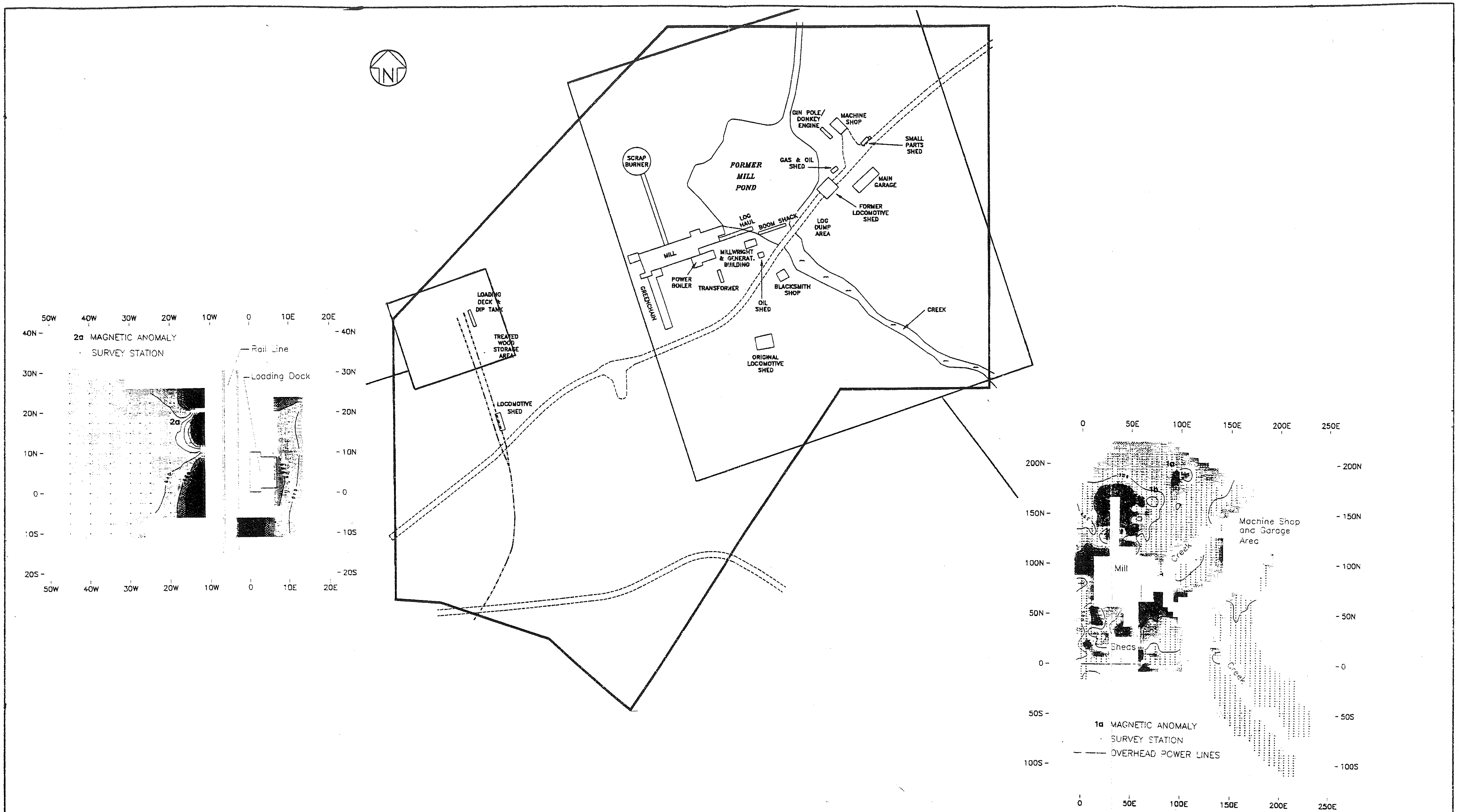
Magnetic anomalies identified from the survey in the mill pond area suggested the occurrence of small quantities of buried metal at a very shallow depth. Anomalies identified to the west of the railway spur in vicinity of the dip tank suggested only small quantities of buried metal. The limited lateral extent of anomalies in both of these regions suggest that the magnetic objects would be relatively small and would not likely represent drums or tanks. The anomalies were further investigated during the test pitting program.

3.2 Test Pitting, Drilling, and Soil Sampling

Test Pitting

Sixteen shallow test pits were excavated using a backhoe and a total of 55 soil samples were collected. Test pitting was selected as an economical and rapid field method to enable visual inspection and sampling in the unsaturated zone. Figure 4 shows the location of test pits.

The test pits were excavated to depths ranging from 1 to 2 meters in depth. Visual and olfactory observations were used to determine the depth intervals over which soil samples were collected during test pitting. Observations included: stratigraphic changes, presence of buried debris, presence of an oil phase, and hydrocarbon or other odours. Test pit soil samples were obtained from the backhoe bucket using a trowel rinsed with hexane. Detailed material descriptions recorded during test pit excavation are provided in Appendix II.

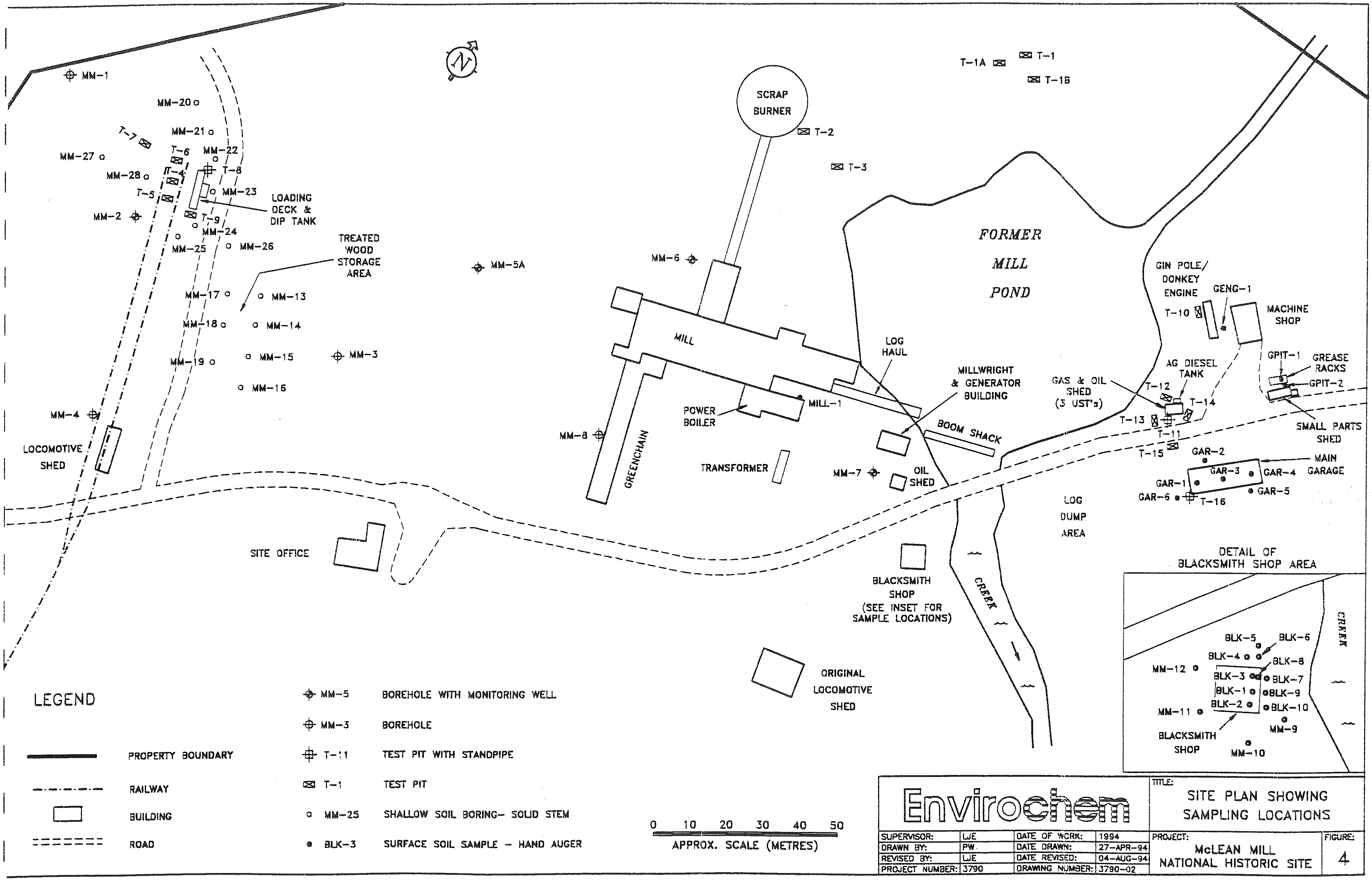


Envirochem			
SUPERVISOR:	LJE	DATE OF WORK:	1994
DRAWN BY:	PW	DATE DRAWN:	27-APR-94
REVISED BY:		DATE REVISED:	
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-02

TITLE: SITE PLAN SHOWING AREAS OF GEOPHYSICAL SURVEY

PROJECT: McLEAN MILL NATIONAL HISTORIC SITE

FIGURE: 3



MM-1
MM-20
MM-21
MM-22
MM-23
MM-24
MM-25
MM-26
MM-27
MM-28
T-4
T-5
T-6
T-7
T-8
T-9
MM-2
LOADING DECK & DIP TANK
TREATED WOOD STORAGE AREA
MM-5A
MM-17
MM-13
MM-18
MM-14
MM-19
MM-15
MM-3
MM-16
MM-4
LOCOMOTIVE SHED
SITE OFFICE
SCRAP BURNER
T-1A
T-1
T-1B
T-2
T-3
MM-6
MILL
GREENCHAIN
MM-8
POWER BOILER
MILL-1
TRANSFORMER
LOG HAUL
MILLWRIGHT & GENERATOR BUILDING
BOOM SHACK
MM-7
OIL SHED
FORMER MILL POND
GIN POLE/ DONKEY ENGINE
GENG-1
T-10
MACHINE SHOP
GPIT-1
GREASE RACKS
GPIT-2
AG DIESEL TANK
GAS & OIL SHED (3 UST's)
T-12
T-13
T-14
T-11
T-15
SMALL PARTS SHED
GAR-2
MAIN GARAGE
GAR-3
GAR-4
GAR-1
GAR-5
GAR-6
T-16
LOG DUMP AREA
CREEK
BLACKSMITH SHOP (SEE INSET FOR SAMPLE LOCATIONS)
ORIGINAL LOCOMOTIVE SHED
DETAIL OF BLACKSMITH SHOP AREA
BLK-5
BLK-6
BLK-4
BLK-8
MM-12
BLK-3
BLK-7
BLK-1
BLK-9
BLK-2
BLK-10
MM-11
MM-9
BLACKSMITH SHOP
MM-10
CREEK
LEGEND
PROPERTY BOUNDARY
RAILWAY
BUILDING
ROAD
MM-5 BOREHOLE WITH MONITORING WELL
MM-3 BOREHOLE
T-11 TEST PIT WITH STANDPIPE
T-1 TEST PIT
MM-25 SHALLOW SOIL BORING- SOLID STEM
BLK-3 SURFACE SOIL SAMPLE - HAND AUGER
0 10 20 30 40 50
APPROX. SCALE (METRES)
Envirochem
TITLE:
SITE PLAN SHOWING SAMPLING LOCATIONS
SUPERVISOR: LJE
DRAWN BY: PW
REVISED BY: LJE
PROJECT NUMBER: 3790
DATE OF WORK: 1994
DATE DRAWN: 27-APR-94
DATE REVISED: 04-AUG-94
DRAWING NUMBER: 3790-02
PROJECT:
McLEAN MILL NATIONAL HISTORIC SITE
FIGURE:
4

Borehole Drilling

Eight boreholes were drilled, for the purpose of installing monitoring wells, using a hollow stem auger drill rig. Drilling was contracted to Drillwell Enterprises Ltd. of Cowichan Bay, B.C. The boreholes were drilled to an average depth of 3 meters. The groundwater table was intercepted in only four of the boreholes and three of the test pits. A total of 7 monitoring wells were installed in 4 boreholes and in 3 of the test pits. The locations of all boreholes and monitoring wells are shown in Figure 4.

Soil samples were obtained at variable depth intervals during drilling using a 0.45 m split-spoon sampling device. This sampling device provides relatively undisturbed soil samples from well-defined depth intervals. To minimize cross-contamination of soil samples the split spoon sampling device was decontaminated between samples using a water rinse followed by hexane. A mobile steam cleaner was used to decontaminate the augers and drill rods between boreholes. A total of 27 discrete soil samples were collected during the hollow stem drilling. Detailed material descriptions are provided in Appendix III.

Shallow Borings

In order to minimize soil disturbance and allow rapid collection of soil samples at well defined depth intervals, a series of 20 shallow borings were drilled using a solid stem auger drill operated by Drillwell Enterprises Ltd.. Soil samples were collected directly from the auger flights at selected depths. A total of 60 soil samples were collected during shallow boring drilling. Detailed material descriptions are provided in Appendix II.

In addition, a number of surface soil samples were obtained with hand sampling implements including a hand-auger and trowel. A total of 25 surface soil samples were obtained across the site.

In general, sampling locations were chosen to provide information from both background areas and areas identified as representing potential environmental concern, including: the diptank area; the sawmill building; power boiler; locomotive shed; generator building; blacksmith shop; gas and oil shed and pump station; maintenance garage; and the machine shop.

Soil samples were stored in laboratory certified glass containers prepared as per U.S. Environmental Protection Agency sample handling protocols (U.S. EPA, 1991[2]). Soil samples submitted for analysis of volatile hydrocarbon parameters such as BTEX compounds were stored with no headspace in glass jars with teflon lids. All soil samples were stored in a cooler on ice until transfer to the analytical laboratory.

3.3 Installation, Development and Groundwater Sampling

Monitoring wells were installed in selected boreholes immediately after drilling to a specified depth. The monitoring well installations consisted of 5 cm diameter PVC standpipes with machine slotted screens at the base for water intake. A commercially graded sand filter pack was placed around the screened section and a bentonite seal was used to isolate the water intake zone. The annulus of the monitoring well was backfilled with a mixture of sand and bentonite to prevent vertical migration of surface water along the casing. The wells were completed with a stainless steel well protector installed at grade and encased in concrete. All monitoring wells installed at the site are screened in the native material at the site. Monitoring wells were installed in 3 test pits and consisted of 5 cm diameter PVC standpipes with machine slotted screens encased with geotextile and backfilled with excavated native sediments. The test pits wells were completed with a stainless steel well protector installed at grade and encased in concrete. The monitoring well installations are shown schematically in Appendix III. Table 1 provides a summary of the monitoring well installations.

Dedicated sampling equipment consisting of polyethylene tubing fitted with a Waterra inertial pump at the base was installed in each monitoring well for the purpose of purging and sampling groundwater. Use of dedicated sampling apparatus eliminates cross-contamination of groundwater samples. The monitoring wells were developed following drilling and monitoring well installation in order to remove any drilling induced disturbances. Well development consisted of rapidly evacuating several well volumes of water using the dedicated sampling equipment in order to remove fine-grained particulates that may have been mobilized in the vicinity of the borehole during drilling.

---

[2] U.S. Environmental Protection Agency. 1991. Compendium of ERT Soil Sampling and Surface Geophysics Procedures. Interim Final Report. OSWER Directive 9360.4-02.

Table 1: Summary of Borehole and Monitoring Well Information
McLean Mill National Historic Site

Borehole	Hole Depth (m)	Screen Interval (m)	Elevation (m-asl)		Depth to Water Level (m)	Elev. of Water (m)	pH	Conductivity (uS/cm)
			Ground	Top of Pipe				
MM-1	1.80	no well installed	-	-	-	-	-	-
MM-2	3.10	0.9-2.4	38.42	39.01	0.92	38.09	7.2	< 100
MM-3	1.70	no well installed	-	-	-	-	-	-
MM-4	1.70	no well installed	-	-	-	-	-	-
MM-5	3.10	0.9-2.4	38.08	38.09	0.46	37.63	8.2	19900
MM-6	2.40	0.3-1.5	33.76	33.67	0.4	33.27	7.5	1400
MM-7	3.66	0.61-3.66	33.17	33.12	1.74	31.38	7.7	2200
MM-8	1.80	no well installed	-	-	-	-	-	-
T-8	1.20	0.3-1.2	39.02	39.27	0.47	38.8	7.1	17000
T-11	2.10	0.6-2.1	32.56	32.47	1.93	30.54	-	-
T-16	1.50	0.46-1.38	31.51	31.47	1.2	30.27	7.3	7000

Notes:

1. See Figure 4 for location of borehole and monitoring wells
2. Lithologic logs of boreholes are shown in Appendix 1
3. Top of Pipe elevation is the reference point used for water level measurements
4. Elevations were surveyed April 11, 1994 and are relative to a geodetic datum
5. Groundwater levels measured April 11, 1994

Groundwater samples were collected from each monitoring well using the dedicated sampling equipment and following established purging and sampling protocols for the various chemical parameters to be analyzed. Accordingly, purging protocols consisted of evacuating a minimum of three well volumes of groundwater using the dedicated sampling equipment. Stabilization of conductivity measurements was also used as a criteria for purging protocols. Following purging, groundwater levels were allowed to recover to near static levels prior to groundwater sampling. pH and conductivity measurements were recorded during groundwater sampling (Table 1).

Groundwater samples obtained for volatile hydrocarbon analysis were collected into purge and trap containers. Groundwater and surface water samples to be collected for total extractable hydrocarbons and chlorophenol analysis were placed in two 1 litre amber glass jars. Samples to be submitted for analysis of dissolved metal concentrations, were filtered in the field using an in-line filter apparatus, and preserved with nitric acid. The groundwater samples were stored in coolers, on ice, until transfer to the analytical laboratory.

All groundwater sampling, preservation, and storage was conducted in accordance to the CCME Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites (1993)[3]

Surveying

The location and geodetic elevation of all monitoring wells was surveyed following completion of the drilling program. The location of test pit excavations was also surveyed. The survey information is summarized in Table 1.

3.4 Sample Preparation and Analytical Program

Selected soil samples collected during the sampling program were tested for pentachlorophenol (PCP) using a immunoassay field test kit. This method of chemical testing determines a range of PCP concentration within a sample. The immunoassay procedure has been tested and approved by the U.S. Environmental Protection Agency. Soil samples with the highest range of chlorophenol concentrations, at or in excess of the industrial criteria, were submitted for

---

[3] CCME. 1993. Guidance Manual on Sampling Analysis and Data Management for Contaminated Sites. Volume 1: Main Report. Report CCME EPC-NCS62E.

analytical testing using electron gas chromatography (GC) in Envirochem's in-house laboratory. The results of the GC analysis were used to confirm and validate the field test results.

Soil samples were also submitted to Envirochem's in-house laboratory for gross petroleum hydrocarbon screening parameters such as mineral oil and grease and total extractable hydrocarbons (TEH); to Quanta Trace Laboratories for metal analyses; and to Cantest for specific petroleum hydrocarbon parameters including halogenated and non-halogenated volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene and xylene (BTEX) and polycyclic aromatic hydrocarbons (PAHs).

Groundwater samples were submitted to Envirochem's in-house laboratory for analysis of total extractable hydrocarbons (TEH) and chlorinated phenols; to Quanta Trace for metals; and to Cantest for analyses of volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs).

A quality assurance and quality control (QA/QC) program was conducted concurrently with the chemical analysis of soil and groundwater samples. The QA/QC program consisted of the analysis of blanks, duplicates, spike recoveries and where applicable, certified reference standards. The results are provided in Appendix IV.

4.0 SUBSURFACE CHARACTERIZATION

4.1 Stratigraphy

Regional Description

The McLean Mill site is located in the Alberni Valley on Vancouver Island, B.C. Surficial geology maps indicate that much of the site is underlain by glacial ground moraine deposits consisting of a heterogeneous mixture of till, alluvium, and colluvium. A portion of the site may also be underlain by Quaternary postglacial alluvial fan deposits of the Salish Sediments group.

Marshy areas are present in several areas of the site indicating poor surface drainage conditions likely associated with the compacted till layer.

Site Stratigraphy

Local site stratigraphy has been determined from the geologic material descriptions obtained during drilling and test pit excavation. The stratigraphic information is summarized in the test pit and borehole logs (Appendix II and III, respectively) and two geologic cross-sections (Figures 5a and 5b).

Dominant physiographic features at the McLean Mill site include low lying marshy areas which surround the site and Kitsucksus Creek which flows through the eastern section of the site. The area is gently sloping with topographic high points on the western and eastern sides of Kitsucksus Creek.

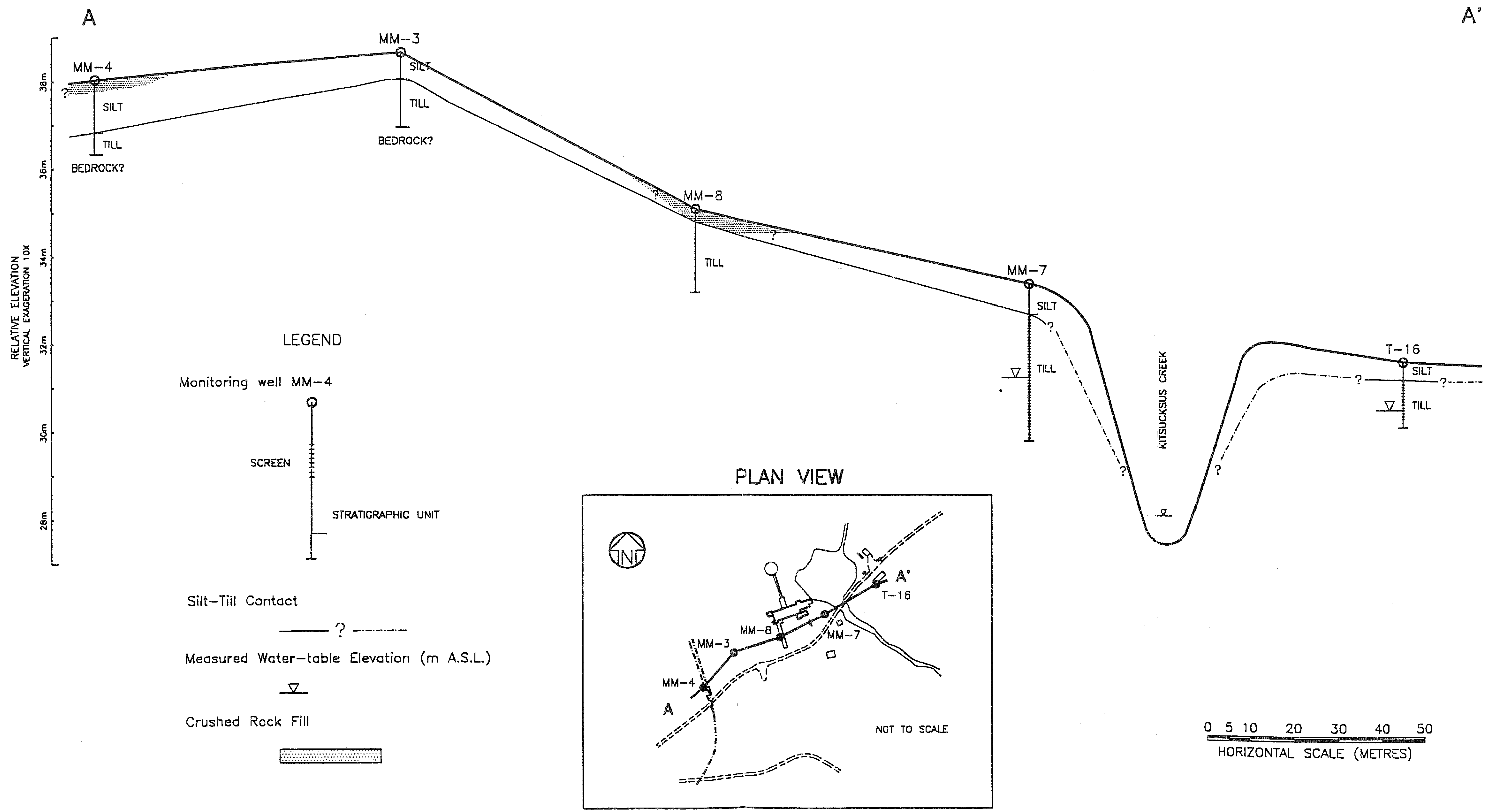
Stratigraphic information derived from the borehole logs and test pit excavations indicates that the site is generally underlain by approximately 0.5 to 1 meter of red-brown silt to sandy silt followed by a compact till unit consisting of grey-brown silt, gravel and cobbles. A crushed rock layer, approximately 0.2 meters thick is present over the western portion of the site in vicinity of the dip tank and former lumber storage areas.

4.2 Groundwater

Eight boreholes were drilled using a hollow stem auger drill to allow installation of groundwater monitoring wells at the McLean Mill site. The boreholes were drilled to the first water bearing zone; however, groundwater was encountered in only four of the eight boreholes within the limited depth of drilling.

Water table elevations were measured in each of the four borehole monitoring wells and the three monitoring wells installed in test pit excavations at the McLean Mill site on April 11, 1994 (Table 1). The measured depth to groundwater ranged from 0.4 to 1.9 meters below ground surface. The relatively few water level measurement points and the distance between monitoring wells precluded the preparation of a groundwater contour map. However, the calculated elevations of the groundwater table shown in Table 1 indicate that in the western portion of the site, the predominant direction of local groundwater flow is toward Kitsucksus Creek. The direction of groundwater flow cannot be estimated on the east side of Kitsucksus Creek because only two monitoring wells were installed in this area. However, it is likely that groundwater flow in the eastern portion of the site is also toward the creek.

The water level elevations shown on the geologic cross-sections in Figure 5a and 5b indicate that the groundwater table appears to occur predominantly in the silt layer overlying the compacted till. Although in monitoring wells MM-7 and T-16, located adjacent to the creek, the water table is present in the till layer. The relatively shallow groundwater table overlying the till unit in the majority of the monitoring wells, the high rate of precipitation in the area and the intermittent nature of groundwater intercepted during drilling likely represents a perched water-table overlying the till unit. Therefore the drilling program did not likely intercept the regional groundwater table.



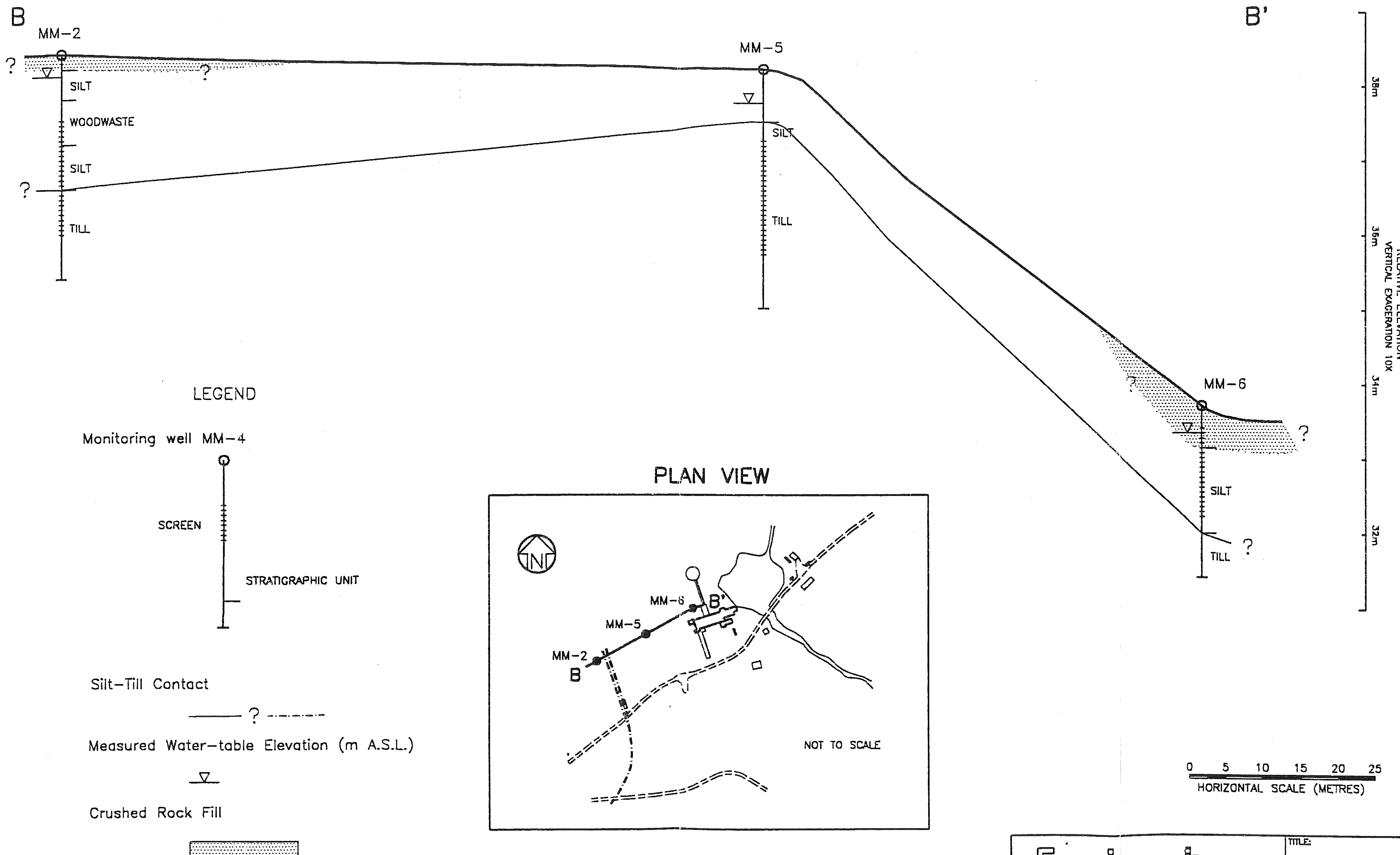
Envirochem

SUPERVISOR:	EG	DATE OF WORK:	1994
DRAWN BY:	CED	DATE DRAWN:	08-JUL-94
REVISED BY:		DATE REVISED:	
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-4

TITLE: GEOLOGIC CROSS SECTION B-B'

PROJECT: McLEAN MILL NATIONAL HISTORIC SITE

FIGURE: 5a



Envirochem

SUPERVISOR:	EG	DATE OF WORK:	1994
DRAWN BY:	CED	DATE DRAWN:	08-JUL-94
REVISED BY:		DATE REVISED:	
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-5

TITLE: GEOLOGIC CROSS SECTION B-B'

PROJECT: McLEAN MILL NATIONAL HISTORIC SITE

FIGURE: 5b

5.0 CONTAMINANT DISTRIBUTION AND MIGRATION

The overall purpose of the contamination assessment was to identify potential environmental liabilities to ensure that the site does not pose any risks to human health and the environment for continued operation of the site as a public tourist attraction.

On the basis of known industrial activities which occurred at the McLean Mill site, the potential releases and corresponding chemical contaminants include:

Petroleum Hydrocarbons:

target parameters	-	mineral oil and grease
		total extractable hydrocarbons (TEH)
		polycyclic aromatic hydrocarbons (PAHs)
		non-halogenated volatile organic compounds (VOCs)

Solvents:

target parameters	-	halogenated and non-halogenated volatile organic compounds (VOCs)

Heavy Metals from blacksmithing activities, machine operations, waste oils:

target parameter	-	metals

Wood Protection Activities:

target parameter	-	chlorinated phenols (PCPs)

Accordingly, soil samples obtained during surface sampling, test pit excavation and drilling were submitted for mineral oil and grease, TEH and metal analyses. Groundwater samples were submitted for TEH, and metal analysis. Selected soil samples and groundwater samples, which contained elevated levels of gross petroleum hydrocarbon screening parameters (i.e. mineral oil and grease or TEH) or were identified as potentially contaminated based on field observations, were submitted for analysis of VOCs and PAHs.

Selected soil and groundwater samples, located in vicinity of the dip tank and treated lumber storage areas, were submitted for chlorophenol analysis. Soil samples were initially screened for chlorophenol concentrations using an immunoassay field test kit. This method of chemical testing determines a range of chlorophenol concentrations within a sample. Soil samples with the highest range of chlorophenol concentrations, at or in excess of the industrial criteria, were subsequently submitted for analytical testing using electron gas chromatography (GC) in Envirochem's in-house laboratory. The results of the GC analysis were used to confirm and validate the field test results.

In order to determine if soil samples containing elevated levels of metals would be classified as Special Waste, selected soil samples were submitted for leachate testing as specified in the *B.C. Special Waste Regulation.*

The analytical data for each chemical group are discussed in terms of:

- the presence of source areas and their location,
- pathways of chemical migration, and
- location and volumes of soils containing chemical concentrations in excess of regulatory standards and criteria, if any.

5.1 Regulatory Framework

Assessment of contamination at the site is based on assessment and remediation criteria for industrial and commercial land use as specified by the Canadian Council of Ministers of the Environment (CCME) *Interim Canadian Environmental Quality Criteria for Contaminated Site (CCME, 1991).* The CCME criteria include numerical values for the assessment and remediation of water and soil for agricultural, residential/parkland and commercial/industrial land use. In order to evaluate data for a site investigation, the criteria appropriate for the intended land use are used to assess the severity of contamination. As the eventual land use at the McLean Mill National Historic Site is intended to be a public tourist attraction, the criteria specified for commercial/industrial land use have been used to assess the severity of contamination at the site.

The CCME criteria have adopted contaminated sites criteria from several Canadian jurisdictions including the B.C. Environment Criteria for Managing Contaminated Sites. For some parameters such as mineral oil and grease and total petroleum hydrocarbons, which do not have CCME criteria, the B.C. Environment criteria have been used. In addition, the *Special Waste Regulation* has been used to evaluate petroleum hydrocarbon contaminated soils at the site. BC Environment has recently drafted proposed regulations for *Bill 26, the Waste Management Amendment Act* (1993). The proposed Soil Numerical Standards in Schedule 4 of Draft 2 - Bill 26, do not specify allowable concentrations for gross petroleum hydrocarbon parameters such as mineral oil and grease and TEH, therefore soil contaminant concentrations have not been evaluated with respect to these proposed standards.

Groundwater contamination was evaluated relative to the Interim Assessment criteria and the Remediation criteria for protection of freshwater aquatic life as specified by the *CCME Interim Canadian Environmental Quality Criteria for Contaminated Sites*. The interim assessment criteria generally represents the approximate achievable analytical detection limits for most organic parameters or the natural background levels for most inorganic parameters. Water is considered uncontaminated if the concentrations are less than the assessment criteria. The interim remediation criteria represents concentrations for water-based discharges to protect freshwater aquatic life. For constituents with concentrations less than the freshwater aquatic remediation criteria, no remediation is required if the receiving water is a habitat for aquatic life only. The remediation criteria are used as benchmarks to evaluate the need for further investigation.

5.2 Soil Quality

The results of chemical analyses of soil samples are summarized in Tables 2 to 6. The regulatory limits have been included with the analytical data in each table. Laboratory reports are provided in Appendix IV.

5.2.1 Metals

A total of 33 soil samples were submitted for metal analysis. The soil samples were obtained from 19 hand-auger borings (discussed as surface soil samples), 8 test pits, 2 boreholes and 8 shallow borings across the site. The results of metal analyses in soil samples are shown in Table 2 and leachable metal results are provided in Table 3.

TABLE 2: RESULTS OF METALS ANALYSES
City of Port Alberni - McLean Mill
Surface Soil Sample (mg/kg)

Sample Depth (m)	GPIT-1 0	GPIT-1 0.1-0.15	GPIT-2 0.1	BLK-1 0.2	BLK-2 0-0.2	BLK-3 0-0.2	BLK-4 0-0.1	BLK-5 0-0.2	BLK-6 0-0.1	BLK-7 0.1-0.2	CCME Criteria Residential	 Industrial
Arsenic	3.3	3.41	11.1	6.5	7.5	18.2	8	4.82	17.5	3.39	30	50
Barium	218	100	403	656	705	650	176	896	1220	137	500	2000
Cadmium	1.6	0.27	1.47	1.4	1.4	0.72	1	<0.25	0.9	0.75	5	20
Chromium	61.1	107	40	32.8	48.5	42	15.1	22	30.4	10.6	250	800
Cobalt	7.8	28.2	13.9	8.2	13.5	11.1	4.3	7.1	8.4	3.3	50	300
Copper	**556**	104	232	155	163	228	71.6	80.2	198	50.6	100	500
Lead	**8270**	90.5	565	483	204	**1800**	390	26.4	**2290**	293	500	1000
Mercury	<0.07	0.066	0.1	0.1	<0.05	0.036	0.1	0.009	<0.05	0.056	2	10
Molybdenum	31	<4	<4	<1	<1	<4	<1	<4	<1	<4	10	40
Nickel	23.5	53.9	34.1	30	37.6	34.7	10.7	21.4	26.1	12.1	100	500
Selenium	<0.1	<0.5	<0.5	0.1	<0.1	<0.5	<0.1	<0.5	<0.1	<0.5	3	10
Silver	< 0.5	<1.5	<1.5	<0.5	< 0.5	<1.5	< 0.5	<1.5	< 0.5	<1.5	20	40
Tin	<0.1	5.1	2.9	<1	17	**540**	< 1	10	<1	203	50	300
Zinc	764	139	231	687	405	1160	1290	63.3	908	1700	500	1500

BLK-4 - surface sample

Exceeds CCME Interim residential/parkland criteria
Exceeds CCME Interim industrial/commercial criteria

TABLE 2 continued: RESULTS OF METALS ANALYSES
City of Port Alberni - McLean Mill
Surface Soil Sample (mg/kg)

Sample Depth (m)	BLK-9 0-0.2	BLK-10 0-0.1	GAR-1 0	GAR-3 0	GAR-4 0	MILL-1A 0-0.1	MILL-1B 0-0.1	MILL-1 0.2-0.3	MILL-3 0-0.1	CCME Criteria Residential	CCME Criteria Industrial
Arsenic	8.3	6.77	6.3	5.5	4.8	58	3.89	10.8	10.6	30	50
Barium	382	362	198	49.8	77.9	65.8	53.5	156	38.8	500	2000
Cadmium	2.6	0.89	1.5	1.3	1.5	0.9	<0.25	0.42	<0.25	5	20
Chromium	16.9	50	66.3	70	82	63	31	103	40.8	250	800
Cobalt	4.9	15.6	19.3	18.2	20.2	17.9	6.4	24.1	10.7	50	300
Copper	67.2	103	135	109	121	83.3	41	134	71.6	100	500
Lead	140	232	1010	112	860	16	21.3	84	175	500	1000
Mercury	<0.05	0.052	0.1	0.2	0.1	0.2	0.065	0.19	0.064	2	10
Molybdenum	< 1	<4	< 1	< 1	< 1	< 1	<4	<4	<4	10	40
Nickel	16.7	39.5	38	37.7	43.2	34.3	15.8	49.2	24..5	100	500
Selenium	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	3	10
Silver	< 0.5	<1.5	< 0.5	< 0.5	< 0.5	< 0.5	<1.5	<1.5	<1.5	20	40
Tin	< 1	57.5	< 1	< 1	< 1	< 1	13.4	9	22.9	50	300
Zinc	1610	616	121	122	158	197	443	603	396	500	1500

BLK-4 - surface sample

Exceeds CCME Interim residential/parkland criteria
Exceeds CCME Interim industrial/commercial criteria

TABLE 2 continued: RESULTS OF METALS ANALYSES
City of Port Alberni - McLean Mill
Test Pit Soil Samples (mg/kg)

Sample	T-1	T-2	T-2	T-7	T-10	T-11	T-14	T-14	CCME Criteria	
Depth (m)	0.2	0-0.1	0.5	0-0.1	0-0.1	0-0.1	0-0.1	0.3	Residential	Industrial
Arsenic	26	11	6.4	6.7	8.1	6.8	4.8	3.3	30	50
Barium	71.5	11.8	151	62	97.1	40.5	40.8	47	500	2000
Cadmium	1	0.1	0.1	0.7	1	0.6	0.8	0.9	5	20
Chromium	91	1	183	49.3	228	48.3	73.1	62	250	800
Cobalt	30.7	0.5	58	18.9	26.4	9.7	27.8	21.3	50	300
Copper	141	2.8	259	84.5	199	79.7	135	110	100	500
Lead	8	4	24	11	12	58	9	34	500	1000
Mercury	0.2	<0.05	<0.05	0.2	0.3	0.4	0.2	0.1	2	10
Molybdenum	<1	<1	<1	<1	<1	<1	<1	<1	10	40
Nickel	52.3	0.97	119	48.7	56.6	24	48.2	38	100	500
Selenium	0.3	1.3	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	3	10
Silver	<0.5	<0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5	<0.5	20	40
Tin	<1	<1	<1	<1	<1	<1	<1	<1	50	300
Zinc	70.1	14.8	165	51.3	78.1	66.6	82.4	72.6	500	1500

T-1 test pit

Exceeds CCME Interim residential/parkland criteria
Exceeds CCME Interim industrial/commercial criteria

TABLE 2 continued: RESULTS OF METALS ANALYSES
City of Port Alberni - McLean Mill
Borehole Soil Samples (mg/kg)

Sample	MM-6	MM-7	MM-9	MM-10	MM-11	MM-12	CCME Criteria	
Depth (m)	0-0.61	0-0.61	0-0.1	0-0.1	0-0.1	0-0.1	Residential	Industrial
Arsenic	9.2	15.2	27.2	23.2	9.1	9.7	30	50
Barium	35.2	168	77	47.4	79.3	231	500	2000
Cadmium	0.9	0.7	1.1	0.98	1.1	3.4	5	20
Chromium	187	54.9	97.4	83.7	75.2	69.4	250	800
Cobalt	25.2	18.5	30.8	26.2	27	26	50	300
Copper	116	104	129	103	98.2	104	100	500
Lead	10	53	9	12	21	213	500	1000
Mercury	0.2	<0.05	0.2	0.1	<0.05	<0.05	2	10
Molybdenum	<1	<1	<1	<1	<1	<1	10	40
Nickel	56	35.4	55.6	49.3	47.1	44	100	500
Selenium	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3	10
Silver	<0.5	<0.5	< 0.5	< 0.5	< 0.5	< 0.5	20	40
Tin	<1	<1	<1	<1	<1	<1	50	300
Zinc	84	129	68	77.8	103	744	500	1500

MM-9 - borehole sample

Exceeds CCME Interim residential/parkland criteria
Exceeds CCME Interim industrial/commercial criteria

TABLE 3: RESULTS OF LEACHATE EXTRACTION PROCEDURE
City of Port Alberni - McLean Mill
Surface Soil Sample (mg/kg)

Sample Depth (m)	GPIT-1 0	BLK-3 0-0.2	MILL-3 0-0.1	BC Special Waste Leachate Quality Standards
Arsenic	<0.75	<0.75	<0.75	5
Barium	0.046	1.67	0.024	100
Boron	0.11	1.12	0.09	500
Cadmium	<0.05	<0.05	<0.05	0.05
Chromium	<0.05	<0.05	<0.05	5
Cobalt	<0.05	<0.05	<0.05	-
Copper	<0.03	<0.03	<0.05	100
Lead	<0.1	<0.1	<0.1	5
Mercury	<0.005	<0.005	<0.005	0.1
Molybdenum	<0.1	<0.1	<0.1	-
Nickel	<0.05	<0.05	<0.05	-
Selenium	<0.25	<0.25	<0.25	1
Silver	<0.5	<0.5	<0.5	5
Tin	<0.1	<0.1	<0.1	-
Zinc	0.58	17.8	1.57	500

BLK-4 - surface sample
- no standard

Exceeds BC Environment Leachate Quality Standard

Surface soil samples:

The results indicate that the surface sample taken from below the grease rack adjacent to the small parts shed contained concentrations of copper and lead in excess of the CCME industrial criteria. The metal contamination is likely associated with heavy oil staining observed on the ground at this location.

Surface soil samples taken from within the former vehicle maintenance garage contained copper and lead concentrations in excess of the CCME residential criteria but only one sample taken from within the maintenance pit (GAR-1) contained lead at a concentration slightly in excess of the CCME industrial criteria. The metal contamination detected in soil samples obtained in vicinity of the maintenance garage is likely associated with oil and fuel spills which had occurred in this area.

Soil samples taken in vicinity of the blacksmith shop contained concentrations of barium, copper, lead, tin, and zinc which exceeded the CCME residential criteria and the industrial criteria as follows:

BLK-3 (black foundry-sand/slag)	> CCME industrial criteria for lead and tin
BLK-6 (soil w/ slag - NE corner)	> CCME industrial criteria for lead
BLK-7 (soil w/ slag - rear of shop)	> CCME industrial criteria for zinc
LK-9 (organic soil - south of BLK-7)	> CCME industrial criteria for zinc

A surface soil sample taken adjacent to the north of the power boiler beneath one of two oil dispensing drums (MILL-1A) contained an arsenic level slightly in excess of the CCME industrial criteria. However, a soil sample obtained from a slightly deeper depth (MILL-1) and a surface sample taken beneath the other dispensing drum (MILL-1B) contained arsenic at a concentration well below the CCME residential criteria, suggesting that the arsenic contamination detected is limited in extent. Therefore, arsenic contamination in soils at this location should not represent an environmental concern.

Test pit soil samples:

- soil samples from the following locations were submitted for metals analyses: north of the mill pond (T-2); adjacent to the scrap burner (T-2); in vicinity of the diptank (T-7); adjacent to the donkey engine (T-10); and adjacent to the gas and oil shed (T-11 & T-14)

- levels of copper in soil samples obtained from the test pits are generally at or exceed the CCME residential criteria which may suggest that the native soils at the site contain a relatively high background level of copper

- a sample taken adjacent to the scrap burner contained a cobalt and nickel concentration slightly in excess of the CCME residential criteria but should not pose a concern

Borehole soil samples:

- soil samples from the following locations were submitted for metals analyses: adjacent to the greenchain (MM-8); adjacent to the oil shed (MM-7); and surrounding the blacksmith shop (MM-9 through 12)

- copper concentrations in the soil samples analyzed ranged from 98.2 mg/kg to 129 mg/kg which is at or slightly above the CCME residential criteria of 100 mg/kg, and may reflect the background copper concentration in native soils at the site

- one soil sample at the northwest corner of the blacksmith shop (MM-12) had a zinc concentration in excess of the CCME residential criteria

Leachable Metals

- soil samples from the following locations were submitted for a leachate extraction procedure as specified by the BC Environment Special Waste Regulation for analysis of leachable metals: below the grease rack (GPIT-1), from the blacksmith shop (BLK-3), and from the mill area (MILL-3); all results are less than the Leachate Quality Standards and therefore are not considered leachable toxic waste

5.2.2 Petroleum Hydrocarbons

A total of 40 soil samples were submitted for mineral oil and grease analysis. The samples were obtained from 19 hand-auger samples, 7 test pits, 4 boreholes and 3 shallow borings across the site. Four soil samples were submitted for Total Extractable Hydrocarbons (TEH) analysis in order to evaluate the hydrocarbon "fingerprint" to identify potential petroleum hydrocarbon sources, if any. The mineral oil and grease and TEH analyses were conducted as gross screening parameters for petroleum hydrocarbon contamination. Results of the mineral oil and grease and TEH analysis are shown in Table 4. Selected soil samples were submitted for analysis of VOC and PAH concentrations based on contaminant observations during soil sampling and the results of gross parameter screening analysis.

Mineral Oil and Grease:

***Surface soil samples*:**

Surface soil samples taken from below the grease rack adjacent to the small parts shed were visibly stained with heavy oil and contained concentrations of mineral oil and grease in excess of the BC Environment Special Waste level of 3%. Surface soil samples taken from within the maintenance garage contained mineral oil and grease at concentrations in excess of the BC Environment Level C industrial criteria. The elevated levels are likely associated with the historic fuel and oil spills on the garage floor.

A representative sample of slag taken from the blacksmith shop contained concentrations of mineral oil and grease which exceeded the BC Environment Level B residential criteria.

Surface soil samples taken adjacent to and on the north side of the power boiler beneath the two oil dispensing drums (MILL-1A and MILL-1) contained a mineral oil and grease concentration in excess of the BC Environment Level C industrial criteria to a depth of 0.3 m.

Surface samples surrounding the secondary steam boiler were all in excess of the BC Environment Special Waste level of 3% with the highest concentrations directly adjacent to the boiler. The contamination extends up to 15 meters beyond the mill and is contaminated to a

TABLE 4: RESULTS OF MINERAL OIL & GREASE AND TEH
City of Port Alberni - McLean Mill

Surface Soil Samples (mg/kg)

Sample	Depth (m)	Oil & Grease	TEH
GPIT-1	0.0	306000	117000
GPIT-1	0.1-0.15	14000	-
GPIT-2	0.1	45400	-
GENG-1	0-0.05	3110	-
GAR-1	0	12300	-
GAR-3	0	17400	-
GAR-4	0	1680	-
BLK-3	0-0.2	1600	-
MILL-1A	0-0.1	12000	-
MILL-1	0.2-0.3	10800	-
MILL-3	0-0.1	301000	126000
MILL-4	0-0.1	397000	-
MILL-4	0.1-0.2	30800	-
MILL-5	0	121000	-
MILL-5	0.3-0.4	19100	-
MILL-6	0	33000	-
MILL-6	0.1-0.2	16500	-
MILL-7	0-0.1	50900	-
MILL-9	0-0.1	147000	34800
MILL-10	0.1	289000	-
BC Environment Criteria			
Level B		1000	400
Level C		5000	2000
Special Waste		30000	-

Exceeds BC Environment Level B Criteria
Exceeds BC Environment Level C Criteria
Exceeds BC Environment Special Waste level

TABLE 4 continued: RESULTS OF MINERAL OIL & GREASE AND TEH
City of Port Alberni - McLean Mill

Test Pit Soil Samples (mg/kg)

Sample	Depth (m)	Oil & Grease	TEH
T-1	0.2	192	-
T-2	0-0.1	1450	-
T-2	0.5	167	-
T-10	0-0.1	214	-
T-11	0-0.1	6440	-
T-11	0.1-0.2	2890	-
T-11	1.3	-	268
T-12	0-0.1	262	-
T-14	0-0.1	2430	-
T-14	0.3	190	-
T-16	0-0.1	769	-

Borehole Soil Samples (mg/kg)

Sample	Depth (m)	Oil & Grease	TEH
MM-3	0-0.61	499	-
MM-4	0-0.61	595	-
MM-4	0.61-1.22	225	-
MM-6	0-0.61	391	-
MM-7	0-0.61	< 100	-
MM-7	0.61-1.22	6160	-
MM-7	1.22-1.81	122	-
MM-8	0-0.61	149	-
MM-24	0-0.1	269	-
MM-25	0-0.1	263	-
BC Environment Criteria			
Level B		1000	400
Level C		5000	2000
Special Waste		30000	-

Exceeds BC Environment Level B Criteria
Exceeds BC Environment Level C Criteria
Exceeds BC Environment Special Waste level

depth of approximately 0.3 meters. The source of the observed mineral oil and grease contamination is likely attributed to historic spills of heavy lubricating oil in this area. Figure 6 illustrates the areal extent of mineral oil and grease contamination in the mill area.

Test pit soil samples:

One surface soil sample taken directly south of the gas and oil shed (T-11 @ 0-0.1 m) contained an mineral oil and grease concentration in excess of the BC Environment Level C criteria. However, the concentration at 0.1-0.2 meters was less than the Level C criteria indicating that the contamination is rapidly attenuated.

Borehole soil samples:

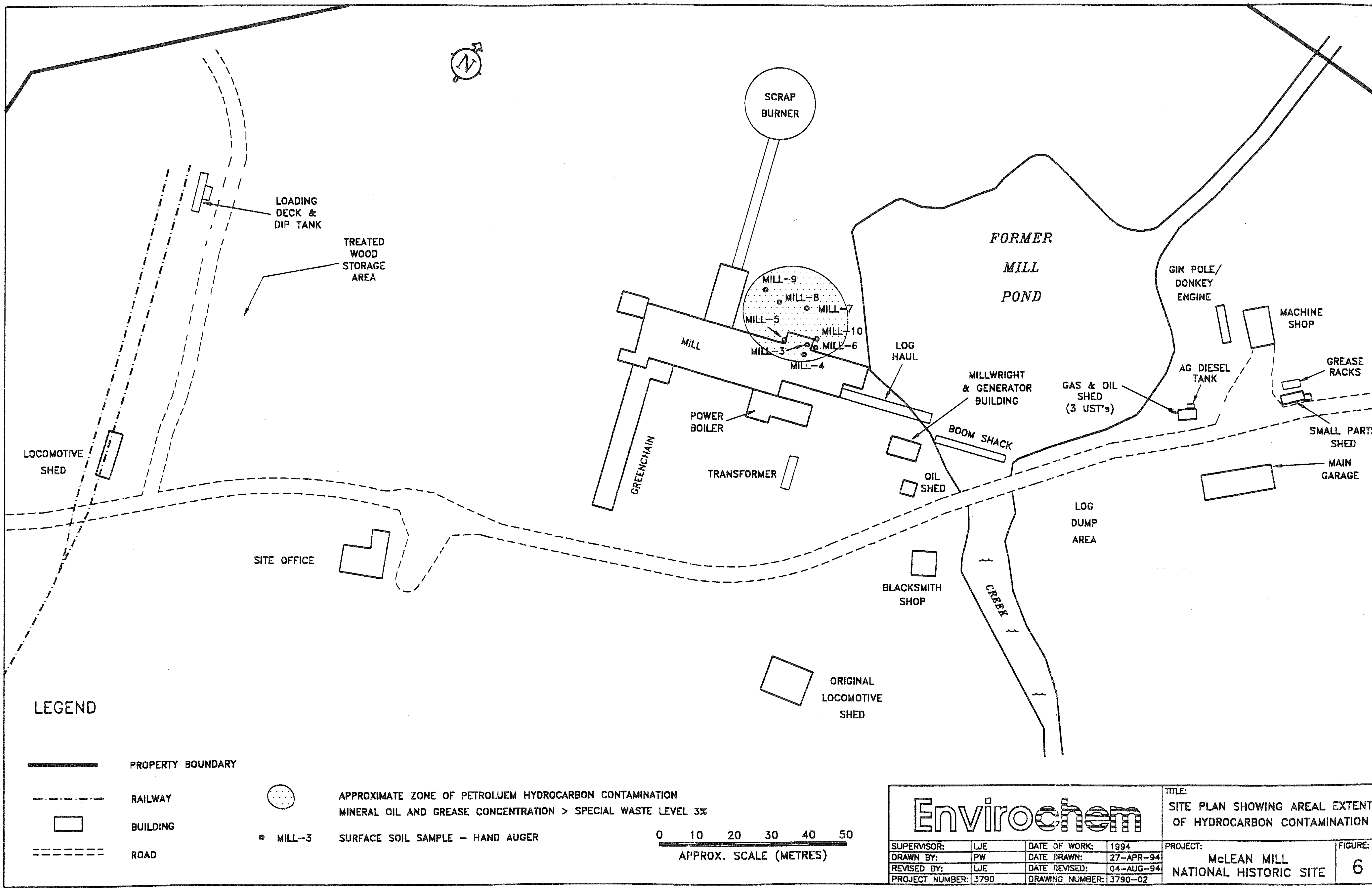
One sample, taken from an area adjacent to the oil shed (MM-7 @ 0.6-1.2 m) contained a mineral oil and grease concentration in excess of the BC Environment Level C criteria. A soil sample taken at a depth of 1.2-1.8 meters in the same borehole contained a mineral oil and grease concentration which was well below the Level B criteria indicating that the contamination is rapidly attenuated.

Total extractable hydrocarbons (TEH):

Total Extractable Hydrocarbon (TEH) analysis was conducted on selected samples to identify the type of petroleum hydrocarbon contamination present. The B.C. Environment Level C criteria for TEH was exceeded in surface soil samples GPIT-1 (vehicle maintenance pit), MILL-3 and MILL-9 (sawmill). The source of the elevated TEH concentrations is attributed to heavy lubricating oil and/or waste oil which was used in the areas. The gas chromatogram for the test pit T-11 soil sample indicates that the sample contains weathered diesel fuel, as was indicated by the olfactory observations during the sampling program. The TEH concentration in this soil sample was lower than the BC Environment Level C criteria.

Volatile organic compounds:

Volatile organic compound (VOCs) analysis was conducted on soil samples from test pits T-11 (at four depths) and T-15 where olfactory evidence suggested evidence of fuel contamination.


SCRAP
BURNER
LOADING
DECK &
DIP TANK
TREATED
WOOD
STORAGE
AREA
FORMER
MILL
POND
MILL-9
MILL-8
MILL-7
MILL-5
MILL-10
MILL-6
MILL-3
MILL-4
MILL
LOG
HAUL
MILLWRIGHT
& GENERATOR
BUILDING
GIN POLE/
DONKEY
ENGINE
MACHINE
SHOP
AG DIESEL
TANK
GREASE
RACKS
GAS & OIL
SHED
(3 UST's)
SMALL PARTS
SHED
POWER
BOILER
BOOM SHACK
GREENCHAIN
TRANSFORMER
OIL
SHED
MAIN
GARAGE
LOCOMOTIVE
SHED
LOG
DUMP
AREA
SITE OFFICE
BLACKSMITH
SHOP
CREEK
ORIGINAL
LOCOMOTIVE
SHED
LEGEND
PROPERTY BOUNDARY
RAILWAY
BUILDING
ROAD
APPROXIMATE ZONE OF PETROLUEM HYDROCARBON CONTAMINATION
MINERAL OIL AND GREASE CONCENTRATION > SPECIAL WASTE LEVEL 3%
MILL-3
SURFACE SOIL SAMPLE - HAND AUGER
0 10 20 30 40 50
APPROX. SCALE (METRES)
Envirochem
SUPERVISOR: LJE
DRAWN BY: PW
REVISED BY: LJE
PROJECT NUMBER: 3790
DATE OF WORK: 1994
DATE DRAWN: 27-APR-94
DATE REVISED: 04-AUG-94
DRAWING NUMBER: 3790-02
TITLE:
SITE PLAN SHOWING AREAL EXTENT
OF HYDROCARBON CONTAMINATION
PROJECT:
McLEAN MILL
NATIONAL HISTORIC SITE
FIGURE:
6

Test pit T-11 is located directly downgradient from three underground fuel storage tanks which are located beneath the gas and oil shed. Test pit T-15 is located south of T-11, across the access road. The results of VOC analyses in soil samples are shown in Table 5.

The results indicate that VOC concentrations in all soil samples are less than the analytical detection limits. The low concentrations of mineral oil and grease, TEH and VOCs detected in the soil samples obtained from test pit T-11, indicates that petroleum hydrocarbon contamination resulting from leaking underground storage tanks is not present at a concentration that should pose a significant environmental concern.

Polycyclic aromatic hydrocarbons:

A soil samples from test pit T-2 (0-0.1 m), and surface soil samples obtained from the blacksmith shop (BLK-4) and the mill area (MILL-4) were submitted for polycyclic aromatic hydrocarbon (PAHs) analysis due to visual observations of potential hydrocarbon contamination. The sample from the blacksmith shop area (BLK-4) had an ash-like appearance, while the soil sample obtained in the mill area (MILL-4) appeared to be contaminated with a heavy black oil. The surface soil sample from test pit T-2 consisted of blackened ash from the wood scrap burner. The results of PAH analyses in soil samples are shown in Table 6.

The results of analysis indicate that, with the exception of the surface soil sample (MILL 4) obtained from the mill area, all soil samples analyzed contained lower concentrations of PAH compounds than specified by CCME for residential land use. Soil sample MILL-4 contained a chrysene concentration which slightly exceeded the CCME residential criteria.

On the basis of the analytical results the PAH concentrations in soil samples analyzed from the McLean Mill site do not represent an environmental concern.

TABLE 5: RESULTS OF VOLATILE ORGANICS ANALYSES
City of Port Alberni - McLean Mill
Test Pit Soil Samples (mg/kg)

Sample Depth (m)	T-11 0.5	T-11 1.3	T-11 1.5	T-11 2.1	T-15 1.2	CCME Criteria Residential	 Industrial
Halogenated Volatiles							
Bromodichloromethane	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
Bromoform	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
Carbon Tetrachloride	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
Chlorobenzene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	1	10
Chloroethane	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-	-
Chloroform	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
Chloromethane	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	-	-
Dibromochloromethane	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
1,2 Dichlorobenzene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	1	10
1,3 Dichlorobenzene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	1	10
1,4 Dichlorobenzene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	1	10
1,1 Dichloroethane	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
1,2 Dichloroethane	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	5	50
cis 1,2 Dichloroethylene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
trans 1,2 Dichloroethylene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
1,1 Dichloroethylene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
1,2 Dichloropropane	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
cis 1,3 Dichloropropylene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
trans 1,3 Dichloropropylene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
1,1,1,2 Tetrachloroethane	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
1,1,2,2 Tetrachloroethane	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
Tetrachloroethylene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
1,1,1 Trichloroethane	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
1,1,2 Trichloroethane	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
Trichloroethylene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
Trichlorofluoromethane	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-	-
Vinyl Chloride	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-	-
Non-Halogenated Volatiles							
Benzene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.5	5
Ethylbenzene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
Styrene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50
Toluene	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	3	30
Xylenes	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	5	50

\- = No criteria
T-11 = Test pit soil sample
Exceeds CCME Interim residential/parkland criteria
Exceeds CCME Interim industrial/commercial criteria

TABLE 6: RESULTS OF PAH ANALYSES
City of Port Alberni - McLean Mill
Surface and Test Pit Soil Samples (mg/kg)

Sample I.D.	T-2	BLK-4	MILL 4	**CCME Criteria**	
Depth (m)	0-0.1	0-0.1	0-0.1	**Residential**	**Industrial**
Low Molecular Wt. PAHs					
Naphthalene	0.4	0.3	0.7	5	50
Acenaphthylene	< 0.05	0.06	< 0.5	-	-
Acenaphthene	< 0.05	< 0.05	< 0.5	-	-
Fluorene	< 0.05	< 0.05	< 0.5	-	-
Phenanthrene	0.18	0.36	2	5	50
Anthracene	< 0.05	< 0.05	0.5	-	-
Total LMW PAHs	0.58	0.72	3.2	-	-
High Molecular Wt. PAHs					
Fluoranthene	0.09	0.27	0.6	-	-
Pyrene	0.07	0.19	2.2	10	100
Benzo(a)anthracene	< 0.05	<0.05	< 0.5	1	10
Chrysene	< 0.05	0.11	1.6	-	-
Benzo(b,k)fluoranthene	< 0.05	0.17	0.9	1	10
Benzo(a)pyrene	< 0.05	0.11	< 0.5	1	10
Indeno(1,2,3-cd)pyrene	< 0.05	0.15	< 0.5	1	10
Dibenz(a,h)anthracene	< 0.05	< 0.05	< 0.5	1	10
Benzo(g,h,i)perylene	< 0.05	0.21	< 0.5	-	-
Total HMW PAHs	0.16	1.2	5.3	-	-
PAHs (Total)	0.74	1.92	8.5	-	-

T-2 = test pit soil sample
BLK-4 / MILL 4 = surface soil sample
Exceeds CCME Interim residential/parkland criteria
Exceeds CCME Interim industrial/commercial criteria

5.2.3 Chlorophenols

Screening analysis for chlorophenol concentrations in 36 soil samples was conducted using the immunoassay testing procedure. Soil samples which were found to contain chlorophenol concentrations in excess of the CCME remediation criteria for commercial land use (5 mg/kg) were subsequently analyzed by gas chromatography to verify the chlorophenol concentration detected by the immunoassay procedure. The chlorophenol results are compared in Table 7.

The results indicate that all concentrations of PCP as measured by the immunoassay procedure were less than the industrial criteria of 5 mg/kg, with the exception of surface soil samples obtained from test pit T-8, and boreholes MM-23, MM-24, -25, -26, -28. The chlorophenol concentration detected in borehole MM-23 using the immunoassay procedure, located adjacent to the dip tank loading dock, was in excess of 50 mg/kg.

The results of analysis by gas chromatography showed that the highest chlorophenol concentration detected was found in a soil sample obtained from borehole MM-23 which had a concentration of 3.49 mg/kg. Chlorophenol concentrations in the remaining soil samples analyzed ranged from less than 0.02 mg/kg to 2.40 mg/kg. The results indicate that chlorophenol concentrations in soils at the McLean Mill site are less than the industrial criteria of 5 mg/kg and do not represent a source of environmental concern.

5.3 Surface and Groundwater Quality

The results of chemical analyses of surface and groundwater samples are summarized in Tables 8 to 11. The applicable regulatory limits are included with the analytical data in each table. Laboratory reports are provided in Appendix IV.

5.3.1 Metals

Water samples obtained from Kitsucksus Creek at locations upstream and downstream of the McLean Mill site were submitted for analysis of total metal concentrations. Groundwater samples from monitoring wells MM-2, -6, -7 and T-8 and T-16 were submitted for analysis of dissolved metal concentrations. The results of metal analysis in surface and groundwater samples is shown in Table 8.

TABLE 7: RESULTS OF CHLOROPHENOL ANALYSES
City of Port Alberni - McLean Mill
Test Pit and Borehole Soil Samples (mg/kg)

Sample	Depth (m)	Immunoassay Test Kit Chlorophenols	Gas Chromatography		
			Tetra-Chlorophenol	Penta-Chlorophenol	Total Chlorophenols
T-4	0	< 5	-	-	-
T-4	0.15	< 5	-	-	-
T-5	0-0.1	< 5	-	-	-
T-6	0-0.1	< 5	-	-	
T-8	0.05-0.1	< 5	0.06	0.71	0.77
T-8	0.3	< 5	-	-	-
T-9	0-0.1	< 5	-	-	-
T-9	0.3	< 5	-	-	-
MM-1	0-0.61	< 5	-	-	-
MM-2	0-0.61	< 5	-	-	-
MM-2	0.61-1.2	< 5	-	-	-
MM-2	1.2-1.83	< 5	-	-	-
MM-3	0-0.61	< 5	-	-	-
MM-3	0.61-1.2	< 5	-	-	-
MM-4	0-0.61	< 5	-	-	-
MM-4	0.61-1.2	< 5	-	-	-
MM-5	0-0.61	< 5	-	-	-
MM-6	0-0.61	< 5	-	-	-
MM-6	0.61-1.2	< 5	-	-	-
MM-8	0-0.61	< 5	-	-	-
MM-13	0-0.1	< 5	-	-	-
MM-14	0-0.1	< 5	-	-	-
MM-15	0-0.1	< 5	-	-	-
MM-15	0-0.1	< 5	-	-	-
MM-16	0-0.1	< 5	-	-	-
MM-17	0-0.1	< 5	-	-	-
MM-17	1	< 5	-	-	-
MM-19	0-0.1	< 5	-	-	-
MM-20	0-0.1	< 5	-	-	-
MM-21	0-0.1	< 5	-	-	-
MM-22	0-0.1	< 5	-	-	-
MM-23	0-0.1	> 50	0.19	3.49	3.68
MM-24	0-0.1	5-50	0.22	2.4	2.62
MM-25	0-0.1	5-50	0.16	1.45	1.61
MM-26	0-0.1	5-50	0.07	0.59	0.66
MM-27	0-0.1	< 5	-	-	-
MM-28	0-0.1	< 5	< 0.02	< 0.02	< 0.02
CCME Interim residential/parkland criteria			0.5	0.5	-
CCME Interim industrial/commercial criteria			5	5	-

T-4: test pit soil sample
MM-25: borehole soil sample
Exceeds CCME Interim residential/parkland remediation criteria
Exceeds CCME Interim industrial/commercial remediation criteria

TABLE 8: RESULTS OF DISSOLVED METALS ANALYSES
City of Port Alberni - McLean Mill
Surface Water and Groundwater Samples (ug/L)

Sample I.D.	Creek Downstream	Creek Upstream	MM-2	MM-6	MM-7	T-8	T-16	**CCME Criteria** **Assessment**	**Remediation**
Aluminum	20	30	210*	10	1720*	10	60	-	5-100
Antimony	< 20	< 20	< 20	< 20	< 20	< 20	< 20	-	-
Arsenic	< 20	< 20	< 20	< 20	< 20	< 20	< 20	5	50
Barium	6	6	68	276	18	19	3	50	-
Beryllium	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-
Bismuth	< 20	< 20	< 20	< 20	< 20	< 20	< 20	-	-
Cadmium	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	1	0.2-1.8
Calcium	23800	24700	27400	61700	44700	63600	16200	-	-
Chromium	< 1	2	2	1	5	< 1	1	15	2-20
Cobalt	1	< 1	5	15	< 1	3	< 1	10	-
Copper	45*	132*	6*	6*	15*	6*	4*	25	2-4
Iron	172	2090*	390*	73	2040*	1250*	85	-	300
Lead	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10	1-7
Lithium	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-
Magnesium	2800	2840	5860	12700	16500	23500	31400	-	-
Manganese	17	21	1160	4950	119	2370	14	-	-
Mercury	NA	NA	NA	NA	NA	NA	NA	0.1	0.1
Molybdenum	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5	-
Nickel	< 1	2	8	26*	5	6	< 1	10	25-150
Phosphorus	< 50	< 50	< 50	< 50	< 50	< 50	< 50	-	-
Potassium	< 200	300	800	1900	1800	900	600	-	-
Selenium	< 20	< 20	< 20	< 20	< 20	< 20	< 20	1	1
Silver	< 1	< 1	< 1	< 1	< 1	< 1	< 1	5	0.1
Sodium	1640	1650	14500	7810	8070	4710	1880	-	-
Tin	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10	-
Vanadium	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-
Zinc	< 5	< 5	< 5	9	31*	28	18	50	30

NA: not analysed
- : no Criteria
[box] Exceeds CCME Interim Assessment Criteria
* Exceeds CCME Interim Remediation Criteria for Protection of Freshwater Aquatic Life
range of criteria varies with pH, temperature, and hardness

The results indicate that all metal concentrations in the downstream creek sample were less than or comparable to the upstream creek sample, suggesting that activities at the site have not significantly impacted the creek as it traverses the site. The copper concentrations are in excess of both the assessment criteria and the remediation criteria for aquatic life for both upstream and downstream samples and may reflect the elevated level of copper in the native soils at the site. In addition, the upstream creek sample contained an elevated level of iron which is in excess of the remediation criteria for aquatic life; however, this is likely due to the iron-rich native soils at the site.

Barium, cobalt and nickel concentrations in groundwater sampled from monitoring well MM-6 slightly exceed the CCME assessment criteria; however, soil samples obtained at this location did not contain metal concentrations in excess of the CCME residential criteria. Therefore the slightly elevated metal levels in groundwater at monitoring well MM-6 do not represent an environmental concern.

5.3.2 Petroleum Hydrocarbons

Total extractable hydrocarbons:

Groundwater samples obtained from monitoring wells MM-6, MM-7 and T-16 were analyzed for TEH as a gross screening parameter for petroleum hydrocarbon contamination. Surface water samples obtained from Kitsucksus Creek at both upstream and downstream locations and a sample obtained from the swamp area located to the southwest (downgradient) of the diptank area were also submitted for TEH analysis. The results of TEH analysis in water samples are shown in Table 9.

Although a criterion level for TEH has not been specified by CCME or the provincial criteria, based on olfactory observations and previous experience, concentrations in excess of 1 mg/l generally suggest that petroleum contamination may be a concern.

The results of analysis indicate that water samples tested at the McLean Mill site contain TEH concentrations which are lower than the analytical detection limit of 0.2 mg/l.

TABLE 9: RESULTS OF TEH ANALYSES
City of Port Alberni - McLean Mill
Surface Water and Groundwater Samples (mg/L)

Sample I.D.	TEH
Creek Upstream	< 0.2
Creek Downstream	< 0.2
Swamp	< 0.2
MM-6	< 0.2
MM-7	< 0.2
T-16	< 0.2

Creek = surface water sample
MM-6 = groundwater sample

<u>**Volatile organic compounds:**</u>

Groundwater samples from monitoring wells MM-7, T-11 and T-16 were submitted for volatile organic compound analysis (VOCs) on the basis of their location in vicinity of petroleum hydrocarbon storage areas and olfactory observations. The results of VOC analysis of water samples is shown in Table 10.

The results indicate that toluene, ethylbenzene and xylene (BTEX) concentrations in groundwater samples are slightly in excess of the assessment criteria in the monitoring well installed in test pit T-11, as are the ethylbenzene and xylene concentrations in monitoring well MM-7. A trace concentration of toluene was detected in groundwater sampled from the well installed in test pit T-16. However, the analytical results indicate that all benzene, toluene, ethylbenzene concentrations detected in groundwater samples are well below the remediation criteria for freshwater aquatic life and therefore do not represent an environmental concern.

5.3.3 Chlorophenols

Groundwater samples from monitoring wells MM-2, MM-5A and T-8 as well as a surface water sample from the swamp downgradient of the diptank were submitted for chlorophenol analyses. The results are shown in Table 11.

The results indicate that the water samples analyzed contain non-detectible chlorophenol concentrations (ie., less than 0.1 mg/l). Therefore, chlorophenol concentrations in groundwater and one surface water sample do not represent a source of environmental concern.

TABLE 10: RESULTS OF VOLATILE ORGANICS ANALYSES
City of Port Alberni - McLean Mill
Groundwater Samples (ug/L)

Monitoring Well I.D.	MM-7	T-11	T-16	CCME Criteria Assessment	CCME Criteria Remediation
Halogenated Volatiles					
Bromodichloromethane	< 0.1	< 0.1	< 0.1	-	-
Bromoform	< 0.2	< 0.2	< 0.2	-	-
Carbon Tetrachloride	< 0.1	< 0.1	< 0.1	0.1	-
Chlorobenzene	< 0.1	< 0.1	< 0.1	0.1	15
Chloroethane	< 0.4	< 0.4	< 0.4	-	-
Chloroform	< 0.1	< 0.1	< 0.1	0.1	-
Chloromethane	< 0.4	< 0.4	< 0.4	-	-
Dibromochloromethane	< 0.1	< 0.1	< 0.1	-	-
1,2 Dichlorobenzene	< 0.1	< 0.1	< 0.1	0.2	2.5
1,3 Dichlorobenzene	< 0.1	< 0.1	< 0.1	0.2	2.5
1,4 Dichlorobenzene	< 0.1	< 0.1	< 0.1	0.2	2.5
1,1 Dichloroethane	< 0.1	< 0.1	< 0.1	0.1	-
1,2 Dichloroethane	< 0.4	< 0.4	< 0.4	0.1	100
cis 1,2 Dichloroethylene	< 0.1	< 0.1	< 0.1	0.1	-
trans 1,2 Dichloroethylene	< 0.1	< 0.1	< 0.1	0.1	-
1,1 Dichloroethylene	< 0.1	< 0.1	< 0.1	0.1	-
Dibromomethane	< 0.2	< 0.2	< 0.2	-	-
1,2 Dichloropropane	< 0.1	< 0.1	< 0.1	0.1	-
cis 1,3 Dichloropropylene	< 0.1	< 0.1	< 0.1	0.1	-
trans 1,3 Dichloropropylene	< 0.1	< 0.1	< 0.1	0.1	-
1,1,2,2 Tetrachloroethane	< 0.2	< 0.2	< 0.2	0.1	-
Tetrachloroethylene	< 0.1	< 0.1	< 0.1	0.1	260
1,1,1 Trichloroethane	< 0.1	< 0.1	< 0.1	0.1	-
1,1,2 Trichloroethane	< 0.1	< 0.1	< 0.1	0.1	-
Trichloroethylene	< 0.1	< 0.1	< 0.1	0.1	20
Trichlorofluoromethane	< 0.2	< 0.2	< 0.2	-	-
Vinyl Chloride	< 0.2	< 0.2	< 0.2	-	-
Non-Halogenated Volatiles					
Benzene	< 0.1	< 0.1	< 0.1	0.5	300
Ethylbenzene	1.1	2.1	< 0.1	0.5	700
Styrene	< 0.1	< 0.1	< 0.1	0.5	-
Toluene	< 0.1	0.4	0.6	0.5	300
Xylenes	6.3	2.3	< 0.1	0.5	-

- = No criteria

Exceeds CCME Interim Assessment Criteria

Exceeds CCME Remediation Criteria for Protection of Freshwater

TABLE 11: RESULTS OF CHLOROPHENOL ANALYSES
City of Port Alberni - McLean Mill
Surface Water and Groundwater Samples (ug/L)

Sample	Tetra-Chlorophenol	Penta-Chlorophenol	Total Chlorophenols
Swamp	< 1	< 1	< 1
MM-2	< 1	< 1	< 1
MM-5A	< 1	< 1	< 1
T-8	< 1	< 1	< 1
CCME Interim Assessment and Remediation Criteria			
Assessment Criteria	1	1	-
Freshwater Aquatic Life	1	0.5	-

Swamp: surface water sample
MM-2 and T-8: groundwater samples
Exceeds CCME Assessement Criteria
Exceeds CCME Remediation Criteria for Protection of Freshwater Aquatic Life

6.0 CONCLUSIONS

The following conclusions are based on the results of the detailed site inspection, field investigation and chemical analysis of soil, surface water and groundwater samples conducted by Envirochem for the contamination assessment at the McLean Mill National Historic Site in Port Alberni, B.C.

No PCB-containing equipment or asbestos-containing insulation is located on the site.

- the site inspection did not reveal the presence of any designated (asbestos) or controlled (PCBs) materials within or associated with buildings at the site

An inventory of residual waste fuels, oils and greases is accumulated on site.

- potentially hazardous materials were identified during the site inspection, including: fuel storage tanks, and potentially oil-contaminated rainwater

The site inspection and field investigation did not reveal evidence of environmental degradation of potential aquatic receptors, including: Kitsucksus Creek, other surface water and groundwater resources.

- Kitsucksus Creek, which empties into the Somass River and eventually flows to the Alberni Inlet bisects the property, flowing in a north-south direction; the Creek supports an anadromous fish population and the upstream portion is used as a drinking water source for the mill site; general observations along the banks and bottom of the Creek showed no signs of environmental degradation

- stratigraphy at the McLean Mill site consists of silt to sandy silt underlain by a compact till unit; a crushed rock layer approximately 0.2 meters thick is present over the western portion of the site

- the thin intermittent nature of groundwater intercepted during drilling likely represents a perched water-table over the majority the site; the compactness of the underlying till unit and the high rate of precipitation in this area would further support the presence of a perched water table

- groundwater is not used for drinking water purposes, therefore the groundwater resource does not represent a human health receptor

Soil contamination at concentrations in excess of provincial and federal regulatory criteria has been identified at the McLean Mill site.

- Special Waste levels of mineral oil and grease were identified in surface soil samples obtained in two areas of the McLean Mill site: below the grease racks adjacent to the small parts shed, and an area of the sawmill adjacent to the secondary steam boiler; no soil samples obtained at depth contained Special Waste levels of petroleum hydrocarbons

- soils containing mineral oil and grease and total extractable hydrocarbon (TEH) concentrations in excess of the B.C. Environment Level C remediation criteria intended for industrial and commercial land use were encountered in surface soil samples obtained from the maintenance garage, in vicinity of the power boiler and the oil and gas shed; only one depth sample, obtained at a depth of 0.6-1.2 meters in a borehole drilled adjacent to the oil shed (MM-7), contained a mineral oil and grease concentration in excess of the provincial remediation criteria

- metal concentrations in excess of the CCME remediation criteria for industrial and commercial land use were found only in surface soil samples. Elevated leachable metal concentrations were not detected, therefore metal contaminated Special Waste soils were not encountered during the present investigation. The elevated metal concentrations in soils were reported under the grease rack area and in vicinity of the power boiler, associated with heavy oil staining, and at the blacksmith shop, associated with disposed foundry sand and slag materials.

Surface water and groundwater resources at the site have not been significantly impacted by past industrial activities relating to the operation of the McLean Mill.

- the results of surface water analysis indicate that water quality in Kitsucksus Creek has not been impacted by industrial activities at the McLean Mill site.

- total copper concentrations in water obtained both upstream and downstream of the McLean Mill site exceed the CCME remediation criteria for protection of freshwater life; however, the elevated level is likely associated with the elevated level of copper detected in the native soils and therefore reflects ambient conditions in this area

- dissolved metal and chlorophenol concentrations in groundwater samples were all less than CCME assessment criteria, therefore these parameters do not represent an environmental concern in groundwater at the McLean Mill site

- volatile organic compound (VOC) analysis of groundwater samples obtained from monitoring wells located in vicinity of petroleum hydrocarbon storage areas indicate that one or more of the BTEX compounds (benzene, toluene, ethylbenzene, xylene) are present in the groundwater samples at concentrations which are slightly in excess of the CCME assessment criteria but less than the CCME remediation criteria for protection of aquatic life. Other VOC compounds were not found in groundwater samples at detectible concentrations.

7.0 RECOMMENDATIONS

Based on the results of the contamination assessment conducted at the McLean Mill site, soil remediation is recommended in three areas of the site in order to satisfy applicable federal and provincial cleanup criteria. These areas include: petroleum hydrocarbon contaminated soils in vicinity of the secondary steam engine and beneath the grease rack adjacent to the small parts storage shed, and metal contaminated soils in vicinity of the blacksmith shop. Both petroleum hydrocarbon and metal contamination is limited to surface soils with some areas of petroleum hydrocarbon contamination extending to depths of up to 0.2-0.3 meters. Excavation and proper disposal of this material is recommended to ensure that the site does not pose any risk to human health or to the environment consistent with the proposed use of the site as an operating sawmill open to the public.

The petroleum hydrocarbon contaminated soil containing mineral oil and grease concentrations above 3 % would classify as a fully regulated Special Waste under the B.C. Special Waste Regulation and would therefore require disposal at a licensed secure landfill or alternate treatment at an approved Special Waste facility. Although, the oil contaminated soil does not pose an immediate risk, it is recommended that the contaminated soil be excavated and disposed of to prevent possible environmental degradation downgradient or in the adjacent creek and to prevent exposure to the general public. The estimated volume of Special Waste material requiring remediation in the mill area is approximately 150-200 m^3. The volume of contaminated soil beneath the grease racks is approximately 20 m^3. Additional in-situ delineation of the areal extent of petroleum hydrocarbon contamination is not deemed necessary as the contaminated material can be identified visually as the excavation proceeds. Estimated costs for disposal of Special Waste "hydrocarbon contaminated soil" are approximately \$ 150-200/m^3 depending on the final disposal destination.

Metal contaminated surface soils in the vicinity of the blacksmith shop should also be excavated and disposed as metal concentrations are in excess of the CCME industrial criteria. The estimated volume of material requiring scraping and disposal is estimated at approximately 25 m^3. Similar to the oil contaminated soil, the slag/fill contaminated material can be identified visually as the excavation proceeds and therefore additional in-situ characterization sampling is not deemed necessary. Estimated costs for disposal of metal contaminated material in excess of industrial criteria are approximately \$125-175/m^3.

Other petroleum contamination identified at the site includes weathered diesel contamination in vicinity of the gas and oil sheds, minor oil contamination within the maintenance garage and elevated levels of oil in the surface soils in vicinity of the power boiler. However, these areas of contamination do not represent a significant environmental or human health risk. As the site will be used as an operational mill and minor oil staining will likely continue to occur, it is recommended that these minor contaminated areas be left in place.

The results of surface water and groundwater analysis indicate that water quality at the site has not been affected by industrial activities and further assessment and remediation is not required.

Specific recommendations regarding the remediation of petroleum hydrocarbon and metal contamination detected in surface soils at the McLean Mill site include:

- Obtain firm price quotes from qualified hazardous waste contractors to excavate, transport and dispose of approximately 250 m^3 of Special Waste 'Hydrocarbon Contaminated Soil' and approximately 25-30 m^3 of metal contaminated soil in excess of the CCME industrial criteria. Suggested qualified contractors include: Triwaste, Laidlaw, Hazco and Philips.

- Develop and submit a detailed soil remediation plan to Environment Canada for review and comment, including the proposed hazardous waste contractor, the proposed treatment and/or disposal options, excavation and transportation protocols, confirmatory sampling protocols, and health and safety protocols.

- Excavate, transport and dispose of contaminated soils as per remediation plan.

- Conduct confirmatory sampling following excavation in order to ensure that the site satisfies cleanup criteria specified in the remediation plan.

8.0 DISCLAIMER

This Environmental Site Assessment Report has been prepared for the City of Port Alberni. It is intended to provide the City of Port Alberni with an understanding of the potential hazards that the property evaluated in this report may pose to human health, or to the general environment due to chemical contamination. It describes what Envirochem Special Projects Inc. believes are reasonable concerns about how the property could potentially become involved in various environmental problems resulting from hazardous or special waste, and hazardous materials. Envirochem Special Projects Inc. has neither created nor contributed to the creation or existence of any hazardous, radioactive, toxic, irritant, pollutant, special waste, or otherwise dangerous substance, or condition at the site.

This report is based upon data and information obtained from boreholes, surveys, explorations and sampling during a Phase II study by Envirochem Special Projects Inc. personnel to the property identified herein and is based solely upon the condition of the property on the date of such inspection, supplemented by information and data obtained by Envirochem Special Projects Inc. and described herein.

The Client recognizes that subsurface conditions may be variable throughout the site, and that there is the potential for variations from conditions encountered at locations where boreholes, surveys or explorations were conducted by Envirochem Special Projects Inc..

The data, interpretations and recommendations of Envirochem Special Projects Inc. are based solely on the information available to them. Envirochem Special Projects Inc. shall not be responsible for the interpretation by others of the information developed. The evaluation and conclusions contained in this report have been prepared in light of the expertise and experience of Envirochem Special Projects Inc..

Envirochem Special Projects Inc. has performed the work, made the findings, and proposed the recommendations described in this report in accordance with generally accepted environmental science practices for Phase II Environmental Site Assessments in effect at the time the work was performed. This warranty stands in lieu of all other warranties, expressed or implied. While this report can be used as a guide by the City of Port Alberni, it must be understood that it is neither a rejection nor an endorsement of the property.

LIMIT OF LIABILITY:

The liability of Envirochem Special Projects Inc. to the owner, the Client and to all third parties shall be limited to injury or loss caused by the negligent acts, error or omissions of Envirochem. The total aggregate liability of Envirochem related to this agreement shall not exceed the lesser of the actual damages incurred, or the total fee of Envirochem for services rendered on this project.

The Client has, by contract, agreed to defend, indemnify and hold harmless Envirochem, its affiliates, officers, directors, employees and agents, from any and all liabilities, in excess of the limits of Envirochem Special Projects Inc. entire liability set out above, incurred by Envirochem Special Projects Inc. or any other party, in connection with the services hereunder, or arising from or in any way connected to uninsurable obligations including those arising from the presence, discharge, dispersal, release, escape or effect of radiation, nuclear reaction of radioactive, toxic, explosive or hazardous substances, or any other pollutants including solid, liquid, gaseous, thermal irritants or contaminants. Such indemnity shall include the costs of the time spent and expenses incurred by Envirochem Special Projects Inc. and its affiliates in connection with the defence of the claims.

PROTECTION AGAINST ERRORS OF OTHERS:

The Client has, by contract, agreed to defend, indemnify and save harmless Envirochem Special Projects Inc., agents and employees against any and all claims, costs suites and damages, including attorney's fees, arising out of errors, omissions and inaccuracies in documents and information provided to Envirochem Special Projects Inc. by the Client, its officers, agents and employees.

APPENDIX I

Geophysical Survey Report

prepared by

Associated Mining Consultants Ltd.

TOTAL FIELD MAGNETOMETER AND GRADIOMETER SURVEY

R.B. McLEAN LUMBER CO. NATIONAL HISTORIC SITE PORT ALBERNI, BRITISH COLUMBIA

Prepared for

ENVIROCHEM SERVICES
North Vancouver, B.C.

Prepared by

ASSOCIATED MINING CONSULTANTS LTD.

1401, 910 - 7th Avenue S.W.
Calgary, Alberta
T2P 3N8

Tel: (403) 264-9496
Fax: (403) 269-7640

525, 21 Four Seasons Place
Etobicoke, Ontario
M9B 6J8

Tel: (416) 620-5797
Fax: (416) 622-6249

PERMIT TO PRACTICE
ASSOCIATED MINING CONSULTANTS LTD.
Signature
Date MAR 2 2 1994
PERMIT NUMBER: P 2361
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

March 1994

PG 12

AMCL

Associated Mining Consultants Ltd.

1401, 910 - 7 Avenue S.W.; Calgary, Alberta, Canada T2P 3N8
Tel: (403) 264-9496 Fax: (403) 269-7640

File: PG 12
March 21, 1994

ENVIROCHEM SERVICES
310 East Esplanade
North Vancouver, B.C.
V7L 1A4

Attention: Linda Eastcott

Dear Ms. Eastcott,

Associated Mining Consultants Ltd. (AMCL) is pleased to submit its report entitled:

"Total Field Magnetometer and Gradiometer Survey
R.B. McLean Lumber Co. National Historic Site
Port Alberni, B.C."

We wish to express our thanks to Envirochem Services for the opportunity to provide our services in relation to this project, and we hope that we may have further opportunities to be of service in the future.

Respectfully submitted,

ASSOCIATED MINING CONSULTANTS LTD.

Mark Bowman, P.Geoph.
Project Geophysicist

MB/mlh
enclosure

TOTAL FIELD MAGNETOMETER AND GRADIOMETER SURVEY R.B. McLEAN LUMBER CO. NATIONAL HISTORIC SITE PORT ALBERNI, BRITISH COLUMBIA

1.0 INTRODUCTION

This report presents the results of a total field magnetometer and gradiometer survey undertaken at the R.B. McLean Lumber Co. National Historic Site near Port Alberni, British Columbia (Figure 1).

The objective of the survey was to map variations in magnetic response to ascertain the presence of buried metal at the site.

All work for this project has been carried out in accordance with Associated Mining Consultants Ltd.'s proposal to Envirochem Services dated March 3, 1994.

2.0 METHODOLOGY

Magnetometers measure the intensity of the geomagnetic field. The geomagnetic field is comprised of two main parts:

i) The earth's magnetic field. The origin of this field is apparently a system of electric currents originating in the earth's fluid conductive core. The resulting magnetic field resembles that of a large bar magnet.

ii) Local magnetic anomalies in the relatively near surface. These consist of variations caused by geologic features such as magnetic rocks, and by man-made magnetic objects.

The gradiometer method consists of simultaneously recording two magnetometer measurements at two instrument sensor elevations at each survey station. This method enhances the signals resulting from near surface metallic objects.

A 5 metre by 10 metre survey grid was established at the site. Total field magnetic and gradient measurements were recorded at 2.5 metre intervals along lines 5 metres apart. A base station, located adjacent to the survey grid, was repeatedly surveyed at small time intervals to compensate for time dependant diurnal variations in the earth's magnetic field.

3.0 RESULTS

Results of the total field magnetometer and gradiometer surveys at the two sites are presented as coloured contour maps illustrating lateral variations in magnetic intensity (Figures 2 to 5).

At the Mill Site, survey results identify several regions of anomalous magnetic response (Figures 2 and 3). Increased total field magnetic intensity and magnetic gradient is evident in the immediate vicinity of the mill and its associated structures. This response is likely due to the metal components of the mill infrastructure.

Two additional areas of anomalous magnetic response at the Mill Site are identified as 1a and **1b** (95 east, 190 north and 70 east, 160 north respectively) in Figures 2 and 3. No surface metals are evident in these regions, suggesting that these responses are likely due to subsurface metals. Anomaly 1b is most prominent in the gradiometer survey results, suggesting a very shallow depth of burial.

Anomalies **1a** and **1b** are of limited lateral extent, suggesting the occurrence of small quantities of buried metal.

Magnetic anomaly **2a** (12.5 west, 15 north) is identified by the total field magnetometer survey results in the vicinity of the Loading Dock (Figure 4). A slightly elevated magnetic gradient (Figure 5) is also apparent in this area. No surface metals are evident that would significantly contribute to the magnitude of this magnetic anomaly.

Anomaly **2b**, evident in the gradiometer survey results (Figure 5), occurs along the northern boundary of the survey grid (20 west, 25 north). No corresponding total field magnetic anomaly is evident, suggesting a relatively shallow depth of burial.

Anomalies **2a** and **2b** are of limited lateral extent, suggesting only small quantities of buried metal occur in these regions.

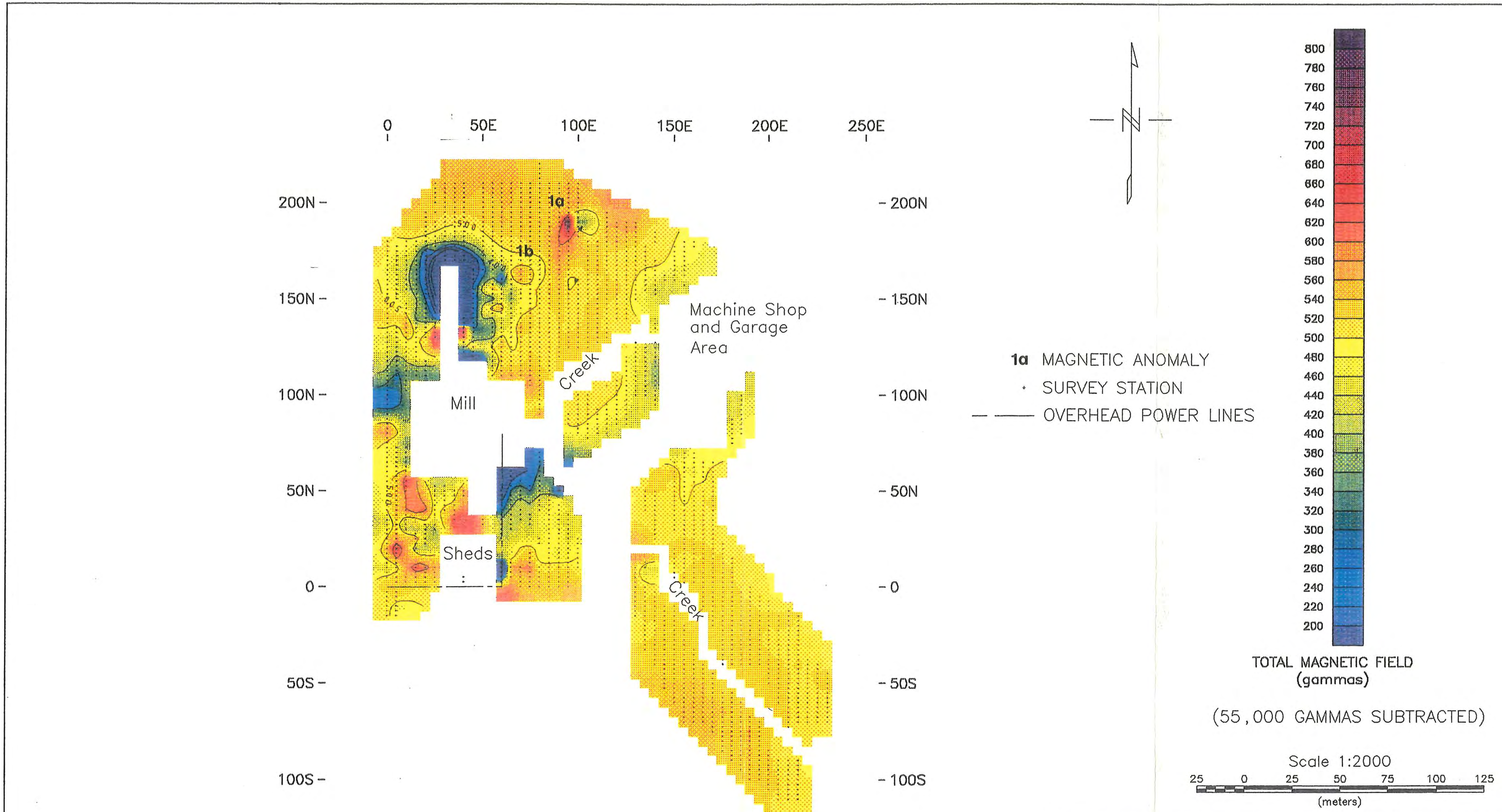
4.0 CONCLUSIONS

Results of the combined total field magnetometer/gradiometer survey at the R.B. McLean Lumber Co. National Historic Site near Port Alberni, B.C. have identified regions of anomalous magnetic intensity. Two anomalous regions at the Mill Site, and one in the vicinity of the Loading Dock, as identified in the accompanying figures, are likely due to buried metallic objects. The limited lateral extent of these regions suggest that the source objects are relatively small.

Because the magnetic response immediately adjacent to the mill infrastructure has been dominated by the associated metal, no information concerning underground sources in these regions may be derived from this data.

★ R. B. McLEAN LUMBER Co.
NATIONAL HISTORIC SITE

ENVIROCHEM SERVICES
R B McLEAN LUMBER Co. NATIONAL HISTORIC SITE PORT ALBERNI, BRITISH COLUMBIA
SITE LOCATION MAP - Figure 1
ASSOCIATED MINING CONSULTANTS LTD. PG-12

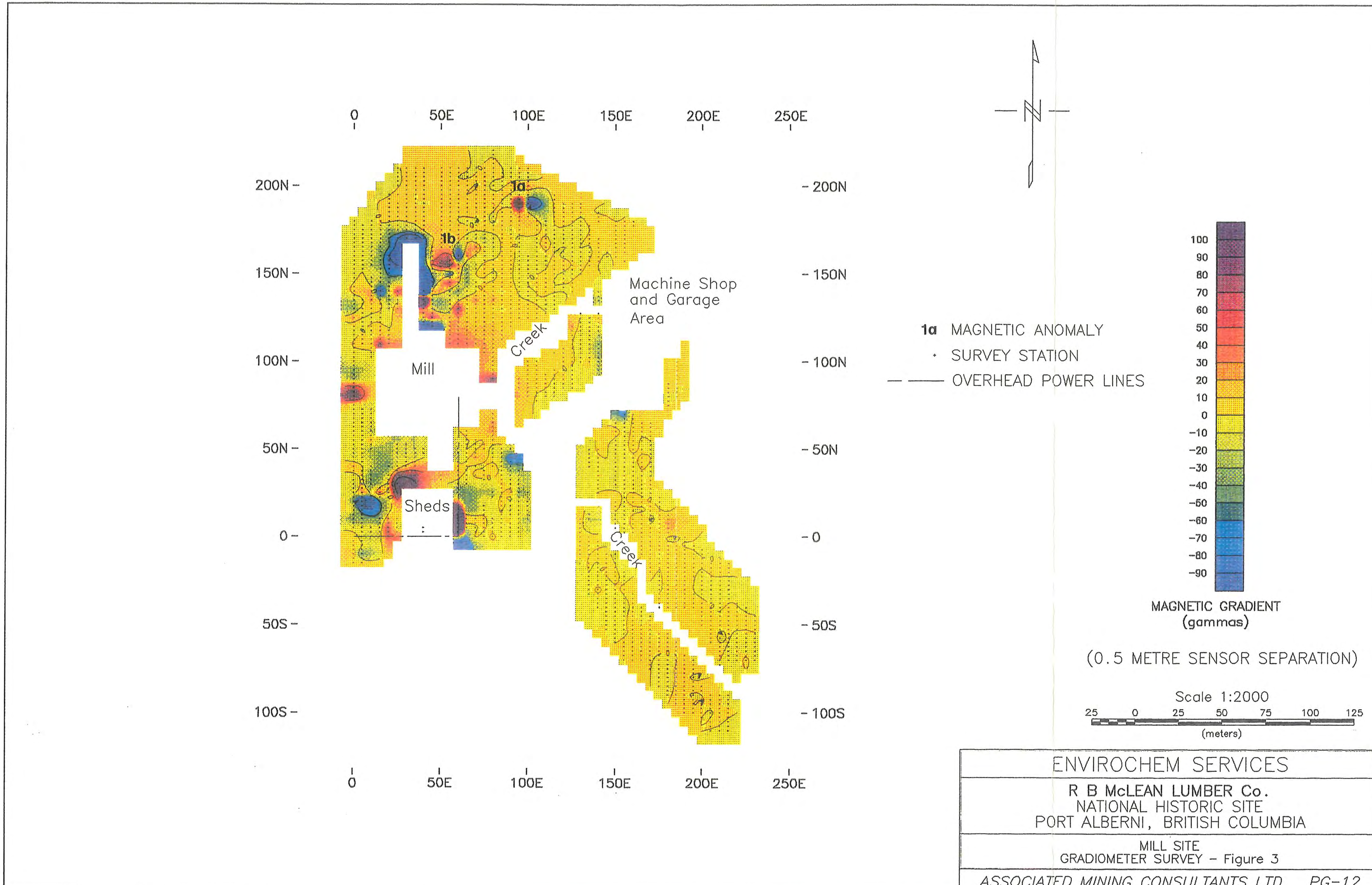


ENVIROCHEM SERVICES

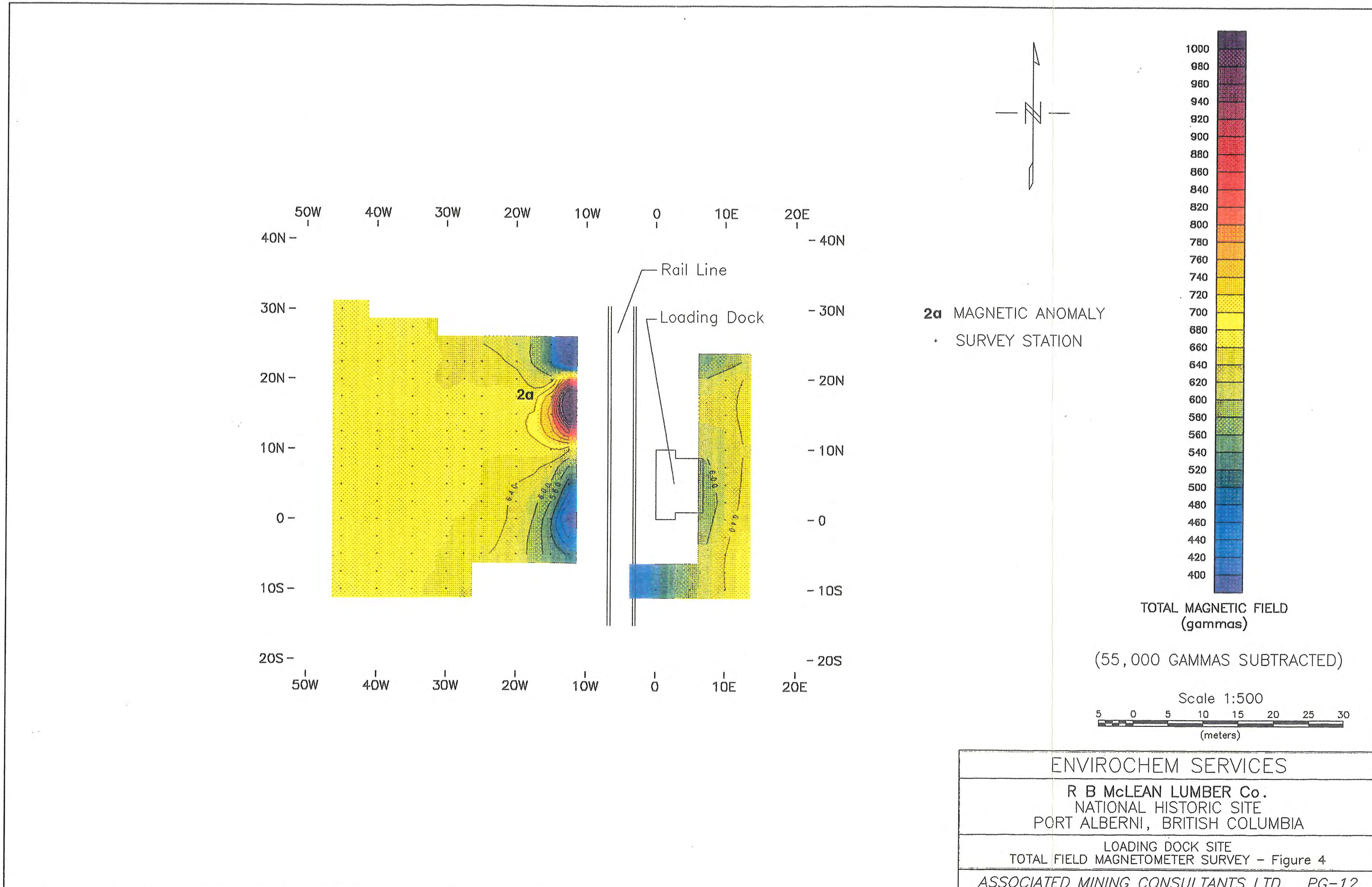
R B McLEAN LUMBER Co.
NATIONAL HISTORIC SITE
PORT ALBERNI, BRITISH COLUMBIA

MILL SITE
TOTAL FIELD MAGNETOMETER SURVEY – Figure 2

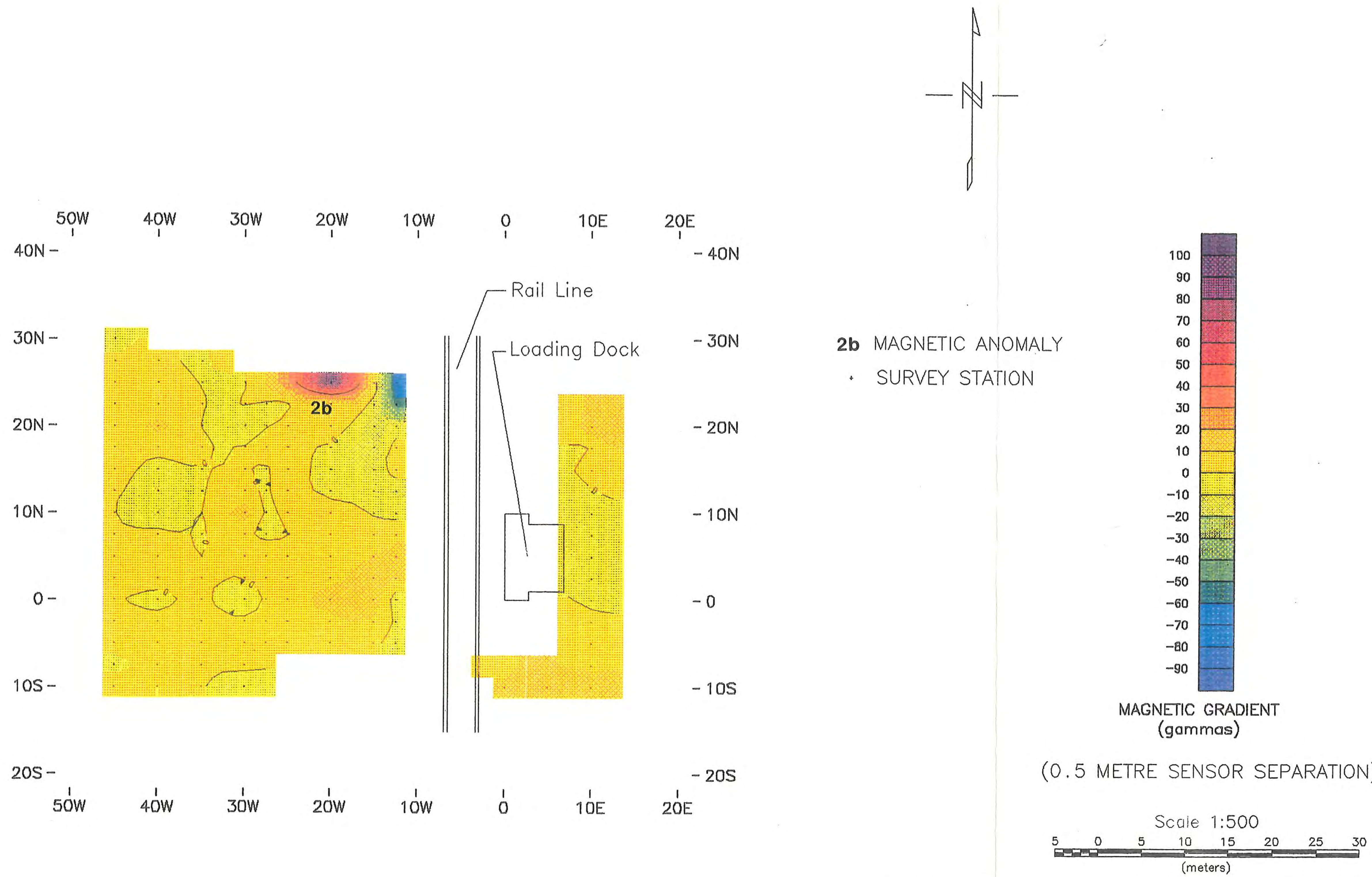
ASSOCIATED MINING CONSULTANTS LTD. PG-12



0
50E
100E
150E
200E
250E
200N
150N
100N
50N
0
50S
100S
1a
1b
Machine Shop
and Garage
Area
Creek
Mill
Sheds
1a MAGNETIC ANOMALY
· SURVEY STATION
— —— OVERHEAD POWER LINES
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
MAGNETIC GRADIENT
(gammas)
(0.5 METRE SENSOR SEPARATION)
Scale 1:2000
25 0 25 50 75 100 125
(meters)
ENVIROCHEM SERVICES
R B McLEAN LUMBER Co.
NATIONAL HISTORIC SITE
PORT ALBERNI, BRITISH COLUMBIA
MILL SITE
GRADIOMETER SURVEY - Figure 3
ASSOCIATED MINING CONSULTANTS LTD. PG-12



50W
40W
30W
20W
10W
0
10E
20E
40N
30N
20N
10N
0
10S
20S
Rail Line
Loading Dock
2a
2a MAGNETIC ANOMALY
SURVEY STATION
1000
980
960
940
920
900
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
540
520
500
480
460
440
420
400
TOTAL MAGNETIC FIELD
(gammas)
(55,000 GAMMAS SUBTRACTED)
Scale 1:500
5 0 5 10 15 20 25 30
(meters)
ENVIROCHEM SERVICES
R B McLEAN LUMBER Co.
NATIONAL HISTORIC SITE
PORT ALBERNI, BRITISH COLUMBIA
LOADING DOCK SITE
TOTAL FIELD MAGNETOMETER SURVEY - Figure 4
ASSOCIATED MINING CONSULTANTS LTD. PG-12



ENVIROCHEM SERVICES

R B McLEAN LUMBER Co.
NATIONAL HISTORIC SITE
PORT ALBERNI, BRITISH COLUMBIA

LOADING DOCK SITE
GRADIOMETER SURVEY – Figure 5

ASSOCIATED MINING CONSULTANTS LTD. *PG-12*

APPENDIX II

Shallow Boring and Test Pit Logs

CITY OF PORT ALBERNI, B.C.
McLEAN MILL NATIONAL HISTORIC SITE
CONTAMINATION ASSESSMENT

GEOLOGIC DESCRIPTION OF SHALLOW BORING SOILS

Twenty shallow borings were drilled across the McLean Mill site using a solid stem auger rig. Drilling and sampling was conducted March 16 and 17, 1994. Drilling was not conducted on the portion of the property located on the east bank of the former mill pond and Kitsucksus Creek, due to load restriction on the bridge crossing the creek. The borings were generally drilled to one meter depth and soil samples were obtained from the auger flights at depths of 0, 0.5 and 1 meter below present grade. Shallow borings MM9 to MM12 were drilled in vicinity of the blacksmith shop; shallow borings MM13 to MM19 were drilled in the former treated wood storage area; shallow borings MM20 to MM28 were drilled in vicinity of the diptank.

MM9

0-0.1 m vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m red-brown sandy silt with abundant gravel and cobbles, boulder at 1.2 meters
* sample collected at 0.5 meter
* sample collected at 1 meter

MM10

0-0.1 m vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m red-brown sandy silt with abundant gravel and cobbles, boulder at 1.5 meters
* sample collected at 0.5 meter
* sample collected at 1 meter

MM11

0-0.1 m vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m red-brown sandy silt with abundant gravel and cobbles, boulder at 1 meter
* sample collected at 0.5 meter
* sample collected at 1 meter

MM12

0-0.1 m vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m red-brown sandy silt with abundant gravel and cobbles, boulder at 1 meter

MM13

0-0.1 m vegetated top soil
0.1-0.5 m red-brown silt with some sand, abundant gravel and cobbles
* sample collected at 0.1-0.5 meter
0.5-1.4 m brown sandy silt with pockets of charred wood
* sample collected at 0.5-1.4 meter
1.4-3 m stiff grey sandy silt to silt with non-distinct brown mottles
* sample collected at 1.4-3 meter

MM14

0-0.1 m vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m red-brown to brown silt to sandy silt with abundant gravel and cobbles, some pockets of charred wood
* sample collected at 0.5 meter
* sample collected at 1 meter

MM15

0-0.1 m vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m red-brown to brown silt to sandy silt with abundant gravel and cobbles, some pockets of charred wood
* sample collected at 0.5 meter
* sample collected at 1 meter

MM16

0-0.1 m vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m red-brown to brown silt to sandy silt with abundant gravel and cobbles, some pockets of charred wood
* sample collected at 0.5 meter
* sample collected at 1 meter

MM17

0-0.1 m vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m red-brown to brown silt to sandy silt with abundant gravel and cobbles, some pockets of charred wood
* sample collected at 0.5 meter
* sample collected at 1 meter

MM18

0-0.1 m   vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m   red-brown to brown silt to sandy silt with abundant gravel and cobbles, some pockets of charred wood
* sample collected at 0.5 meter
* sample collected at 1 meter

MM19

0-0.1 m   vegetated top soil
* sample collected at 0-0.1 meter
0.1-1 m   red-brown to brown silt to sandy silt with abundant gravel and cobbles, some pockets of charred wood
* sample collected at 0.5 meter
* sample collected at 1 meter

MM20

0-0.25 m   crushed rock and silt fill
* sample collected at 0-0.1 meter
0.25-1 m   red-brown silt to sandy silt with abundant gravel and cobbles, frequent inclusions of charred wood
* sample collected at 0.5 meter
* sample collected at 1 meter

MM21

0-0.15 m   crushed rock fill
* sample collected at 0-0.1 meter
0.15-1m   red-brown silt to sandy silt with abundant gravel and cobbles, frequent inclusions of charred wood, trace ash
* sample collected at 0.5 meter
* sample collected at 1 meter

MM22

0-0.15 m   crushed rock fill
* sample collected at 0-0.1 meter
0.15-1m   red-brown silt to sandy silt with abundant gravel and cobbles, frequent inclusions of charred wood, trace ash
* sample collected at 0.5 meter
* sample collected at 1 mete

MM23

0-0.8 m crushed rock, silt, and sand fill with frequent inclusions of charred wood
* sample collected at 0-0.1 meter
0.8-1 m crushed rock fill and wood debris
* sample collected at 0.5 meter
* sample collected at 1 meter

MM24

0-0.3 m crushed rock fill
* sample collected at 0-0.1 meter
0.3-1 m red-brown silt to sandy silt with abundant gravel and cobbles
* sample collected at 0.5 meter
* sample collected at 1 meter

MM25

0-0.3 m crushed rock fill
* sample collected at 0-0.1 meter
0.3-1 m red-brown silt to sandy silt with abundant gravel and cobbles
* sample collected at 0.5 meter
* sample collected at 1 meter

MM26

0-0.3 m crushed rock fill
* sample collected at 0-0.1 meter
0.3-0.8 m red-brown silt to sandy silt with abundant gravel, cobbles and wood debris, some charred wood; fill material
* sample collected at 0.5 meter
0.8-1 m grey-brown sandy silt and clay with abundant gravel and cobbles
* sample collected at 1 meter

MM27

0-0.2 m crushed rock fill
* sample collected at 0-0.1 meter
0.2-0.6 m red-brown sandy silt and clay with abundant gravel, cobbles and charred wood
* sample collected at 0.5 meter
0.6-1 m light brown silty sand with abundant gravel and cobbles, trace charred wood
* sample collected at 1 meter

MM28

0-0.2 m crushed rock fill

* sample collected at 0-0.1 meter

0.2-0.6 m red-brown sandy silt and clay with abundant gravel, cobbles and charred wood

* sample collected at 0.5 meter

0.6-1 m light brown silty sand with abundant gravel and cobbles, some pockets of ash, trace charred wood

* sample collected at 1 meter

MCLEAN MILL TEST PIT LOGS

Sixteen shallow test pits were excavated at the McLean Mill National Historic Site on March 15, 16, 17, 1994. Standpipes were placed in three of the test pits to obtain groundwater level measurements and groundwater samples. Test pits were located as shown in Figure 4.

T1

surface grass
0-0.1 m topsoil w/ charred wood
0.1-0.5 m red-brown sandy silt
*0.2 m sample
0.5-2.0 m compact brown sandy silt w/ gravel, till
*0.6 m sample
2.0 m hardpan EOH

T1a

surface grass
0-1.0 m red-brown sandy silt w/ charred/rotting wood, roots, twigs (FILL)
*0-0.5 m sample
1-1.3 m compact brown sandy silt, till - water seeping into hole at 1.2 m
1.3 m hardpan EOH

T2

0-0.4 m black wood ash
*0-0.1 m sample
0.4-1.0 m red-brown sandy silty to silt
*0.5 m sample
1-1.3 m compact brown sandy silt, till
*1.3 m sample
1.3 m EOH

T3

surface grass
0-0.4 m black ash - watermain at 0.3 m
*0.2-0.3 m sample
0.4-0.9 m red-brown sandy silt
*0.4 m sample
0.9-1.0 m brown sandy silt, till
*1.0 m sample
1.0 m hardpan EOH

T4

0-0.1 m topsoil and grass
*0 m sample
0.1-0.3 m wet sand and gravel
*0.15 m sample
0.3-1.0 m red-brown sandy silt
*0.4 m sample
*1.0 m sample
1.0 m hardpan EOH

T5

0-0.1 m grass and topsoil
*0-0.1 m sample
0.1-0.5 m red-brown sandy silt
*0.4-0.5 m sample
0.5-0.6 m black silt
*0.5-0.6 m sample
0.6-1.1 m brown silt w/ gravel till - water seeping into hole at 0.8 m
*1.0 m sample
1.1 m hardpan EOH

T6

0-0.1 m topsoil and grass
*0-0.1 m sample
0.1-0.3 m wet sand and gravel
*0.4 m sample
0.3-1.0 m red sandy silty clay
*0.9 m sample
1.0 m hardpan EOH

T7

0-0.1 m sand and gravel
*0-0.1 m sample
0.1-0.7 m red-brown sandy silt - black silt seam at 0.3 m
*0.4 m sample
0.7-1.0 m wet soft light brown clay
*0.8 m sample
1.0-1.2 m brown silt, till
1.2 m hardpan EOH

T8

0-0.05 m topsoil
*0-0.05 m sample
0.05-0.5m wet sand and gravel
*0.05-0.1 m sample
*0.3 m sample
0.5-0.7 m black organic silt
*0.5 m sample
0.7-1.0 m wet sand and gravel
1.0-1.6 m brown sandy silty till
*1.6 m sample
1.6 m EOH
@ 1.2 m -standpipe 3' screen 2' blank

T9

0-0.1 m topsoil
*0-0.1 m sample
0.1-1.0 m sand and gravel
*0.3 m sample
*0.8 m sample
1.0 m EOH

T10

0-0.1 m sandy gravel
*0-0.1 m sample
0.1-0.4 m red-brown sandy silt
0.4-0.5 m black silt
*0.4-0.5 m sample
0.5-1.0 m red silty sandy clay
*0.6-0.7 m sample
1.0-2.4 m silty sand till
*2.4 m sample
2.4 m EOH

T11

0-0.1 m brown sand and gravel
*0-0.1 m sample
0.1-0.2 m compact grey sandy gravel
*0.1-0.2 m sample
0.2-0.4 m red-brown/black mottled silty sandy clay w/ gravel

*0.4 m sample
0.4-1.0 m brown black silty clay - moderate fuel odour
*0.5 m sample
1.0-1.4 m grey silty sand w/ gravel - moderate to strong fuel odour
*1.3 m sample
1.4-2.0 m grey silty sand w/ gravel - sight to moderate fuel odour
*1.5 m sample
2.0-2.1 m brown wet silty gravel -trace fuel odour
*2.1 m sample
2.1 m EOH
@ 2.1 m - standpipe 5' screen, 2' blank

T12

0-0.2 m red sandy silt
*0-0.1 m sample
0.2-1.3 m brown-black silt to silty clay
*0.5 m sample
1.3-1.5 m light brown silty sand
*1.5 m sample
1.5 m EOH

T13

surface topsoil, grass
0.1-0.7 m red-brown sandy silt
0.7-0.9 m very hard packed till w/ boulders
0.9 m EOH

T14

0-0.1 m sand and gravel - some soil staining
*0-0.1 m sample
0.1-0.8 m red-brown silty sand w/ gravel
*0.3 m sample
0.8-0.9 m compact grey-brown sandy silt, till w/ boulders
*0.9 m sample
0.9 m EOH

T15

0-0.3 m sand and gravel
*0-0.1 m sample
0.7-1.0 m brown silty till
*0.7 m sample
1.0-1.2 m grey silty clay w/ gravel, till - slight fuel odour
*1.2 m sample
1.2 m EOH

T16

0-0.2 m compact sandy gravel
*0-0.1 m sample
0.2-0.4 m red-brown silt to sandy silt
*0.3 m sample
0.4-1.5 m brown sandy silty clay, till
*0.4 m sample
*1.5 m sample
1.5 m EOH
@ 1.5 m -standpipe 4' screen, 2' blank

APPENDIX III

Borehole Logs

Envirochem

BOREHOLE LOG

Borehole Name: MM-1	Borehole 1 of 8
Project No.: 3790	Project: McLean Mill
Page 1 of 1	

Location: Port Alberni, B.C.	Borehole Diam.: 22 cm	Date: 15 MARCH 1994
Drilling Method: Hollow Stem Auger	Casing Diam.: – cm	Elev. Casing (m ASL): –
Screened Interval: None		Elev. Manhole (m ASL): –
		Logged By: EG

Depth ft m	Sample	Stratigraphy	Piezometer Installation	Depth ft m
		CRUSHED ROCK FILL	NO MONITORING WELL INSTALLED	
	0–2 ft	TILL: Compacted, brown silt with abundant gravels & cobbles		
	2–4 ft			
	4–6 ft			
		End of Hole at 1.8 m		

LEGEND

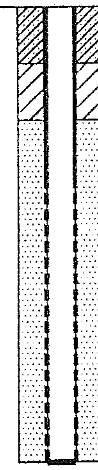
Sampled Core; Solid PVC Pipe 50 mm ø; Slotted PVC Pipe 50 mm ø; Bentonite Seal; Silica Sand; Cement; Elevation of Water Table

Envirochem	BOREHOLE LOG	Borehole Name: MM-2
		Borehole 2 of 8
Project No.: 3790	Project: McLean Mill	Page 1 of 1

Location: Port Alberni, B.C.
Drilling Method: Hollow Stem Auger
Screened Interval: 0.91 – 2.4 m
Borehole Diam.: 22 cm
Casing Diam.: 5.1 cm
Date: 15 MARCH 1994
Elev. Casing (m ASL): 39.0
Elev. ~~Manhole~~ ground level (m ASL): 38.42
Logged By: EG

Sample	Stratigraphy
	CRUSHED ROCK FILL
0–2 ft	SILT, brown oxidized with abundant gravel, some sand.
2–4 ft	WOOD WASTE, some silt and gravel
4–6 ft	SILT, stiff, grey, non distinct brown mottles grading to strongly mottled grey-brown silt
6–8 ft 8–10 ft	TILL, compact grey-brown silt with abundant gravels and cobbles, some sand
	End of Hole at 3.05 m

Piezometer Installation



Depth ft m

LEGEND

1–2 Sampled Core; Solid PVC Pipe 50 mm ø; Slotted PVC Pipe 50 mm ø; Bentonite Seal; Silica Sand; Cement; Elevation of Water Table

Envirochem — BOREHOLE LOG

Borehole Name: MM-3	Borehole 3 of 8
Project No.: 3790 — Project: McLean Mill	Page 1 of 1

Location: Port Alberni, B.C.
Borehole Diam.: 22 cm
Drilling Method: Hollow Stem Auger
Casing Diam.: – cm
Screened Interval: None

Date: 15 MARCH 1994
Elev. Casing (m ASL): –
Elev. Manhole (m ASL): –
Logged By: EG

Depth	Sample	Stratigraphy	Piezometer Installation
		SILT LOAM, brown, vegetated topsoil	NO MONITORING WELL INSTALLED
	0–2 ft	SILT, red-brown, oxidized ~~silt~~ with some organic layers	
	2–4 ft 4–6 ft	TILL, compacted light brown–brown silt with abundant gravels and cobbles, some sand	
		~~End of~~ Hole at 1.7 m Rock	

Depth scale: ft 0–25; m 0–7.

LEGEND
Sampled Core — Solid PVC Pipe 50 mm ø — Slotted PVC Pipe 50 mm ø — Bentonite Seal — Silica Sand — Cement — Elevation of Water Table

Envirochem

BOREHOLE LOG

Borehole Name:	MM-4
Borehole 4 of 8	
Page 1 of 1	

Project No.: 3790 | Project: McLean Mill

Location: Port Alberni, B.C.
Borehole Diam.: 22 cm
Drilling Method: Hollow Stem Auger
Casing Diam.: - cm
Screened Interval: None

Date: 15 MARCH 1994
Elev. Casing (m ASL): -
Elev. Manhole (m ASL): -
Logged By: EG

Depth ft / m	Sample	Stratigraphy	Piezometer Installation
0–0.1 m		CRUSHED ROCK FILL, vegetated	NO MONITORING WELL INSTALLED
to ~1.2 m	0-2 ft; 2-4 ft	SILT, red-brown to brown, sandy, with some gravel; perched water at approximately 0.9 m	
to 1.7 m	4-6 ft	TILL, compacted gravelly, brown, sandy silt	
		End of Hole at 1.7 m	

Depth scale: ft 5, 10, 15, 20, 25; m 1, 2, 3, 4, 5, 6, 7

LEGEND
Sampled Core | Solid PVC Pipe 50 mm ø | Slotted PVC Pipe 50 mm ø | Bentonite Seal | Silica Sand | Cement | Elevation of Water Table

Envirochem BOREHOLE LOG

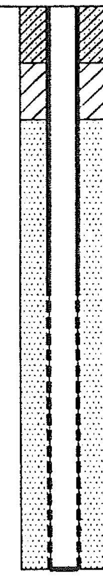
Borehole Name: MM-5	Borehole 5 of 8
Project No.: 3790	Project: McLean Mill
	Page 1 of 1

Location: Port Alberni, B.C.
Borehole Diam.: 22 cm
Drilling Method: Hollow Stem Auger
Casing Diam.: 5.1 cm
Screened Interval: 1.5 – 3.1 m

Date: 16 MARCH 1994
Elev. Casing (m ASL): ~~12~~ 38.0
Elev. ~~Manhole~~ ground level (m ASL): 38.08
Logged By: EG

Depth (m)	Sample	Stratigraphy
0 – 0.6	0–2 ft	SILT, hard, brown, with abundant gravel
0.6 – 3.1	2–4 ft; 8–10 ft	TILL, compacted grey brown silt with abundant gravel and cobbles; some sand
3.1		End of Hole at 3.1 m

Piezometer Installation



Depth: ft 5, 10, 15, 20, 25; m 1, 2, 3, 4, 5, 6, 7

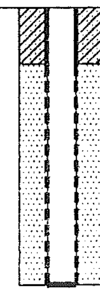
LEGEND

1–2 Sampled Core; Solid PVC Pipe 50 mm ø; Slotted PVC Pipe 50 mm ø; Bentonite Seal; Silica Sand; Cement; Elevation of Water Table

Envirochem	BOREHOLE LOG	Borehole Name: MM-6
		Borehole 6 of 8
Project No.: 3790	Project: McLean Mill	Page 1 of 1

Location: Port Alberni, B.C.
Borehole Diam.: 22 cm
Drilling Method: Hollow Stem Auger
Casing Diam.: 5.1 cm
Screened Interval: 0.3 – 1.5 m

Date: 16 MARCH 1994
Elev. Casing (m ASL): 33.67
Elev. ~~Manhole~~ (m ASL): 33.76
Logged By: EG ground

Depth (ft / m)	Sample	Stratigraphy	Piezometer Installation
0 – 1 m	0–2 ft 2–4 ft	CRUSHED ROCK FILL, partly decomposed wood waste, cobbles and boulders; perched water at 0.3–1 m	
5 ft	4–6 ft	SILT, grey-green, with strong brown mottles, abundant gravel and broken rock	
2 m	6–8 ft	TILL, compacted brown silt with abundant gravels and cobbles	
		End of Hole at 2.4 m	

Depth scale: ft 5, 10, 15, 20, 25; m 1, 2, 3, 4, 5, 6, 7

LEGEND
1–2 Sampled Core | Solid PVC Pipe 50 mm ø | Slotted PVC Pipe 50 mm ø | Bentonite Seal | Silica Sand | Cement | Elevation of Water Table

Envirochem

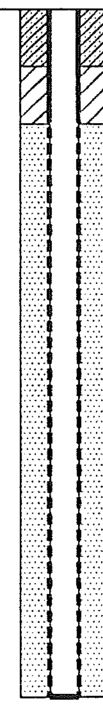
BOREHOLE LOG

Borehole Name: MM-7	Borehole 7 of 8	Page 1 of 1
Project No.: 3790	Project: McLean Mill	

Location: Port Alberni, B.C. Borehole Diam.: 22 cm
Drilling Method: Hollow Stem Auger Casing Diam.: 5.1 cm
Screened Interval: 0.61 – 3.66 m

Date: 16 MARCH 1994
Elev. Casing (m ASL): 33.12
Elev. Manhole (m ASL): 33.17
Logged By: EG

Depth ft m	Sample	Stratigraphy	Piezometer Installation	Depth ft m
		TOPSOIL, black organic silt, vegetated		
	0–2 ft	SILT LOAM, oxidized, red-brown with some gravel		
1 m	2–4 ft			1 m
5 ft	4–6 ft			5 ft
2 m		TILL, compacted red-brown to brown sandy gravelly silt		2 m
10 ft / 3 m				10 ft / 3 m
		End of Hole at 3.66 m		
4 m				4 m
15 ft / 5 m				15 ft / 5 m
20 ft / 6 m				20 ft / 6 m
7 m				7 m
25 ft				25 ft



LEGEND
1–2 Sampled Core; Solid PVC Pipe 50 mm ø; Slotted PVC Pipe 50 mm ø; Bentonite Seal; Silica Sand; Cement; Elevation of Water Table

Envirochem

BOREHOLE LOG

Borehole Name: MM-8

Borehole 8 of 8

Project No.: 3790 | Project: McLean Mill

Page 1 of 1

Location: Port Alberni, B.C.
Drilling Method: Hollow Stem Auger
Screened Interval: None

Borehole Diam.: 22 cm
Casing Diam.: – cm

Date: 16 MARCH 1994
Elev. Casing (m ASL): –
Elev. Manhole (m ASL): –
Logged By: EG

Depth ft m	Sample	Stratigraphy	Piezometer Installation	Depth ft m
		CRUSHED ROCK FILL, perched water table	NO MONITORING WELL INSTALLED	
	0–2 ft	TILL, compacted brown silt with abundant gravel and some sand		
1	2–4 ft			1
5	4–6 ft			5
2		End of Hole at 1.8 m		2
10 / 3				10 / 3
4				4
15 / 5				15 / 5
20 / 6				20 / 6
7				7
25				25

LEGEND
Sampled Core; Solid PVC Pipe 50 mm ø; Slotted PVC Pipe 50 mm ø; Bentonite Seal; Silica Sand; Cement; Elevation of Water Table

APPENDIX IV

Laboratory Reports

QA/QC Data

RECEIVED APR 19 1994

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1

Tel:(604)438-522
Fax:(604)436-056

ANALYSIS OF ENVIRONMENTAL SAMPLES

To: ENVIROCHEM SPECIAL PROJECTS INC.
310 East Esplanade
North Vancouver, B.C. *
V7L 1A4

Workorder: 22935
Received : 28-Mar-9
Completed: 14-Apr-9

Attn: Eva Gerencher

Re: Proj # 3790 - PO# 70904

METHODOLOGY

The soil samples were dried at 55 degrees Celsius and pulverized to pass a 100 mesh screen in a non-contaminating agate grinder. A sub-sample was acid digested in a closed vessel in a microwave oven (modified EPA Method 3051) and metals were determined on the resulting solution by ICP-AES with ultrasonic nebulization except where noted below.

Certified Reference Material BCR 142 (Light Sandy Soil) was digested and analysed concurrently to monitor the accuracy of the analysis.

Mercury was determined by cold-vapour atomic absorption.

Antimony, Arsenic, Bismuth and Selenium were determined by both ICP-AES with ultrasonic nebulization and ICP-AES with hydride generation. The values reported below are taken from the hydride generation determination because of its greater sensitivity. The results from the regular ICP scan were used for confirmation of high values.

Results are reported as micrograms of element per gram of dry sample (ppm).

Limits listed below refer to the B.C. Ministry of the Environment "Criteria for Managing Contaminated Sites in British Columbia." (1989) and are provided for information only.

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Tel:(604)438-5226
Fax:(604)436-0565

To: ENVIROCHEM SPECIAL PROJECTS INC.

W/O: 22935 Pag 1

Sample type	soil	soil	soil	soil	soil
Identification	T-1 0.2M	T-2 0-0.1M	T-2 0.5M	T-7 0-0.1M	T-7 0-0.1M
Lab Reference #	22935-001	22935-002	22935-003	22935-004A	22935-00 B
ICP - ULTRASONIC NEBULIZATION					
Method used	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwav RAR solub e
Amount analysed	0.499 g	0.517 g	0.503 g	0.500 g	0.501 g
LEVEL A LIMITS - RESIDENTIAL					
Arsenic 5 As	26.	11.	6.4	6.7	6.8
Barium 200 Ba	71.5	11.8	151.	62.0	66.1
Cadmium 1 Cd	1.0	0.1	0.1	0.7	0.6
Chromium 20 Cr	91.0	1.0	183.	49.3	44.9
Cobalt 15 Co	30.7	0.5	58.	18.9	17.5
Copper 30 Cu	141.	2.8	259.	84.5	86.7
Lead 50 Pb	8.	4.	24.	11.	9.
Mercury 0.1 Hg	0.2	< 0.05	< 0.05	0.2	0.2
Molybdenum 4 Mo	< 1.	< 1.	< 1.	< 1.	< 1.
Nickel 20 Ni	52.3	0.97	119.	48.7	29.3
Selenium 2 Se	0.3	1.3	0.3	< 0.1	< 0.1
Silver 2 Ag	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Tin 5 Sn	< 1.	< 1.	< 1.	< 1.	< 1.
Zinc 80 Zn	70.1	14.8	165.	51.3	48.8
Results in	ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g
OTHER ELEMENTS					
Aluminum Al	57200	327.	93800	50800	46500
Antimony Sb	1.6	3.2	0.5	0.5	0.5
Beryllium Be	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bismuth Bi	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Calcium Ca	12900	1170	14000	22500	19900
Iron Fe	94300	530	940	75200	69500
Lithium Li	11.8	0.5	< 0.5	25.4	27.6
Magnesium Mg	20100	118.	22600	20300	17600
Manganese Mn	1390	69.3	1310	1360	1250
Phosphorus P	274.	132.	820	487.	474.
Potassium K	1400	70	2800	770	810
Silicon Si	940.	< 5.	670	537.	519.
Sodium Na	301.	6.	360	461.	453.
Strontium Sr	24.	7.	50	36.	34.
Sulfur S	40	20	< 10.	110	100
Thorium Th	< 1.	2.	60	< 1.	< 1.
Titanium Ti	4860	16.6	7080	5150	4660
Uranium U	< 5.	< 5.	< 5.	< 5.	< 5.
Vanadium V	270	1.	370	230	210
Zirconium Zr	25.5	0.8	53.	17.9	16.7
Results in	ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry

/2...

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Tel:(604)438-522[illegible]
Fax:(604)436-056[illegible]

To: ENVIROCHEM SPECIAL PROJECTS INC.

Sample type			soil	soil	soil	soil	soil
Identification			T-10	T-11	T-14	T-14	GPIT-1
			0-0.1M	0-0.1M	0-0.1M	0.3M	0M
Lab Reference #			22935-005	22935-006	22935-007	22935-008	22935-009
ICP - ULTRASONIC NEBULIZATION							
Method used			microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble
Amount analysed			0.506 g	0.501 g	0.493 g	0.495 g	0.518 g
LEVEL A LIMITS - RESIDENTIAL							
Arsenic	5	As	8.1	6.8	4.8	3.3	3.3
Barium	200	Ba	97.1	40.5	40.8	47.0	218.
Cadmium	1	Cd	1.0	0.6	0.8	0.9	1.6
Chromium	20	Cr	228.	48.3	73.1	62.0	61.1
Cobalt	15	Co	26.4	9.7	27.8	21.3	7.8
Copper	30	Cu	199.	79.7	135.	110.	556.
Lead	50	Pb	12.	58.	9.	34.	8270
Mercury	0.1	Hg	0.3	0.4	0.2	0.1	< 0.07
Molybdenum	4	Mo	< 1.	< 1.	< 1.	< 1.	31.
Nickel	20	Ni	56.6	24.0	48.2	38.0	23.5
Selenium	2	Se	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Silver	2	Ag	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Tin	5	Sn	< 1.	< 1.	< 1.	< 1.	< 0.1
Zinc	80	Zn	78.1	66.6	82.4	72.6	764.
Results in			ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g
OTHER ELEMENTS							
Aluminum		Al	67400	55100	72900	56500	10800
Antimony		Sb	1.6	2.9	0.3	0.6	3.0
Beryllium		Be	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bismuth		Bi	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Calcium		Ca	27600	18000	16200	18500	4520
Iron		Fe	88500	80300	109000	90300	31100
Lithium		Li	16.1	7.8	8.3	7.4	4.3
Magnesium		Mg	37300	24600	23300	25200	4670
Manganese		Mn	1560	381.	1750	1590	249.
Phosphorus		P	313.	205.	703.	572.	937.
Potassium		K	2220	640	830	740	590
Silicon		Si	209.	162.	512.	351.	296.
Sodium		Na	579.	194.	296.	306.	137.
Strontium		Sr	53.	6.	17.	16.	11.
Sulfur		S	210	110	90	150	2940
Thorium		Th	< 1.	< 1.	< 1.	< 1.	< 1.
Titanium		Ti	5550	4450	7090	6490	1000
Uranium		U	< 5.	< 5.	< 5.	< 5.	< 5.
Vanadium		V	250	67.	320	270	49.
Zirconium		Zr	8.9	3.9	32.2	21.9	4.7
Results in			ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g

/3...

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Tel:(604)438-5226
Fax:(604)436-0565

To: ENVIROCHEM SPECIAL PROJECTS INC.

Sample type		soil	soil	soil	soil	soil
Identification		BLK-1	GAR-4	GAR-3	GAR-1	BLK-2
		0.2M	0M	0M	0M	0-0.2M
Lab Reference #		22935-010	22935-011	22935-012	22935-013	22935-01
ICP - ULTRASONIC NEBULIZATION						
Method used		microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwav RAR solub e
Amount analysed		0.510 g	0.507 g	0.504 g	0.497 g	0.506 g
LEVEL A LIMITS - RESIDENTIAL						
Arsenic 5	As	6.5	4.8	5.5	6.3	7.5
Barium 200	Ba	656.	77.9	49.8	198.	705.
Cadmium 1	Cd	1.4	1.5	1.3	1.5	1.4
Chromium 20	Cr	32.8	82.0	70.0	66.3	48.5
Cobalt 15	Co	8.2	20.2	18.2	19.3	13.5
Copper 30	Cu	155.	121.	109.	135.	163.
Lead 50	Pb	483.	860	112.	1010	204.
Mercury 0.1	Hg	0.1	0.1	0.2	0.1	< 0.05
Molybdenum 4	Mo	< 1.	< 1.	< 1.	< 1.	< 1.
Nickel 20	Ni	30.0	43.2	37.7	38.0	37.6
Selenium 2	Se	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Silver 2	Ag	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Tin 5	Sn	< 1.	< 1.	< 1.	< 1.	17.
Zinc 80	Zn	687.	158.	122.	121.	405.
Results in		ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry
OTHER ELEMENTS						
Aluminum	Al	17000	38300	47700	43900	28500
Antimony	Sb	54.	40.	2.	1.	42.
Beryllium	Be	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bismuth	Bi	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Calcium	Ca	60400	20800	18400	13200	72700
Iron	Fe	55000	63400	73800	79000	67300
Lithium	Li	8.0	9.0	8.9	8.5	7.1
Magnesium	Mg	6290	20500	22500	16100	10100
Manganese	Mn	3420	951.	986.	1110	3390
Phosphorus	P	4540	415.	321.	575.	3720
Potassium	K	8700	1160	1120	1100	10300
Silicon	Si	291.	584.	332.	229.	168.
Sodium	Na	1440	1840	355.	293.	1600
Strontium	Sr	246.	35.	23.	19.	254.
Sulfur	S	620	760	340	360	420
Thorium	Th	< 1.	< 1.	< 1.	< 1.	< 1.
Titanium	Ti	843.	3730	4070	4390	2310
Uranium	U	< 5.	< 5.	< 5.	< 5.	< 5.
Vanadium	V	38.	180	200	200	76.
Zirconium	Zr	5.2	12.8	10.2	14.5	6.2
Results in		ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry

/4...

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Tel:(604)438-522[illegible]
Fax:(604)436-056[illegible]

To: ENVIROCHEM SPECIAL PROJECTS INC.

Sample type		soil	soil	soil	soil	soil
Identification		BLK-4	BLK-6	BLK-9	BLK-9	MILLIA
		0-0.1M	0-0.1M	0-0.2M	0-0.2M	0-0.1M
Lab Reference #		22935-015	22935-016	22935-017A	22935-017B	22935-018
ICP - ULTRASONIC NEBULIZATION						
Method used		microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble
Amount analysed		0.495 g	0.508 g	0.498 g	0.501 g	0.512 g
LEVEL A LIMITS - RESIDENTIAL						
Arsenic 5	As	8.0	17.5	8.3	7.7	58.
Barium 200	Ba	176.	1220	382.	361.	65.8
Cadmium 1	Cd	1.0	0.9	2.6	2.5	0.9
Chromium 20	Cr	15.1	30.4	16.9	17.1	63.0
Cobalt 15	Co	4.3	8.4	4.9	5.2	17.9
Copper 30	Cu	71.6	198.	67.2	75.5	83.3
Lead 50	Pb	390.	2290	140.	150.	16.
Mercury 0.1	Hg	0.1	< 0.05	< 0.05	< 0.05	0.2
Molybdenum 4	Mo	< 1.	< 1.	< 1.	< 1.	< 1.
Nickel 20	Ni	10.7	26.1	16.7	18.3	34.3
Selenium 2	Se	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Silver 2	Ag	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Tin 5	Sn	< 1.	< 1.	< 1.	< 1.	< 1.
Zinc 80	Zn	1290	908.	1610	1500	197.
Results in		ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g
OTHER ELEMENTS						
Aluminum	Al	9730	27700	8820	8620	42900
Antimony	Sb	49.	260	13.	16.	4.
Beryllium	Be	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bismuth	Bi	< 5.	< 5.	< 5.	< 5.	< 5.
Calcium	Ca	92900	71000	44500	41600	10100
Iron	Fe	24300	53900	30900	32500	64500
Lithium	Li	2.0	4.6	2.0	2.1	9.1
Magnesium	Mg	2020	10600	2740	2700	10800
Manganese	Mn	1060	5260	2080	1990	946.
Phosphorus	P	629.	4550	2350	2370	394.
Potassium	K	1110	8000	3470	3630	1060
Silicon	Si	290.	511.	514.	501.	85.
Sodium	Na	166.	1020	427.	438.	185.
Strontium	Sr	83.	215.	153.	151.	23.
Sulfur	S	690	490	910	870	170
Thorium	Th	< 1.	< 1.	< 1.	< 1.	< 1.
Titanium	Ti	620.	1750	476.	483.	2750
Uranium	U	< 5.	< 5.	< 5.	< 5.	< 5.
Vanadium	V	23.	40.	21.	22.	180
Zirconium	Zr	0.6	1.1	0.5	0.7	16.0
Results in		ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Tel:(604)438-5226
Fax:(604)436-0565

To: ENVIROCHEM SPECIAL PROJECTS INC.

Sample type	soil	soil	soil	soil	soil
Identification	MM-6 0-0.61M	MM-7 0-0.61M	MM9 0-0.1M	MM10 0-0.1M	MM10 0-0.1M
Lab Reference #	22935-019	22935-020	22935-021	22935-022A	22935-022B
ICP - ULTRASONIC NEBULIZATION					
Method used	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble
Amount analysed	0.499 g	0.500 g	0.499 g	0.513 g	0.503 g
LEVEL A LIMITS - RESIDENTIAL					
Arsenic 5 As	9.2	15.2	27.2	23.2	24.2
Barium 200 Ba	35.2	168.	77.0	47.4	44.3
Cadmium 1 Cd	0.9	0.7	1.1	0.98	0.8
Chromium 20 Cr	187.	54.9	97.4	83.7	77.8
Cobalt 15 Co	25.2	18.5	30.8	26.2	24.3
Copper 30 Cu	116.	104.	129.	103.	98.6
Lead 50 Pb	10.	53.	9.	12.	9.
Mercury 0.1 Hg	0.2	< 0.05	0.2	0.1	0.1
Molybdenum 4 Mo	< 1.	< 1.	< 1.	< 1.	< 1.
Nickel 20 Ni	56.0	35.4	55.6	49.3	46.4
Selenium 2 Se	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Silver 2 Ag	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Tin 5 Sn	< 1.	< 1.	< 1.	< 1.	< 1.
Zinc 80 Zn	84.0	129.	68.0	77.8	72.3
Results in	ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g
OTHER ELEMENTS					
Aluminum Al	45000	50700	58600	63700	59100
Antimony Sb	1.0	8.6	1.1	1.0	3.
Beryllium Be	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bismuth Bi	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Calcium Ca	21200	12100	12200	9260	8980
Iron Fe	64800	74100	96600	96000	89600
Lithium Li	10.0	7.7	10.7	11.2	10.2
Magnesium Mg	29300	12700	21600	18600	17200
Manganese Mn	894.	1080	1400	977.	889.
Phosphorus P	443.	453.	153.	291.	253.
Potassium K	870	790	1260	760	710
Silicon Si	440.	102.	526.	278.	261.
Sodium Na	604.	163.	289.	193.	186.
Strontium Sr	27.	23.	22.	13.	13.
Sulfur S	130	280	40	70	70
Thorium Th	< 1.	< 1.	< 1.	< 1.	< 1.
Titanium Ti	4720	4780	5010	5590	5260
Uranium U	< 5.	< 5.	< 5.	< 5.	< 5.
Vanadium V	190	220	270	280	260
Zirconium Zr	12.6	14.1	31.3	24.0	21.7
Results in	ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry

/6...

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1

Tel:(604)438-522
Fax:(604)436-0565

To: ENVIROCHEM SPECIAL PROJECTS INC.

W/O: 22935

Sample type	soil	soil	soil	QC/QC	QC/QC
Identification	MM11 0-0.1M	MM12 0-0.1M	REF S0575	BCR Light Sandy Soil	BCR Light Sandy Soil
Fraction				TOTAL	ACID SOL
Lab Reference #	22935-023	22935-024	22935-025	22935-025A	22935-025B
ICP - ULTRASONIC NEBULIZATION					
Method used	microwave RAR soluble	microwave RAR soluble	microwave RAR soluble	MEAN VALUE	MEAN VALUE
Amount analysed	0.513 g	0.499 g	0.504 g	0.500 g	1.00 g
LEVEL A LIMITS - RESIDENTIAL					
Arsenic 5 As	9.1	9.7	10.1	-	-
Barium 200 Ba	79.3	231.	161.	-	-
Cadmium 1 Cd	1.1	3.4	0.3	0.250	0.220
Chromium 20 Cr	75.2	69.4	45.6	74.9	44.4
Cobalt 15 Co	27.0	26.0	7.2	7.90	-
Copper 30 Cu	98.2	104.	26.7	27.5	25.3
Lead 50 Pb	21.	213.	29.	37.8	30.9
Mercury 0.1 Hg	< 0.05	< 0.05	0.1	0.104	0.104
Molybdenum 4 Mo	< 1.	< 1.	< 1.	-	-
Nickel 20 Ni	47.1	44.0	29.3	29.2	28.9
Selenium 2 Se	< 0.1	< 0.1	0.6	0.530	-
Silver 2 Ag	< 0.5	< 0.5	< 0.5	-	-
Tin 5 Sn	< 1.	< 1.	< 1.	-	-
Zinc 80 Zn	103.	744.	79.8	92.4	79.6
Results in	ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g
OTHER ELEMENTS					
Aluminum Al	62400	39600	18300	50100	-
Antimony Sb	1.	8.8	1.2	-	-
Beryllium Be	< 0.10	< 0.1	0.9	-	-
Bismuth Bi	< 5.	< 5.	< 5.	-	-
Calcium Ca	16200	14600	31900	35300	-
Iron Fe	99700	67900	17400	19600	-
Lithium Li	9.92	8.2	16.8	-	-
Magnesium Mg	18200	11000	5690	6570	-
Manganese Mn	2280	1560	499.	569	527.
Phosphorus P	530.	1090	848.	961	-
Potassium K	999.	1620	3950	20000	-
Silicon Si	291.	64.	481.	319000	-
Sodium Na	269.	325.	257.	7200	-
Strontium Sr	28.	72.	73.	-	-
Sulfur S	110	270	940	-	-
Thorium Th	< 1.0	11.	< 1.0	-	-
Titanium Ti	4610	3370	319.	3720	-
Uranium U	< 5.	72.	< 5.	-	-
Vanadium V	270	180	26.	-	-
Zirconium Zr	23.0	27.2	3.7	-	-
Results in	ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g

Analyst:

RECEIVED MAY 1994

Analysis Report

CANTEST

CanTest Ltd

Professional
Analytical
Services

1523 West 3rd
Vancouver. BC
V6J 1J8

Fax: 604 731 2[illegible]

Tel: 604 734 72[illegible]

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Envirochem Services
310 East Esplanade
North Vancouver, B.C.
V7L 1A4

Att'n: Ms. Linda Eastcott

PROJECT NUMBER: 3790
P.O. NUMBER: 70839

NUMBER OF SAMPLES: 10

REPORT DATE: May 18, 1994

DATE SUBMITTED: May 3, 1994

GROUP NUMBER: 4050316

SAMPLE TYPE: Soil

TEST METHODS:

Metals in Soil - Undried representative samples were digested with a mixture of nitric acid and hydrochloric acid ("Aqua Regia"). Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques asdescribed. Moisture was determined gravimetrically at 105 C on a separate sample portion.

Arsenic - Analysis by Zeeman background-corrected Graphite Furnace Atomic Absorption Spectrophotometry.

Cadmium - Analysis by background-corrected Flame Atomic Absorption Spectrophotometry.

Lead - Analysis by background-corrected flame Atomic Absorption Spectrophotometry.

Mercury - Analysis by Cold Vapour Atomic Absorption Spectrophotometry.

Selenium - Analysis by Zeeman background-corrected Graphite Furnace Atomic Absorption Spectrophotometry.

Special Waste Extraction Procedure - The samples were prepared in accordance with methodologies described in the Waste Management Act, Schedule 4, Part 1, Leachate Extraction Procedure, April 16, 1992. The metals were determined using Inductively Coupled Argon Plasma Atomic Emission Spectrometry (ICP/AES) or by specific technique described.

COMMENTS:

Due to insufficient sample mass being provided the weight of sample and volume of acetic acid for samples GPIT1 0m and GPIT3 0 - 0.2m had to be scaled. The actual sample weight and volume of acetic acid for sample GPIT1 0m was 32.58g and 1 mL and for sample GPIT3 0 - 0.2m was 60.57g and 141 mL respectively.

TEST RESULTS:

(See following pages)

CANTEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: Envirochem Services

REPORT DATE: May 18, 1994

GROUP NUMBER: 4050316

CANTEST

Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		GPIT 0.1-0.15m	GPIT2 0.1m	GPIT3 0-0.2 BLK3 0-0.2	GPIT5 0-0.2 BLK 5 0-0.2		
DATE SAMPLED:		May 3/94	May 3/94	May 3/94	May 3/94	B.C. M.O.E. CRITERIA	UNITS
CAN TEST ID:		405030075	405030079	405030080	405030083		
Moisture		17.0	11.2	42.0	43.7	-	%
B.C. M.O.E. Criteria							
Arsenic	As	3.41	11.1	18.2	4.82	5	ug/g
Barium	Ba	100	403	650	896	200	ug/g
Cadmium	Cd	0.27	1.47	0.72	< 0.25	1	ug/g
Chromium	Cr	107	40.0	42.0	22.0	20	ug/g
Cobalt	Co	28.2	13.9	11.1	7.1	15	ug/g
Copper	Cu	104	232	228	80.2	30	ug/g
Lead	Pb	90.5	565	1800	26.4	50	ug/g
Mercury	Hg	0.066	0.10	0.036	0.009	0.1	ug/g
Molybdenum	Mo	< 4	< 4	< 4	< 4	4	ug/g
Nickel	Ni	53.9	34.1	34.7	21.4	20	ug/g
Selenium	Se	< 0.5	< 0.5	< 0.5	< 0.5	2	ug/g
Silver	Ag	< 1.5	< 1.5	< 1.5	< 1.5	2	ug/g
Tin	Sn	5.1	2.9	540	10.0	5	ug/g
Zinc	Zn	139	231	1160	63.3	80	ug/g
Other Metals							
Aluminum	Al	44400	16900	18400	19000	-	ug/g
Antimony	Sb	< 8	< 8	169	< 8	-	ug/g
Beryllium	Be	< 1.5	< 1.5	< 1.5	< 1.5	-	ug/g
Boron	B	64.9	35.8	101	44.9	-	ug/g
Calcium	Ca	5500	3650	62300	70700	-	ug/g
Iron	Fe	69900	38100	53500	24200	-	ug/g
Magnesium	Mg	12700	10800	7020	5690	-	ug/g
Manganese	Mn	1620	626	3000	3250	-	ug/g
Phosphorus	PO4	1920	865	8840	11200	-	ug/g
Potassium	K	255	140	7170	13100	-	ug/g
Sodium	Na	147	113	1090	1650	-	ug/g
Strontium	Sr	11.7	9.5	343	393	-	ug/g
Titanium	Ti	1360	38.7	184	99.2	-	ug/g
Vanadium	V	151	7.3	57.7	42.1	-	ug/g

% = percent
< = Less than detection limit

ug/g = micrograms per gram, on a dry weight basis.

REPORTED TO: Envirochem Services

REPORT DATE: May 18, 1994

GROUP NUMBER: 4050316

CANTEST

Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		GPIT7 0.1-0.2 BLK 7	GPIT10 0-0.1 BLK 10	Mill 1B 0-0.1	Mill 1 0.2-0.3	B.C. M.O.E. CRITERIA	UNITS
DATE SAMPLED:		May 3/94	May 3/94	May 3/94	May 3/94		
CAN TEST ID:		405030084	405030085	405030086	405030087		
Moisture		73.6	50.1	23.5	25.1	-	%
B.C. M.O.E. Criteria							
Arsenic	As	3.39	6.77	3.89	10.8	5	ug/g
Barium	Ba	137	362	53.5	156	200	ug/g
Cadmium	Cd	0.75	0.89	< 0.25	0.42	1	ug/g
Chromium	Cr	10.6	50.0	31.0	103	20	ug/g
Cobalt	Co	3.3	15.6	6.4	24.1	15	ug/g
Copper	Cu	50.6	103	41.0	134	30	ug/g
Lead	Pb	293	232	21.3	84.0	50	ug/g
Mercury	Hg	0.056	0.052	0.065	0.19	0.1	ug/g
Molybdenum	Mo	< 4	< 4	< 4	< 4	4	ug/g
Nickel	Ni	12.1	39.5	15.8	49.2	20	ug/g
Selenium	Se	< 0.5	< 0.5	< 0.5	< 0.5	2	ug/g
Silver	Ag	< 1.5	< 1.5	< 1.5	< 1.5	2	ug/g
Tin	Sn	203	57.5	13.4	9.0	5	ug/g
Zinc	Zn	1700	616	443	603	80	ug/g
Other Metals							
Aluminum	Al	3990	21400	11300	37600	-	ug/g
Antimony	Sb	< 8	< 8	< 8	< 8	-	ug/g
Beryllium	Be	< 1.5	< 1.5	< 1.5	< 1.5	-	ug/g
Boron	B	33.6	68.3	20.2	58.4	-	ug/g
Calcium	Ca	22700	35900	5050	19600	-	ug/g
Iron	Fe	16100	55000	19500	65600	-	ug/g
Magnesium	Mg	1680	8840	3700	13600	-	ug/g
Manganese	Mn	756	1730	430	1280	-	ug/g
Phosphorus	PO4	4040	3910	1260	1980	-	ug/g
Potassium	K	1680	3830	563	1020	-	ug/g
Sodium	Na	251	740	160	252	-	ug/g
Strontium	Sr	101	194	17.8	43.3	-	ug/g
Titanium	Ti	288	406	204	828	-	ug/g
Vanadium	V	17.9	83.3	20.9	122	-	ug/g

% = percent

< = Less than detection limit

ug/g = micrograms per gram, on a dry weight basis.

REPORTED TO: Envirochem Services

REPORT DATE: May 18, 1994

GROUP NUMBER: 4050316

CANTEST

Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		**Mill 3 0-0.1**		
DATE SAMPLED:		May 3/94	B.C. M.O.E. CRITERIA	UNITS
CAN TEST ID:		405030088		
Moisture		8.12	-	%
B.C. M.O.E. Criteria				
Arsenic	As	10.6	5	ug/g
Barium	Ba	38.8	200	ug/g
Cadmium	Cd	< 0.25	1	ug/g
Chromium	Cr	40.8	20	ug/g
Cobalt	Co	10.7	15	ug/g
Copper	Cu	71.6	30	ug/g
Lead	Pb	175	50	ug/g
Mercury	Hg	0.064	0.1	ug/g
Molybdenum	Mo	< 4	4	ug/g
Nickel	Ni	24.5	20	ug/g
Selenium	Se	< 0.5	2	ug/g
Silver	Ag	< 1.5	2	ug/g
Tin	Sn	22.9	5	ug/g
Zinc	Zn	396	80	ug/g
Other Metals				
Aluminum	Al	16600	-	ug/g
Antimony	Sb	< 8	-	ug/g
Beryllium	Be	< 1.5	-	ug/g
Boron	B	28.7	-	ug/g
Calcium	Ca	3700	-	ug/g
Iron	Fe	29300	-	ug/g
Magnesium	Mg	5350	-	ug/g
Manganese	Mn	398	-	ug/g
Phosphorus	PO4	1030	-	ug/g
Potassium	K	534	-	ug/g
Sodium	Na	108	-	ug/g
Strontium	Sr	10.4	-	ug/g
Titanium	Ti	1240	-	ug/g
Vanadium	V	74.2	-	ug/g

% = percent
< = Less than detection limit

ug/g = micrograms per gram, on a dry weight basis.

REPORTED TO:	Envirochem Services
REPORT DATE:	May 18, 1994
GROUP NUMBER:	4050316

CANTEST

Special Waste Extraction Procedure in Soil

CLIENT SAMPLE IDENTIFICATION:		**GPIT1 0m**	**GPIT3 0-0.2** BLK 3	**Mill 3 0-0.1**		
DATE SAMPLED:		May 3/94	May 3/94	May 3/94	**B.C. M.O.E. CRITERIA**	**UNITS**
CAN TEST ID:		405030076	405030080	405030088		
Moisture		35.5	42.0	8.12	-	%
Weight of sample in extraction		77.52	86.21	54.42	-	g
Initial pH		5.66	8.67	5.60	-	pH units
0.5 normal acetic acid added		3	200	1	-	mL
Final pH		5.20	5.54	5.12	-	pH units
B.C. M.O.E. Criteria						
Arsenic	As	< 0.75	< 0.75	< 0.75	5	mg/L
Barium	Ba	0.046	1.67	0.024	100	mg/L
Boron	B	0.11	1.12	0.09	500	mg/L
Cadmium	Cd	< 0.05	< 0.05	< 0.05	0.05	mg/L
Chromium	Cr	< 0.05	< 0.05	< 0.05	5	mg/L
Copper	Cu	< 0.03	< 0.03	0.05	100	mg/L
Lead	Pb	< 0.1	< 0.1	< 0.1	5	mg/L
Mercury	Hg	< 0.005	< 0.005	< 0.005	0.1	mg/L
Selenium	Se	< 0.25	< 0.25	< 0.25	1	mg/L
Silver	Ag	< 0.5	< 0.5	< 0.5	5	mg/L
Zinc	Zn	0.58	17.8	1.57	500	mg/L
Other Metals						
Aluminum	Al	< 0.3	< 0.3	0.61	-	mg/L
Antimony	Sb	< 0.3	0.39	< 0.3	-	mg/L
Beryllium	Be	< 0.005	< 0.005	< 0.005	-	mg/L
Bismuth	Bi	< 1	< 1	< 1	-	mg/L
Calcium	Ca	4.99	1730	12.4	-	mg/L
Cobalt	Co	< 0.05	< 0.05	< 0.05	-	mg/L
Iron	Fe	< 0.1	< 0.1	0.4	-	mg/L
Magnesium	Mg	0.63	72.9	2.24	-	mg/L
Manganese	Mn	0.30	3.87	0.75	-	mg/L
Molybdenum	Mo	< 0.1	< 0.1	< 0.1	-	mg/L
Nickel	Ni	< 0.05	< 0.05	< 0.05	-	mg/L
Phosphorus	PO4	< 1	20	< 1	-	mg/L
Silicon	SiO2	1.6	56.4	0.7	-	mg/L
Sodium	Na	3.5	17.0	5.5	-	mg/L
Strontium	Sr	0.015	5.92	0.025	-	mg/L
Tin	Sn	< 0.1	< 0.1	< 0.1	-	mg/L
Titanium	Ti	< 0.01	< 0.01	< 0.01	-	mg/L
Vanadium	V	< 0.05	< 0.05	< 0.05	-	mg/L

% = percent
mL = milliliters
< = Less than detection limit

g = grams
mg/L = milligrams per liter

The BC MOE criteria is used to determine whether the waste is a "special waste", in accordance with the Waste Management Act Special Waste Regulation.

CANTEST

QUALITY ASSURANCE/QUALITY CONTROL DATA

CANTEST

Client: Envirochem Services
File: 4050316
Page: 5

Sample I.D.		405030075 GPIT 0.1−0.15m	405030075' GPIT 0.1−0.15m	405030075 GPIT 0.1−0.15m		Detection Limit
			Duplicate	Average	RPD	
% Moisture	H2O	19.8 %	14.3 %	17.0 %		
Arsenic	As	2.90	3.93	3.41	30.05	0.05
Barium	Ba	102	98.5	100	3.70	0.05
Cadmium	Cd	0.28	0.25	0.27	11.57	0.25
Chromium	Cr	104	110	107	6.25	1.5
Cobalt	Co	28.3	28.2	28.2	0.46	1.0
Copper	Cu	100	108	104	7.77	0.75
Lead	Pb	94.3	86.7	90.5	8.39	1.0
Mercury	Hg	0.065	0.067	0.066	2.14	0.001
Molybdenum	Mo	5	<	<		4
Nickel	Ni	54.4	53.3	53.9	1.94	1.5
Selenium	Se	<	<	<		0.5
Silver	Ag	<	<	<		1.5
Tin	Sn	8.0	2.2	5.1	112.84	1.5
Zinc	Zn	141	138	139	2.07	0.75
Aluminum	Al	44200	44600	44400	0.90	8.0
Antimony	Sb	<	<	<		8.0
Beryllium	Be	<	<	<		0.75
Bismuth	Bi	<	<	<		25
Boron	B	65.3	64.5	64.9	1.25	0.5
Calcium	Ca	5500	5500	5500	0.01	0.5
Iron	Fe	69200	70600	69900	2.04	1.5
Magnesium	Mg	13100	12200	12700	7.05	0.05
Manganese	Mn	1530	1719	1624	11.62	0.15
Phosphorus	PO4	1830	2000	1920	8.64	20
Potassium	K	377	133	255	95.50	0.5
Sodium	Na	145	148	147	2.14	5.0
Strontium	Sr	12.3	11.1	11.7	10.37	0.05
Titanium	Ti	1110	1610	1360	36.67	0.3
Vanadium	V	129	173	151	28.86	0.5

All results expressed as micrograms per gram (μg/g) on a dry weight basis.

metals123\envidup

CANTEST

Client: Envirochem Services
File: 4050316
Date: May 4, 1994

Cantest I.D. Client I.D.		Digestion Blank #1	Digestion Blank #2	Digestion Blank #3	Detection Limit
Aluminum	Al	<	<	<	0.15
Antimony	Sb	<	<	<	0.15
Arsenic	As	<	<	<	0.01
Barium	Ba	<	0.001	<	0.001
Beryllium	Be	<	<	<	0.006
Boron	B	0.012	<	0.016	0.010
Cadmium	Cd	<	<	<	0.005
Calcium	Ca	0.079	0.057	0.072	0.01
Chromium	Cr	<	<	<	0.03
Cobalt	Co	<	<	<	0.02
Copper	Cu	<	<	<	0.015
Iron	Fe	0.063	<	0.045	0.030
Lead	Pb	<	<	<	0.08
Magnesium	Mg	0.017	0.011	0.015	0.001
Manganese	Mn	<	<	<	0.003
Mercury	Hg	<	<	<	0.0002
Molybdenum	Mo	<	<	<	0.04
Nickel	Ni	<	<	<	0.025
Phosphorus	PO4	<	<	<	0.4
Potassium	K	<	<	<	1
Selenium	Se	<	<	<	0.05
Silver	Ag	<	<	<	0.03
Sodium	Na	<	<	<	0.1
Strontium	Sr	<	<	<	0.001
Tin	Sn	<	<	<	0.03
Titanium	Ti	<	<	<	0.006
Vanadium	V	<	<	<	0.010
Zinc	Zn	<	<	0.015	0.015

Results expressed as milligrams per litre (mg/L).
< = Less than

A\metals123\enviblnk

CANTEST

Client: Envirochem Services
File: 4050316
Date: May 4, 1994

National Research Council Canada (NRC)
Certified Reference Material

PACS−1

COMPONENT		RESULT	PERCENT RECOVERY	CERTIFIED VALUE
Major Components	(%)			
Silica	SiO2	−		55.7 ±0.5
Alumina	Al2O3	4.26	34.85	12.23 ±0.22
Iron	Fe2O3	6.22	89.38	6.96 ±0.12
Calcium	CaO	1.47	50.31	2.92 ±0.09
Magnesium	MgO	1.77	73.61	2.41 ±0.09
Sodium	Na2O	2.41	54.84	4.40 ±0.11
Potassium	K2O	0.55	36.55	1.50 ±0.09
L.O.I.		−		
Trace Components	(ug/g)			
Antimony	Sb	20	11.70	171. ±14.
Arsenic	As	200	94.79	211. ±11.
Barium	Ba	370		−
Beryllium	Be	<3.0		−
Boron	B	65		−
Cadmium	Cd	2.05	86.13	2.38 ±0.20
Chromium	Cr	67.0	59.29	113. ±8.
Cobalt	Co	20.0	114.29	17.5 ±1.1
Copper	Cu	455	100.66	452. ±16.
Lead	Pb	400	99.01	404. ±20.
Manganese	Mn	305	64.89	470. ±12.
Mercury	Hg	3.00	65.65	4.57 ±0.16
Molybdenum	Mo	13.5	104.65	12.9 ±0.9
Nickel	Ni	39.0	88.44	44.1 ±2.0
Phosphorous	PO4	2900	93.25	3110. ±240.
Selenium	Se	0.75	68.81	1.09 ±0.11
Silver	Ag	<15		−
Strontium	Sr	90.0	32.49	277. ±11.
Tin	Sn	26.0	63.26	41.1 ±3.1
Titanium	Ti	1300	30.88	4210. ±66.
Vanadium	V	85	66.93	127. ±5.
Zinc	Zn	820	99.51	824. ±22.

< = Not detected
% = Percent
μg/g = micrograms per gram

metals123\envipac

SAMPLE TRANSMITTAL AND CHAIN OF CUSTODY FORM

Record No:

ENVIROCHEM SPECIAL PROJECTS INC.
310 East Esplanade North Vancouver, B.C.
Tel: (604) 986-0233, Fax: (604) 986-8583

To: CANTEST

Attention: DON NOOT

Project No: 3790

Envirochem Contact: LINDA EASTCOTT

Purchase Order: 70 839

Date: 05/03/94

Results required by: 5-7 days

Number of Samples: Water ____ Sediment 10 Other ____

Sample Identification	Sample Date	Sample Type	Parameter: ICP Metal Scan	Leachate Extraction Procedure				Detect. Level
GPIT 1 0.1-0.15 m			✓					
GPIT 1 0 m				✓				
GPIT 2 0.1			✓					
~~GPIT 2 0.2~~			~~✓~~					
BLK 3 0-0.2			✓	✓				
BLK 5 0-0.2			✓					
BLK 7 0.1-0.2			✓					
BLK 10 0-0.1			✓					
MILL 1B 0-0.1			✓					
MILL 1 0.2-0.3			✓					
MILL 3 0-0.1			✓	✓				

Date	Time	Relinquished By (Name & Affil.)	Relinquished To (Name & Affil.)
May 3/94	13:41		S. TIMUSS – CTL

N.B. Analyses are to be conducted as per " Sample Transmittal Notes " (see over).

Special Instructions: 1 duplicate for metals & LEP

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	April 26, 1994
Date of Sampling:	March 15-17, 1994
Date of Analysis:	March 29, 1994
Report On:	Gravimetric Mineral Oil and Grease (Sediment)
Project Number:	3790
Report To:	Mclean Mill c/o Envirochem Services
Attention:	Eva Gerencher

Methodology:
The samples are extracted for 4 hours with hexane/acetone in a soxhlet extractor. The extract is cleaned up by silica gel, rota-evaporated to dryness and weighed to determine gravimetric mineral oil and grease.

Results of Analysis:
Results are presented in the attached table.

Fragrance Chen
Analytical Chemist
ENVIROCHEM SERVICES ANALYTICAL DEPARTMENT

RESULTS OF ANALYSIS

SAMPLE IDENTIFICATION	Mineral Oil and Grease (mg/Kg of dry sample)
T-1 0.2m	192
T-1 0.2m Duplicate	293
T-2 0-0.1m	1450
T-2 0.5m	167
T-10 0-0.1m	214
T-11 0-0.1m	6440
T-12 0-0.1m	262
T-14 0-0.1m	2430
T-14 0.3m	190
GPIT 1 0m	306000
MILL 3 0-0.1m	301000
MILL 9 0-0.1m	147000
Blank	<100
Spike	96% Recovery
GENG 1 0-0.05m	3110
GPIT 1 0.1-0.5m	14000
GPIT 1 0.1-0.5m Duplicate	21500
GPIT 2 0.1m	45400
GAR 1 0m	12300
GAR 3 0m	17400
GAR 4 0m	1680
MILL 1A 0-0.1m	12000
MILL 4 0-0.1m	397000
MILL 5 0m	121000
MILL 5 0m Duplicate	134000

RESULTS OF ANALYSIS

SAMPLE IDENTIFICATION	Mineral Oil and Grease (mg/Kg of dry sample)
MILL 5 0.3-0.4m	19100
MILL 6 0m	33000
MILL 6 0.1-0.2m	16500
MILL 10 0.1m	289000
MM 3 0-0.61m	499
MM 4 0-0.61m	595
Blank	< 100
Spike	93% Recovery
MM 4 0.61-1.22m	225
MM 6 0-0.61m	391
MM 7 0-0.61m	< 100
MM 7 0.61-1.22m	6160
MM 8 0-0.61m	149
MM 24 0-0.1m	269
MM 25 0-0.1m	263
MM 25 0-0.1m Duplicate	162
Blank	< 100
Spike	96% Recovery

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	May 11, 1994
Date of Sampling:	March 17, 1994
Date of Analysis:	May 4 , 1994
Report On:	Gravimetric Mineral Oil and Grease (Sediment)
Project Number:	3790
Report To:	Mclean Mill c/o Envirochem Special Projects Inc.
Attention:	Linda Eastcott

Methodology:
The samples are extracted for 4 hours with hexane/acetone in a soxhlet extractor. The extract is cleaned up by silica gel, rota-evaporated to dryness and weighed to determine gravimetric mineral oil and grease.

Results of Analysis:
Results are presented in the attached table.

Fragrance Chen
Analytical Chemist
ENVIROCHEM ANALYTICAL DEPARTMENT

RESULTS OF ANALYSIS

SAMPLE IDENTIFICATION	Mineral Oil and Grease (mg/Kg of dry sample)
T-11 0.1-0.2m	2890
T-16 0-0.1m	769
BLK3 0-0.2m	1600
MILL 1 0.2-0.3m	10800
MILL 4 0.1-0.2m	30800
MILL 7 0-0.1m	50900
MILL 7 0-0.1m Duplicate	39600
MILL 7 1.2-1.8m	122
Blank	< 100
Spike	81% Recovery

McLean. 3790

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	April 15, 1994
Date of Analysis:	April 7, 1994
Report On:	Total Extractable Hydrocarbons
Project Number:	3790
Report To:	Eva Gerencher

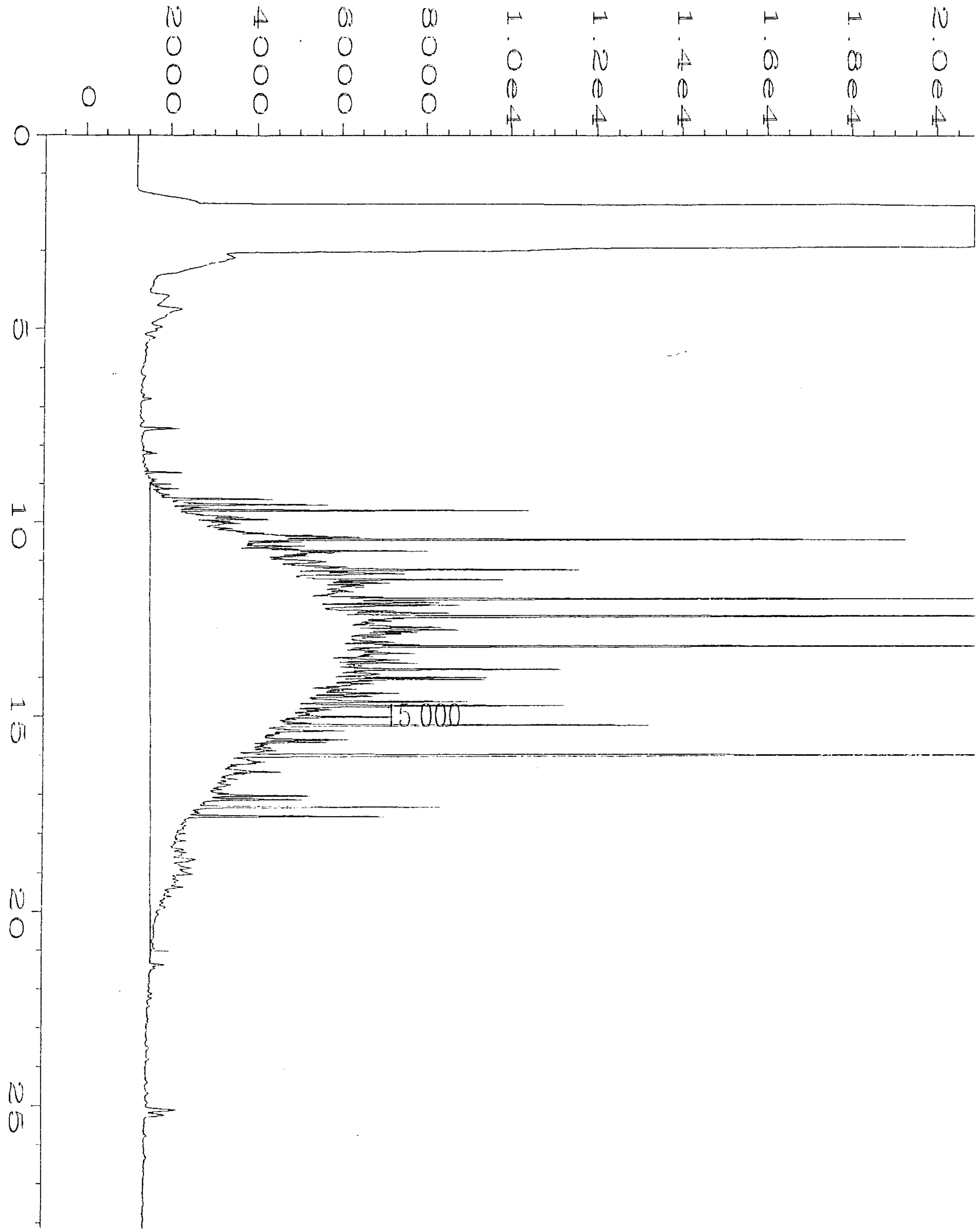
Methodology:
The samples are extracted for 4 hours with hexane/acetone in a soxhlet extractor. Then the extract is rota-evaporated to dryness and made up to volume with hexane. The final extract is analyzed using a Hewlett-Packard 5890 Series II gas chromatograph equipped with a flame ionization detector.

Results of Analysis:
Results are presented in the attached table.

Fragrance Chen
Analytical Chemist
ENVIROCHEM SERVICES ANALYTICAL DEPARTMENT

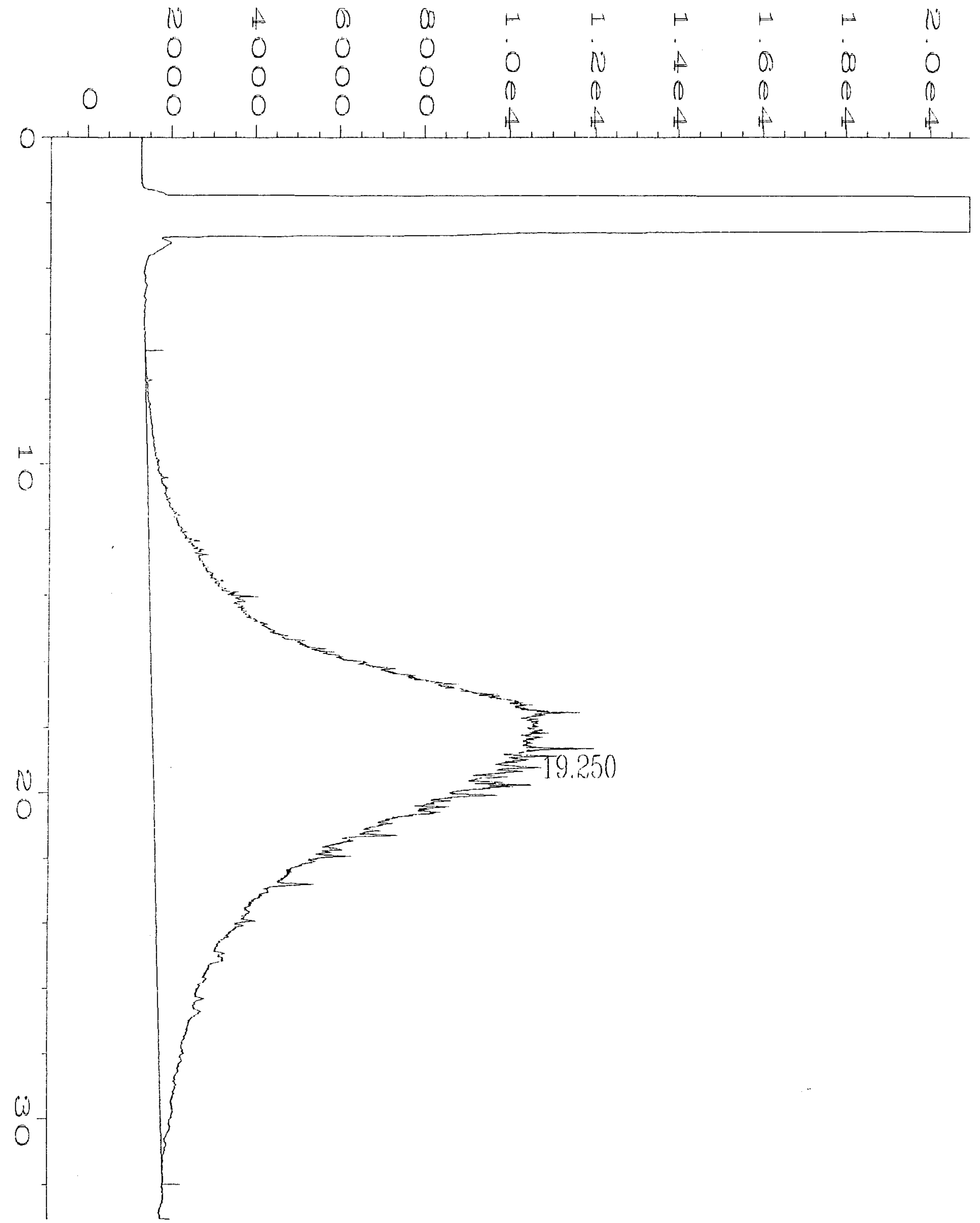
RESULTS OF ANALYSIS

SAMPLE IDENTIFICATION	TEH (mg/Kg of dry sample)
T-11 1.3m	268
T-11 1.3m Duplicate	277
GPIT 1 0m	117000
Mill 3 0-0.1m	126000
Mill 9 0-0.1m	34800
Spike	103%

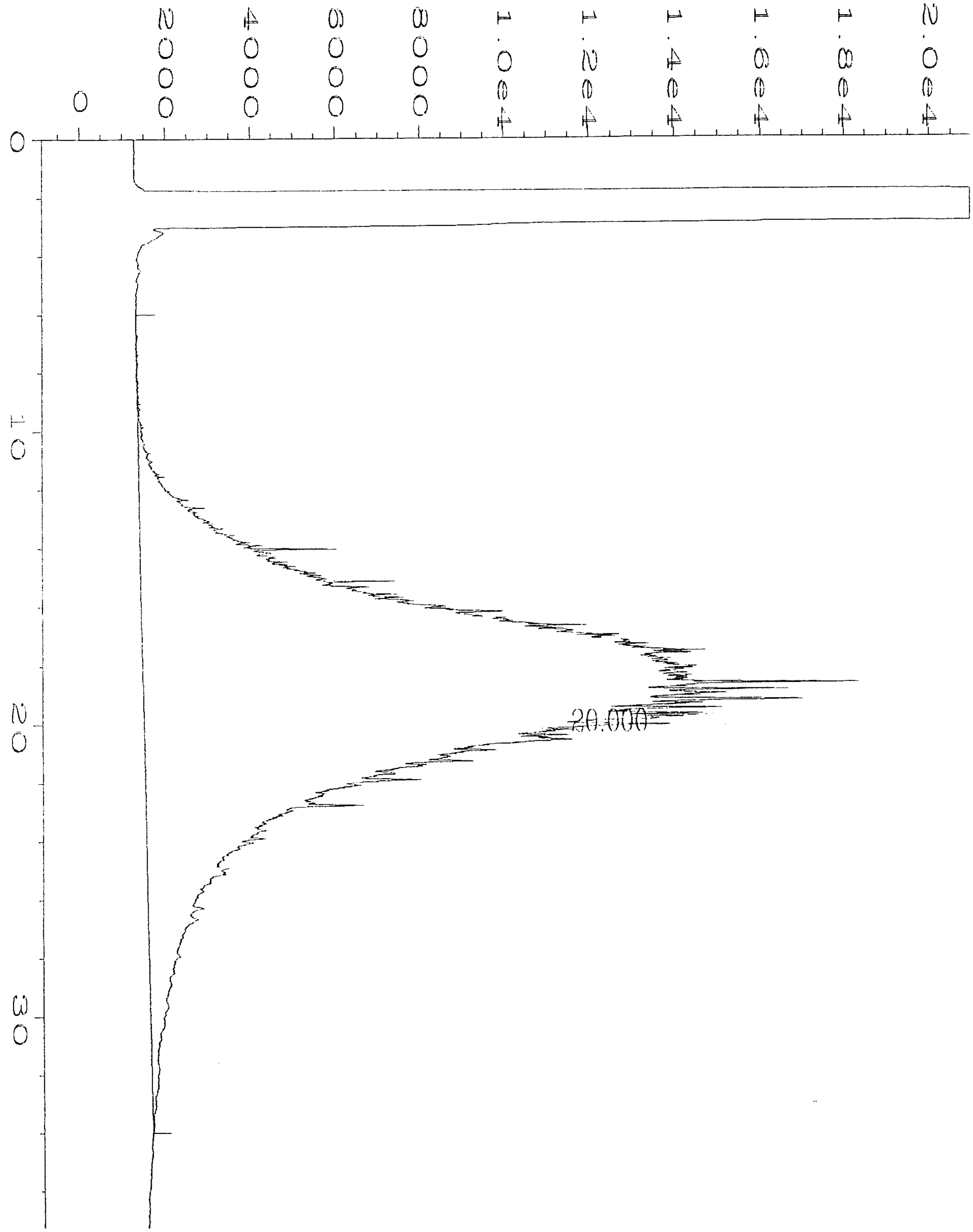


Data File Name : C:\HPCHEM\1\DATA\TEH\H0043A.D
Operator : Fragrance
Instrument : HP 5890
Sample Name : T-11 1.3m 5ml 11.7065 g dry wt
Run Time Bar Code:
Acquired on : 07 Apr 94 03:27 PM
Report Created on: 08 Apr 94 10:47 AM
Last Recalib on : 05 AUG 93 02:21 PM
Multiplier : 1

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: H-C.MTH
Analysis Method : H-C.MTH
Sample Amount : 0
ISTD Amount :

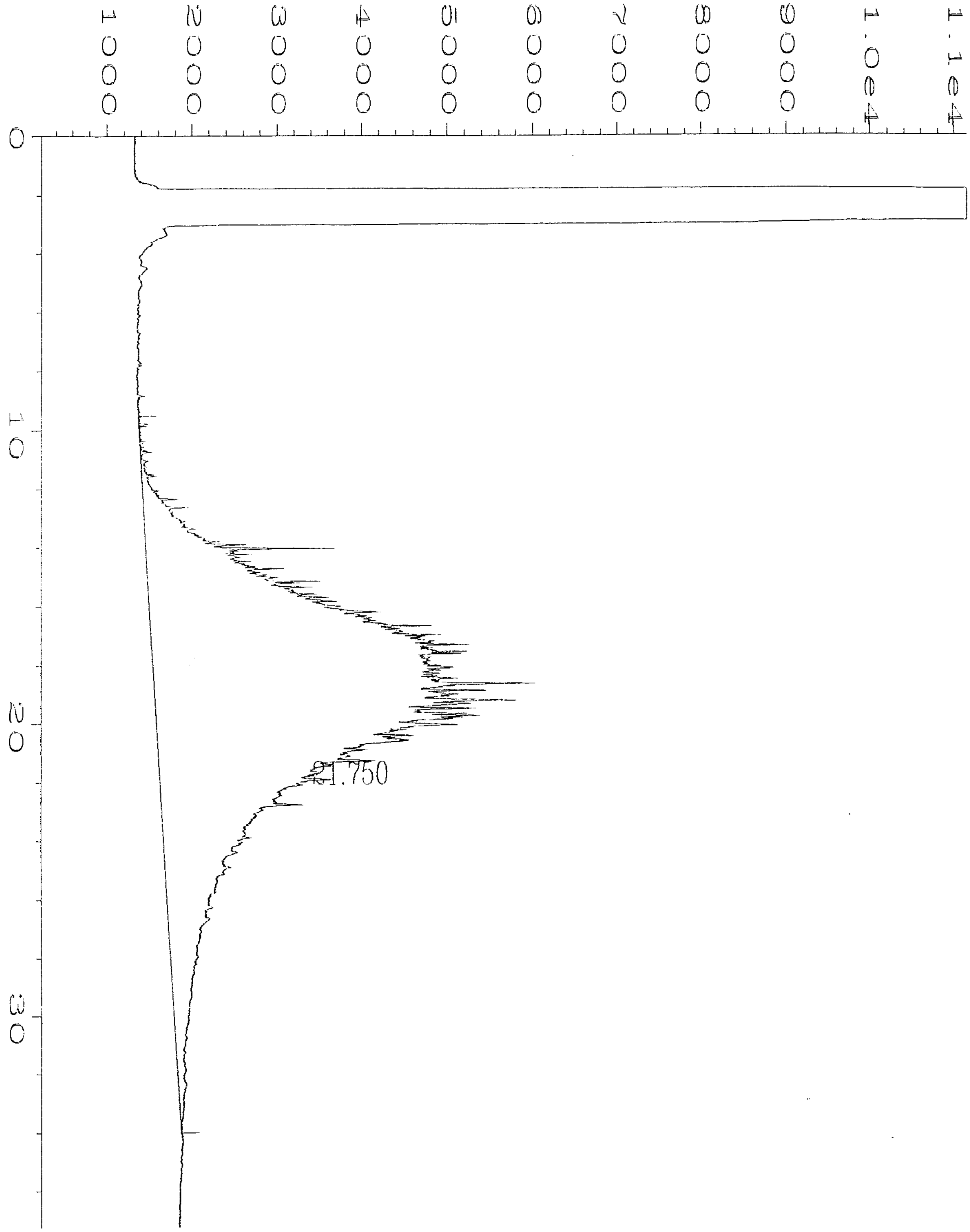


Data File Name	: C:\HPCHEM\1\DATA\TEH\H0043B.D		
Operator	: Fragrance	Page Number	: 1
Instrument	: HP 5890	Vial Number	:
Sample Name	: GPIT 1 0m 1000x 10.9297 g dry wt	Injection Number	:
Run Time Bar Code:		Sequence Line	:
Acquired on	: 08 Apr 94 09:27 AM	Instrument Method	: H-C.MTH
Report Created on	: 08 Apr 94 01:51 PM	Analysis Method	: H-C.MTH
Last Recalib on	: 05 AUG 93 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:



Data File Name : C:\HPCHEM\1\DATA\TEH\H0043D.D
Operator : Fragrance
Instrument : HP 5890
Sample Name : Mill 3 0-0.1m 12.4387 g dry wt
1000 × dil
Run Time Bar Code:
Acquired on : 08 Apr 94 11:04 AM
Report Created on: 08 Apr 94 02:54 PM
Last Recalib on : 05 AUG 93 02:21 PM
Multiplier : 1

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: H-C.MTH
Analysis Method : H-C.MTH
Sample Amount : 0
ISTD Amount :



Data File Name : C:\HPCHEM\1\DATA\TEH\H0043E.D
Operator : Fragrance
Instrument : HP 5890
Sample Name : Mill 9 0-0.1m 500x dil
Run Time Bar Code: 6.9266 g dry wt
Acquired on : 08 Apr 94 11:55 AM
Report Created on: 08 Apr 94 03:07 PM
Last Recalib on : 05 AUG 93 02:21 PM
Multiplier : 1

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: H-C.MTH
Analysis Method : H-C.MTH
Sample Amount : 0
ISTD Amount :

Analysis Report

CANTEST

CanTest Ltd
Professional Analytical Services
1523 West 3rd Ave
Vancouver, BC
V6J 1J8
Fax: 604 731 2386
Tel: 604 734 7276
1 800 665 8566

REPORT ON: Results of Testing

REPORTED TO: Envirochem Services
310 East Esplanade
North Vancouver, B.C.
V7L 1A4

Att'n: Linda

PROJECT NUMBER: 3790
P.O. NUMBER: 70824

NUMBER OF SAMPLES: 5

REPORT DATE: March 29, 1994

DATE SUBMITTED: March 24, 1994

GROUP NUMBER: 4032404

SAMPLE TYPE: Soil

TEST METHODS:

Volatile Organic Compounds - were determined with methodology based upon U.S. EPA Methods 624/8240, involving sparging/collection with a Purge and Trap apparatus and analysis using GC/MS.

TEST RESULTS:

(See following pages)

CAN TEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: Envirochem Services

REPORT DATE: March 29, 1994

GROUP NUMBER: 4032404

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	T-11 0.5m	T-11 1.3m	T-11 1.5m	T-11 2.1m	
DATE SAMPLED:	Mar 17/94	Mar 17/94	Mar 17/94	Mar 17/94	
CAN TEST ID:	403240012	403240013	403240014	403240015	DETECTION LIMIT
ANALYSIS DATE:	Mar 25/94	Mar 25/94	Mar 25/94	Mar 25/94	
Benzene	<	<	<	<	0.01
Bromodichloromethane	<	<	<	<	0.01
Bromoform	<	<	<	<	0.01
Bromomethane	<	<	<	<	0.04
2-Butanone	<	<	<	<	0.5
Carbon Tetrachloride	<	<	<	<	0.01
Chlorobenzene	<	<	<	<	0.01
Chloroethane	<	<	<	<	0.02
Chloroform	<	<	<	<	0.01
Chloromethane	<	<	<	<	0.04
Dibromochloromethane	<	<	<	<	0.01
1,2-Dibromoethane	<	<	<	<	0.01
Dibromomethane	<	<	<	<	0.01
1,2-Dichlorobenzene	<	<	<	<	0.01
1,3-Dichlorobenzene	<	<	<	<	0.01
1,4-Dichlorobenzene	<	<	<	<	0.01
Dichlorodifluoromethane	<	<	<	<	0.02
1,1-Dichloroethane	<	<	<	<	0.01
1,2-Dichloroethane	<	<	<	<	0.02
1,1-Dichloroethene	<	<	<	<	0.01
cis-1,2-Dichloroethene	<	<	<	<	0.01
trans-1,2-Dichloroethene	<	<	<	<	0.01
1,2-Dichloropropane	<	<	<	<	0.01
cis-1,3-Dichloropropene	<	<	<	<	0.01
trans-1,3-Dichloropropene	<	<	<	<	0.01
Ethylbenzene	<	<	<	<	0.01
2-Hexanone	<	<	<	<	0.5
4-Methyl-2-pentanone	<	<	<	<	0.2
Methylene Chloride	<	<	<	<	0.3
Styrene	<	<	<	<	0.01
1,1,2,2-Tetrachloroethane	<	<	<	<	0.01
Tetrachloroethene	<	<	<	<	0.01
Toluene	<	<	<	<	0.01
1,1,1-Trichloroethane	<	<	<	<	0.01

(Continued on next page)

REPORTED TO: Envirochem Services

REPORT DATE: March 29, 1994

GROUP NUMBER: 4032404

CANTEST

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	T-11 0.5m	T-11 1.3m	T-11 1.5m	T-11 2.1m	
DATE SAMPLED:	Mar 17/94	Mar 17/94	Mar 17/94	Mar 17/94	
CAN TEST ID:	403240012	403240013	403240014	403240015	
ANALYSIS DATE:	Mar 25/94	Mar 25/94	Mar 25/94	Mar 25/94	DETECTION LIMIT
1,1,2-Trichloroethane	<	<	<	<	0.01
Trichloroethene	<	<	<	<	0.01
Trichlorofluoromethane	<	<	<	<	0.01
Vinyl Chloride	<	<	<	<	0.02
Xylenes	<	<	<	<	0.01
SURROGATE RECOVERY					
1,2-Dichloroethane-d4	114	115	114	98	-
Toluene-d8	95	114	113	90	-
Bromofluorobenzene	90	93	112	88	-

Results expressed as micrograms per gram, on a dry weight basis. (ug/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Envirochem Services

REPORT DATE: March 29, 1994

GROUP NUMBER: 4032404

CANTEST

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	T-15 1.2m	
DATE SAMPLED:	Mar 17/94	
CAN TEST ID:	403240016	
ANALYSIS DATE:	Mar 25/94	DETECTION LIMIT
Benzene	<	0.01
Bromodichloromethane	<	0.01
Bromoform	<	0.01
Bromomethane	<	0.04
2-Butanone	<	0.5
Carbon Tetrachloride	<	0.01
Chlorobenzene	<	0.01
Chloroethane	<	0.02
Chloroform	<	0.01
Chloromethane	<	0.04
Dibromochloromethane	<	0.01
1,2-Dibromoethane	<	0.01
Dibromomethane	<	0.01
1,2-Dichlorobenzene	<	0.01
1,3-Dichlorobenzene	<	0.01
1,4-Dichlorobenzene	<	0.01
Dichlorodifluoromethane	<	0.02
1,1-Dichloroethane	<	0.01
1,2-Dichloroethane	<	0.02
1,1-Dichloroethene	<	0.01
cis-1,2-Dichloroethene	<	0.01
trans-1,2-Dichloroethene	<	0.01
1,2-Dichloropropane	<	0.01
cis-1,3-Dichloropropene	<	0.01
trans-1,3-Dichloropropene	<	0.01
Ethylbenzene	<	0.01
2-Hexanone	<	0.5
4-Methyl-2-pentanone	<	0.2
Methylene Chloride	<	0.3
Styrene	<	0.01
1,1,2,2-Tetrachloroethane	<	0.01
Tetrachloroethene	<	0.01
Toluene	<	0.01
1,1,1-Trichloroethane	<	0.01

(Continued on next page)

REPORTED TO: Envirochem Services

REPORT DATE: March 29, 1994

GROUP NUMBER: 4032404

CANTEST

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	**T-15 1.2m**	
DATE SAMPLED:	Mar 17/94	
CAN TEST ID:	403240016	DETECTION LIMIT
ANALYSIS DATE:	Mar 25/94	
1,1,2-Trichloroethane	<	0.01
Trichloroethene	<	0.01
Trichlorofluoromethane	<	0.01
Vinyl Chloride	<	0.02
Xylenes	<	0.01
SURROGATE RECOVERY		
1,2-Dichloroethane-d4	89	-
Toluene-d8	90	-
Bromofluorobenzene	83	-

Results expressed as micrograms per gram, on a dry weight basis. (ug/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

RECEIVED APR 11 1994

Analysis Report

CANTEST

CanTest Ltd

Professional
Analytical
Services

1523 West 3rd Ave
Vancouver, BC
V6J 1J8

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Results of Testing

REPORTED TO: Envirochem Services
310 East Esplanade
North Vancouver, B.C.
V7L 1A4

Att'n: Ms. Eva Gerencher

PROJECT NUMBER: 3790
P.O. NUMBER: 70903

NUMBER OF SAMPLES: 3

REPORT DATE: April 5, 1994

DATE SUBMITTED: March 28, 1994

GROUP NUMBER: 4032824

SAMPLE TYPE: Soil

TEST METHODS:

Polynuclear Aromatic Hydrocarbons - were determined with methodology based upon U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

TEST RESULTS:

(See following page)

CAN TEST LTD.

Don Noot, M.Sc.
Supervisor, Trace Organics

REPORTED TO:	Envirochem Services	CANTEST
REPORT DATE:	April 5, 1994	
GROUP NUMBER:	4032824	

Polynuclear Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	T-2 0-0.1m	BLK-4 0-0.1m	MILL 4 0-0.1m	
DATE SAMPLED:	Mar 17/94	Mar 17/94	Mar 17/94	DETECTION LIMIT
CAN TEST ID:	403280062	403280063	403280064	
Low Molecular Weight PAH's				
Naphthalene	0.40	0.30	0.7	0.05
Acenaphthylene	<	0.06	< 0.5	0.05
Acenaphthene	<	<	< 0.5	0.05
Fluorene	<	<	< 0.5	0.05
Phenanthrene	0.18	0.36	2.0	0.05
Anthracene	<	<	0.5	0.05
Total LMW-PAH's	0.58	0.72	3.2	
High Molecular Weight PAH's				
Fluoranthene	0.09	0.27	0.6	0.05
Pyrene	0.07	0.19	2.2	0.05
Benzo(a)anthracene	<	<	< 0.5	0.05
Chrysene	<	0.11	1.6	0.05
Benzo(b)fluoranthene	<	0.17	0.9	0.05
Benzo(k)fluoranthene				
Benzo(a)pyrene	<	0.11	< 0.5	0.05
Indeno(1,2,3-c,d)pyrene	<	0.15	< 0.5	0.05
Dibenz(a,h)anthracene	<	<	< 0.5	0.05
Benzo(g,h,i)perylene	<	0.21	< 0.5	0.05
Total HMW-PAH's	0.16	1.20	5.3	
Total PAH's	0.74	1.92	8.5	

Results expressed as micrograms per gram, on a dry weight basis. (ug/g)
< = Less than detection limit
Sample# 403280064 - Detection limits adjusted: Interference present in sample
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	May 6, 1994
Date of Sampling:	March 16-17, 1994
Date of Analysis:	April 29, 1994
Report On:	Chlorophenols (Sediment)
Project Number:	3790
Report To:	McLean Mill c/o Envirochem Special Projects Inc.
Attention:	Eva Gerencher

Methodology:
The samples are first extracted with potassium hydroxide solution, washed with dichloromethane, derivatized and extracted into hexane. The sample extract is then analyzed using a Hewlett-Packard 5890 Series II gas chromatograph equipped with an electron capture detector.

Results of Analysis:
Results are presented in the attached table.

Fragrance Chen
Analytical Chemist
ENVIROCHEM SERVICES ANALYTICAL DEPARTMENT

RESULTS OF ANALYSIS

SAMPLE	2,3,4,6-Tetrachlorophenol (mg/Kg of dry sample)	Pentachlorophenol (mg/kg of dry sample)	*% Recovery
T-8 0.05-0.1 m	0.06	0.71	98
MM23 0-0.1m	0.19	3.49	106
MM24 0-0.1m	0.22	2.40	108
MM25 0-0.1m	0.16	1.45	75
MM25 0-0.1m Duplicate	0.14	1.54	81
MM26 0-0.1m	0.07	0.59	76
MM28 0-0.1m	<0.02	<0.02	85
Blank	<0.02	<0.02	98
Spike	98%	88%	85

*% Recovery represents the recovery of a surrogate, 2,4-Dibromophenol (which is similar to chlorophenols), placed in each sample prior to anlyses. Surrogate and chlorophenol recoveries are a function of the analytical techniques and can also be affected by site dependent interferences. By evaluating the recovery of a known amount of 2,4-Dibromophenol, it is assumed that 2,3,4,6-Tetrachlorophenol and pentachlorophenol would likewise be afffected. It could be simplistically interpreted that the actual concentration is:

$$\frac{\text{Reported Concentration}}{\text{\% Recovery}} \quad \text{X} \quad 100\ \%$$

Results of Field Analysis for PCP
Date Apr 7 '94
Location ESP
Operator MZ

Property of: **Envirochem Special Projects Inc.**
310 East Esplanade
North Vancouver, BC

	Sample ID	OD	PCB level (ppm)	Notes
	C1	0.71	5	0.7 = 5ppm
	C1	0.68	5	
	~~C2~~	~~0.70~~	~~5~~	
	C2	0.64	50	0.64 = 50ppm
	NC	1.07	0.0	
1	T4 0m	0.80	<5	
2	T4 0.15m	0.89	<5	
3	T5 0-0.1m	0.75	<5	
4	T6 0-0.1m	0.80	<5	
5	T8 0.05-0.1m	0.69	~~5/50~~	Roughly 5ppm
6	T8 0.3m	0.77	<5	
7	T9 0-0.1m	0.81	<5	
8	T9 0.3m	0.78	<5	
9	MM-1, 0-0.61m	0.88	<5	dip tank
10	MM-2, 0-0.61m	0.86	<5	"
11	MM-2, 0.61-1.22m	0.84	<5	"
12	MM-2, 1.22-1.83	0.87	<5	"
13	MM-2, 1.22-1.83	0.92	<5	" Duplicate, separate extraction

(*) wood material present in some samples.
(*) Performed using kit that was wet in the field
(*) ~~[illegible]~~
Some components of kit out of date

12

Results of Field Analysis for PCP
Date apr 7 '94
Location ESP
Operator MZ

Property of: **Envirochem Special Projects Inc.**
310 East Esplanade
North Vancouver, BC

	Sample ID	OD	PCB level (ppm)	Notes
	C1	0.71	5	
	C1	0.71	5	
	C2	0.64	50	
	C2	0.59	50	
	NC	1.01	0.0	
14	MM-3, 0-0.61m	0.76	<5	
15	MM-3, 0.61-1.22	0.79	<5	
16	MM-4, 0-0.61	0.78	<5	
17	MM4, 0.61-1.22	0.78	<5	
18	MM5, 0-0.61	0.81	<5	
~~19~~	~~MM5, 0.61-1.22~~			
20	MM6, 0-0.61	0.79	<5	
21	MM6, 0.61-1.22	0.74	<5	
22	MM8, 0-0.61	0.87	<5	
23	MM13, 0-0.1	0.83	<5	
24	MM14, 0-0.1	0.74	<5	
25	MM15, 0-0.1	0.79	<5	
26	MM15, 0-0.1	0.77	<5	Duplicate, separate extraction

11

Results of Field Analysis for PCP
Date apr 7 '94
Location ESP
Operator MZ

Property of: **Envirochem Special Projects Inc.**
310 East Esplanade
North Vancouver, BC

	Sample ID	OD	PCB level (ppm)	Notes
	C1	0.71	5	
	C1	0.70	5	
	C2	0.56	50	
	C2	0.61	50	
	NC	0.96	0.0	
27	MM16, 0-0.1	0.73	<5	
28	MM17, 0-0.1	0.72	<5	
29	MM17, 1	0.71	<5	
30	MM19, 0-0.1	0.75	<5	
31	MM20, 0-0.1	0.71	<5	
32	MM21, 0-0.1	0.74	<5	
33	MM22, 0-0.1	0.77	<5	
34	MM23, 0-0.1	0.55	>50	
35	MM24, 0-0.1	0.64	5-50	
36	MM25, 0-0.1	0.60	5-50	
37	MM26, 0-0.1	0.68	5-50	
38	MM27, 0-0.1	0.72	<5	
39	MM28, 0-0.1	0.70	~5	
40	MM28, 0-0.1	0.72	<5	Duplicate, separate extraction

13

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Tel:(604)438-5226
Fax:(604)436-0565

ANALYSIS OF ENVIRONMENTAL SAMPLES

To: ENVIROCHEM SPECIAL PROJECTS INC.
310 East Esplanade
North Vancouver, B.C. *
V7L 1A4

Workorder: 23031
Received : 12-Apr-94
Completed: 22-Apr-94

Attn: Eva Gerencher

METHODOLOGY

Samples were analysed using procedures detailed in publications of the American Public Health Association, U.S Environmental Protection Agency, B.C Ministry of the Environment, and Environment Canada - Conservation and Protection.

Dissolved metals were determined in a filtered (0.45 um) and acidified sample aliquot by ICP-AES with ultrasonic nebulization (EPA Method 200.7).

Total metals were determined in a sample aliquot which was acid digested in a closed teflon vessel in a microwave oven (EPA Method 3015). The digest was analyzed by ICP-AES with ultrasonic nebulization (EPA Method 200.7)

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1

Tel:(604)438-5226
Fax:(604)436-0565

To: ENVIROCHEM SPECIAL PROJECTS INC.

W/O: 23031

Sample type		water	water	water	water	water
Identification		Downstream	Upstream	Upstream	MM-2	MM-6
Lab Reference #		23031-001	23031-002A	23031-002B	23031-003	23031-004
ICP - ULTRASONIC NEBULIZATION						
Method used		uwave HNO3 TOTAL	uwave HNO3 TOTAL	uwave HNO3 TOTAL	field filt. DISSOLVED	field filt. DISSOLVE
Aluminum	Al	0.02	0.03	0.03	0.21	0.01
Antimony	Sb	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Arsenic	As	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Barium	Ba	0.006	0.006	0.007	0.068	0.276
Beryllium	Be	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Bismuth	Bi	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Cadmium	Cd	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0007
Calcium	Ca	23.8	24.7	25.1	27.4	61.7
Chromium	Cr	< 0.001	0.002	< 0.001	0.002	0.00
Cobalt	Co	0.001	< 0.001	0.001	0.005	0.01
Copper	Cu	0.045	0.132	0.175	0.006	0.006
Iron	Fe	0.172	2.09	0.422	0.390	0.07
Lead	Pb	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lithium	Li	< 0.002	< 0.002	< 0.002	< 0.002	0.004
Magnesium	Mg	2.80	2.84	2.88	5.86	12.7
Manganese	Mn	0.017	0.021	0.018	1.16	4.95
Molybdenum	Mo	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Nickel	Ni	< 0.001	0.002	< 0.001	0.008	0.026
Phosphorus	P	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Potassium	K	< 0.2	0.3	0.3	0.8	1.9
Selenium	Se	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Silicon	Si	3.01	3.06	3.05	5.57	8.11
Silver	Ag	< 0.001	< 0.001	< 0.001	< 0.001	< 0.00
Sodium	Na	1.64	1.65	1.66	14.5	7.81
Strontium	Sr	0.030	0.036	0.035	0.055	0.11
Sulfur	S	0.98	1.0	1.1	4.23	1.39
Thorium	Th	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Titanium	Ti	0.003	0.004	0.004	0.021	0.004
Tin	Sn	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Uranium	U	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Vanadium	V	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Zinc	Zn	< 0.005	< 0.005	< 0.005	< 0.005	0.00
Zirconium	Zr	< 0.001	< 0.001	< 0.001	< 0.001	< 0.00
Results in		mg/L	mg/L	mg/L	mg/L	mg/L

/2...

Quanta Trace Laboratories Inc.
#401-3700 Gilmore Way
Burnaby, B.C. V5G 4M1
Tel:(604)438-5226
Fax:(604)436-0565

To: ENVIROCHEM SPECIAL PROJECTS INC. W/O: 23031

Sample type		water		water		water		water
Identification		MM-7		MM-7		T-8		T-16
Lab Reference #		23031-005A		23031-005B		23031-006		23031-007
ICP - ULTRASONIC NEBULIZATION								
Method used		field filt. DISSOLVED		field filt. DISSOLVED		field filt. DISSOLVED		field filt. DISSOLVED
Aluminum	Al		1.72		1.62		0.01		0.06
Antimony	Sb	<	0.02	<	0.02	<	0.02	<	0.02
Arsenic	As	<	0.02	<	0.02	<	0.02	<	0.02
Barium	Ba		0.018		0.018		0.019		0.003
Beryllium	Be	<	0.0002	<	0.0002	<	0.0002	<	0.0002
Bismuth	Bi	<	0.02	<	0.02	<	0.02	<	0.02
Cadmium	Cd	<	0.0005	<	0.0005	<	0.0005	<	0.0005
Calcium	Ca		44.7		45.3		63.6		16.2
Chromium	Cr		0.005		0.005	<	0.001		0.001
Cobalt	Co	<	0.001		0.001		0.003	<	0.001
Copper	Cu		0.015		0.015		0.006		0.004
Iron	Fe		2.04		1.90		1.25		0.085
Lead	Pb	<	0.01	<	0.01	<	0.01	<	0.01
Lithium	Li	<	0.002	<	0.002	<	0.002	<	0.002
Magnesium	Mg		16.5		16.6		23.5		3.14
Manganese	Mn		0.119		0.118		2.37		0.0141
Molybdenum	Mo	<	0.005	<	0.005	<	0.005	<	0.005
Nickel	Ni		0.005		0.003		0.006	<	0.001
Phosphorus	P	<	0.05	<	0.05	<	0.05	<	0.05
Potassium	K		1.8		1.9		0.9		0.6
Selenium	Se	<	0.02	<	0.02	<	0.02	<	0.02
Silicon	Si		11.4		11.3		9.38		5.98
Silver	Ag	<	0.001	<	0.001	<	0.001	<	0.001
Sodium	Na		8.07		7.94		4.71		1.88
Strontium	Sr		0.063		0.066		0.120		0.034
Sulfur	S		2.56		2.69		0.35		0.77
Thorium	Th	<	0.01	<	0.01	<	0.01	<	0.01
Titanium	Ti		0.156		0.145		0.005		0.008
Tin	Sn	<	0.01	<	0.01	<	0.01	<	0.01
Uranium	U	<	0.06	<	0.06	<	0.06	<	0.06
Vanadium	V		0.010		0.009		0.002	<	0.002
Zinc	Zn		0.031		0.028		0.028		0.018
Zirconium	Zr	<	0.001	<	0.001	<	0.001	<	0.001
Results in			mg/L		mg/L		mg/L		mg/L

 Analyst: ________

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	May 4, 1994
Date of Sampling:	April 11, 1994
Date of Analysis:	April 20, 1994
Report On:	Total Extractable Hydrocarbons (Water)
Project Number:	3790
Attention:	Eva Gerencher

Methodology :
The samples are extracted with hexane under acidic conditions. Then the extract is rota-evaporated to dryness and made up to volume with hexane. The final extract is analyzed using a Hewlett-Packard 5890 Series II gas chromatograph equipped with a flame ionization detector.

Results of Analysis:
Results are presented in the attached table.

Fragrance Chen
Analytical Chemist
ENVIROCHEM SERVICES ANALYTICAL DEPARTMENT

RESULTS OF ANALYSIS

SAMPLE IDENTIFICATION	TEH (mg/L)
MM6	<0.20
MM7	<0.20
Upstream	<0.20
Downstream	<0.20
Swamp	<0.20
T-16	<0.20
Trip Blank	<0.20
Laboratory Blank	<0.20
Spike	80% Recovery

Analysis Report

CANTEST

CanTest Ltd

Professional Analytical Services

1523 West 3rd Ave
Vancouver, BC
V6J 1J8

Fax: 604 731 23
Tel: 604 734 72
1 800 665 8566

REPORT ON: Results of Testing

REPORTED TO: Envirochem Services
310 East Esplanade
North Vancouver, B.C.
V7L 1A4

Att'n: Ms. Eva Gerencher

RECEIVED MAY 3 1994

PROJECT NUMBER: 3790
P.O. NUMBER: 70917

NUMBER OF SAMPLES: 3

REPORT DATE: April 21, 1994

DATE SUBMITTED: April 12, 1994

GROUP NUMBER: 4041209

SAMPLE TYPE: Water

TEST METHODS:

Volatile Organic Compounds - were determined with methodology based upon U.S. EPA Methods 624/8240, involving sparging/collection with a Purge and Trap apparatus and analysis using GC/MS.

TEST RESULTS:

(See following pages)

CAN TEST LTD.

Don Noot, M.Sc.
Supervisor, Trace Organics

REPORTED TO: Envirochem Services

REPORT DATE: April 21, 1994

GROUP NUMBER: 4041209

CANTEST

Volatile Organic Compounds in Water

CLIENT SAMPLE IDENTIFICATION:	MM-7	T-11	T-16	
DATE SAMPLED:	Apr 11/94	Apr 11/94	Apr 11/94	
CAN TEST ID:	404120067	404120068	404120069	
ANALYSIS DATE:	Apr 19/94	Apr 19/94	Apr 19/94	DETECTION LIMIT
Benzene	<	<	<	0.1
Bromodichloromethane	<	<	<	0.1
Bromoform	<	<	<	0.2
Bromomethane	<	<	<	0.8
2-Butanone	<	<	<	5
Carbon Tetrachloride	<	<	<	0.1
Chlorobenzene	<	<	<	0.1
Chloroethane	<	<	<	0.4
Chloroform	<	<	<	0.1
Chloromethane	<	<	<	0.4
Dibromochloromethane	<	<	<	0.1
1,2-Dibromoethane	<	<	<	0.1
Dibromomethane	<	<	<	0.2
Dichlorodifluoromethane	<	<	<	0.2
1,2-Dichlorobenzene	<	<	<	0.1
1,3-Dichlorobenzene	<	<	<	0.1
1,4-Dichlorobenzene	<	<	<	0.1
1,1-Dichloroethane	<	<	<	0.1
1,2-Dichloroethane	<	<	<	0.4
1,1-Dichloroethene	<	<	<	0.1
cis-1,2-Dichloroethene	<	<	<	0.1
trans-1,2-Dichloroethene	<	<	<	0.1
1,2-Dichloropropane	<	<	<	0.1
cis-1,3-Dichloropropene	<	<	<	0.1
trans-1,3-Dichloropropene	<	<	<	0.1
Ethylbenzene	1.1	2.1	<	0.1
2-Hexanone	<	<	<	5
4-Methyl-2-pentanone	<	<	<	2
Methylene Chloride	<	<	<	6
Styrene	<	<	<	0.1
1,1,2,2-Tetrachloroethane	<	<	<	0.2
Tetrachloroethene	<	<	<	0.1
Toluene	<	0.4	0.6	0.1
1,1,1-Trichloroethane	<	<	<	0.1

(Continued on next page)

REPORTED TO: Envirochem Services

REPORT DATE: April 21, 1994

GROUP NUMBER: 4041209

CANTEST

Volatile Organic Compounds in Water

CLIENT SAMPLE IDENTIFICATION:	MM-7	T-11	T-16	
DATE SAMPLED:	Apr 11/94	Apr 11/94	Apr 11/94	
CAN TEST ID:	404120067	404120068	404120069	
ANALYSIS DATE:	Apr 19/94	Apr 19/94	Apr 19/94	DETECTION LIMIT
1,1,2-Trichloroethane	<	<	<	0.1
Trichloroethene	<	<	<	0.1
Trichlorofluoromethane	<	<	<	0.2
Vinyl Chloride	<	<	<	0.2
Xylenes	6.3	2.3	<	0.1
SURROGATE RECOVERY				
1,2-Dichloroethane-d4	101	95	94	-
Toluene-d8	98	98	98	-
Bromofluorobenzene	91	97	92	-

Results expressed as micrograms per liter (ug/L)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO:	Envirochem Services	CANTEST
REPORT DATE:	April 21, 1994	
GROUP NUMBER:	4041209	

QA/QC Data: Volatile Organic Compounds

CLIENT SAMPLE IDENTIFICATION	–	T–16	T–11	T–11	
CAN TEST ID	Method Blank	Matrix Spike	404120068	404120068 Duplicate	DETECTION LIMIT
Benzene	<	91	<	<	0.1
Bromodichloromethane	<	90	<	<	0.1
Bromoform	<	88	<	<	0.2
Bromomethane	<	101	<	<	0.8
2–Butanone	<	–	<	<	5
Carbon Tetrachloride	<	90	<	<	0.1
Chlorobenzene	<	91	<	<	0.1
Chloroethane	<	106	<	<	0.4
Chloroform	<	101	<	<	0.1
Chloromethane	<	85	<	<	0.4
Dibromochloromethane	<	83	<	<	0.1
1,2–Dibromoethane	<	88	<	<	0.1
Dibromomethane	<	88	<	<	0.2
1,2–Dichlorobenzene	<	86	<	<	0.1
1,3–Dichlorobenzene	<	87	<	<	0.1
1,4–Dichlorobenzene	<	88	<	<	0.1
Dichlorodifluoromethane	<	89	<	<	0.2
1,1–Dichloroethane	<	101	<	<	0.1
1,2–Dichloroethane	<	88	<	<	0.4
1,1–Dichloroethene	<	94	<	<	0.1
cis–1,2–Dichloroethene	<	96	<	<	0.1
trans–1,2–Dichloroethene	<	95	<	<	0.1
1,2–Dichloropropane	<	79	<	<	0.1
cis–1,3–Dichloropropene	<	91	<	<	0.1
trans–1,3–Dichloropropene	<	87	<	<	0.1
Ethylbenzene	<	90	1.0	2.1	0.1
2–Hexanone	<	–	<	<	5
4–Methyl–2–pentanone	<	–	<	<	2
Methylene Chloride	<	–	<	<	6
Styrene	<	90	<	<	0.1
1,1,2,2–Tetrachloroethane	<	90	<	<	0.2
Tetrachloroethene	<	87	<	<	0.1
Toluene	<	100	0.2	0.4	0.1
1,1,1–Trichloroethane	<	91	<	<	0.1

(Continued on next page)

REPORTED TO:	Envirochem Services	CANTEST
REPORT DATE:	April 21, 1994	
GROUP NUMBER:	4041209	

QA/QC Data: Volatile Organic Compounds (continued)

CLIENT SAMPLE IDENTIFICATION	–	T–16	T–11	T–11	
CAN TEST ID	Method Blank	Matrix Spike	404120068	404120068 Duplicate	DETECTION LIMIT
1,1,2–Trichloroethane	<	88	<	<	0.1
Trichloroethene	<	87	<	<	0.1
Trichlorofluoromethane	<	102	<	<	0.2
Vinyl Chloride	<	100	<	<	0.2
Xylenes	<	91	1.1	2.3	0.1
SURROGATE RECOVERY					
1,2–Dichloroethane–d4	102	103	96	95	–
Toluene–d8	96	100	97	98	–
Bromofluorobenzene	88	99	93	97	–

Duplicate results expressed as micrograms per liter (ug/L)
Spike recoveries expressed as percent (%)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

NOTE – Duplicate results were based upon four separate analyses: two runs from each of two vials submitted. Results indicated that there was a discrepancy between the two vials for this sample.

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	May 6, 1994
Date of Sampling:	April 11, 1994
Date of Analysis:	April 28, 1994
Report On:	Chlorophenols
Project Number:	3790
Report To:	Mclean Mill - City of Port Alberni c/o Envirochem Speical Projects Inc.
Attention:	Eva Gerencher

Methodology:
The samples are first derivatized and extracted with hexane. The sample extract is then analyzed using a Hewlett-Packard 5890 Series II gas chromatograph equipped with an electron capture detector.

Results of Analysis:
Results are presented in the attached table.

Fragrance Chen
Analytical Chemist
ENVIROCHEM ANALYTICAL DEPARTMENT

RESULTS OF ANALYSIS

SAMPLE	2,3,4,6-Tetrachlorophenol ($\mu g/L$)	Pentachlorophenol ($\mu g/L$)
Swamp	< 1.0	< 1.0
MM2-2	< 1.0	< 1.0
MM2-2 Duplicate	< 1.0	< 1.0
MM5A	< 1.0	< 1.0
T-8	< 1.0	< 1.0
Blank	< 1.0	< 1.0

APPENDIX E.

3.2.9 McLean Mill National Historic Site, Port Alberni, B.C. Soil Remediation Summary. 1995. Envirochem Special Projects Inc. (Envirochem)

SOIL REMEDIATION SUMMARY
MCLEAN MILL NATIONAL HISTORIC SITE
PORT ALBERNI, B.C.

Prepared for:

City of Port Alberni
Parks & Recreation Department
4255 Wallace Street
Port Alberni, BC, V9Y 3Y6

Prepared by:

Linda Eastcott, M.A.Sc., P. Eng.
Envirochem Special Projects Inc.
North Vancouver, B.C.

July 1995

SOIL REMEDIATION SUMMARY
MCLEAN MILL NATIONAL HISTORIC SITE
PORT ALBERNI, B.C.

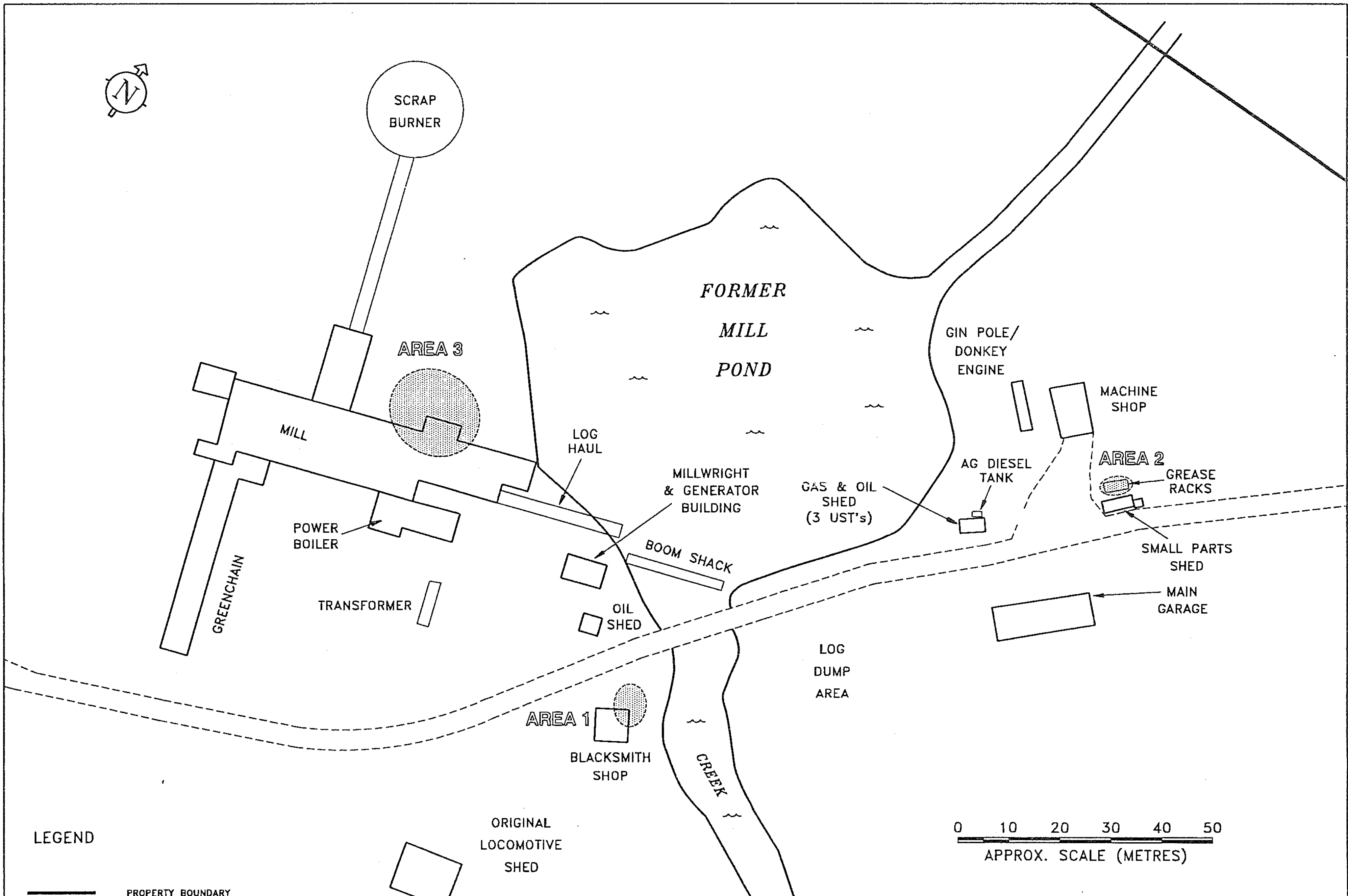
Envirochem Special Projects Inc. has completed the soil remediation program at the McLean Mill National Historic Site property. The soils requiring remediation were characterized as contaminated with petroleum hydrocarbons at levels which classified the soils as a Special Waste in accordance with the BC Environment *Special Waste Regulation* and with metals at levels in excess of the BC Environment industrial remediation criteria (Level C) as specified in the *Criteria for Managing Contaminated Sites in B.C.* and the CCME *Interim Canadian Environmental Quality Criteria for Contaminated Sites* (Envirochem, October 1994).

The purpose of the excavation was to remove, for off-site disposal or on-site treatment, all soils containing petroleum hydrocarbons at concentrations in excess of the B.C. Special Waste levels and metals at concentrations in excess of the BC Environment Level C criteria and the CCME industrial remediation criteria.

Contaminant Description

The McLean Mill National Historic Site is located 15 km northwest of Port Alberni, B.C.. A contamination assessment was completed by Envirochem in October 1994. The assessment was conducted to determine the presence, severity and extent of contamination in soils and groundwater at the site, and to identify and inventory all hazardous materials on the site such as chemical and fuel storage tanks.

Based on the results of the contamination assessment conducted at the McLean Mill site, soil remediation was recommended in three areas of the site in order to satisfy applicable federal and provincial cleanup criteria for commercial/industrial land use. The location of the three areas at the McLean Mill site is shown in Figure 1 and includes: Area 1 - metal contaminated soils in the vicinity of the blacksmith shop; Area 2 - soils beneath the grease rack adjacent to the small parts storage shed, and; Area 3 - petroleum hydrocarbon contaminated soils in vicinity of the secondary steam engine at the mill. Both petroleum hydrocarbon and metal contamination was limited primarily to surface soils with some areas of petroleum hydrocarbon contamination extending to depths of up to 0.3-0.5 meters. Excavation and proper disposal of this material was recommended to ensure that the site does not pose any risk to human health or the environment consistent with the proposed use of the site as an operating sawmill open to the public.



Envirochem				TITLE: SITE PLAN SHOWING AREAS OF REMEDIATION	
SUPERVISOR:	LJE/EG	DATE OF WORK:	1995	PROJECT: McLEAN MILL NATIONAL HISTORIC SITE	FIGURE: 1
DRAWN BY:	PW	DATE DRAWN:	27-APR-94		
REVISED BY:	EG	DATE REVISED:	30-JUN-95		
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-02A		

The petroleum hydrocarbon contaminated soil designated for remediation contained mineral oil and grease concentrations above 3% which classified it as a fully regulated Special Waste under the *B.C. Special Waste Regulation.*

The contaminant assessment conducted by Envirochem in 1994 characterized the petroleum hydrocarbon contaminated soils in the mill area as containing a heavy lubrication oil with negligible concentrations of volatile compounds and polycyclic aromatic hydrocarbons (PAHs). On this basis the oil contaminated soil does not pose a significant environmental or human health risk; however, it was recommended that the contaminated soil be excavated and disposed of to prevent possible environmental degradation downgradient or in the adjacent creek and to prevent exposure to the general public.

Potential Impacts of Excavation

The remediation target contaminants in soils were heavy-end petroleum hydrocarbons and metals. Consequently, the release of volatile chemical components was not a significant concern during the excavation. Soils targeted for removal were excavated from approximately 1-2 meters above the groundwater table and therefore no direct contact with the water table was encountered. Stockpiles of excavated contaminated soil material were placed on polyethylene sheeting and covered to prevent rain infiltration and generation of contaminated leachate. No contaminated water was permitted to run-off the site.

Potential exposure to on-site workers was minimized by the use of personnel protective equipment (PPE) and decontamination procedures as detailed in the Health and Safety Plan prepared and provided prior to the commencement of the excavation activities.

An archeologist was on-site during the excavation of soil in the vicinity of the blacksmith shop to record artifacts as they were encountered during the excavation.

Procedures

Material Handling

Soil excavation in areas designated for remediation was carried out by McLean Mill workers under the direction of Envirochem personnel. The soil remediation program at the McLean Mill included: the manual excavation of contaminated soils with the use of a shovels; stockpiling of contaminated soil; stockpile sampling, analysis and classification; transportation and disposal off-site of metal contaminated soils; on-site treatment of petroleum hydrocarbon contaminated soils; confirmatory sampling and analysis to ensure all of soil materials designated contaminated have been removed to the greatest extent practical; and, backfilling of the excavation with clean material, as required.

Soils were generally removed from the upper 0.3 meters of soil and up to 1 meter depth in limited areas in the vicinity of the mill, as required. All of the soils identified as contaminated were located above the groundwater table and thus the excavation did not require dewatering.

Prior to the excavation of each lift, grid cells were marked to identify the designation of material to be removed, as required. Hydrocarbon and metal contaminated materials were segregated and placed in separate stockpiles pending final stockpile soil testing to finalize disposal destinations.

Confirmatory Sampling

Confirmatory samples were taken from the final surfaces of the excavation as the soil removal operation proceeded, to confirm that all soil containing metal concentrations in excess of the BC Environment Level C criteria and petroleum hydrocarbon concentrations which exceed the BC Environment Special Waste levels have been removed to the greatest extent possible. Sampling frequency was based on obtaining a minimum sample support volume of 10 m^3 which generally represents a truck load of material.

Backfilling

Following completion of the excavation activities, the excavation was backfilled with imported clean granular soils meeting the BC Environment Level C criteria. The backfill was compacted and resurfaced in accordance with the requirements of the McLean Mill.

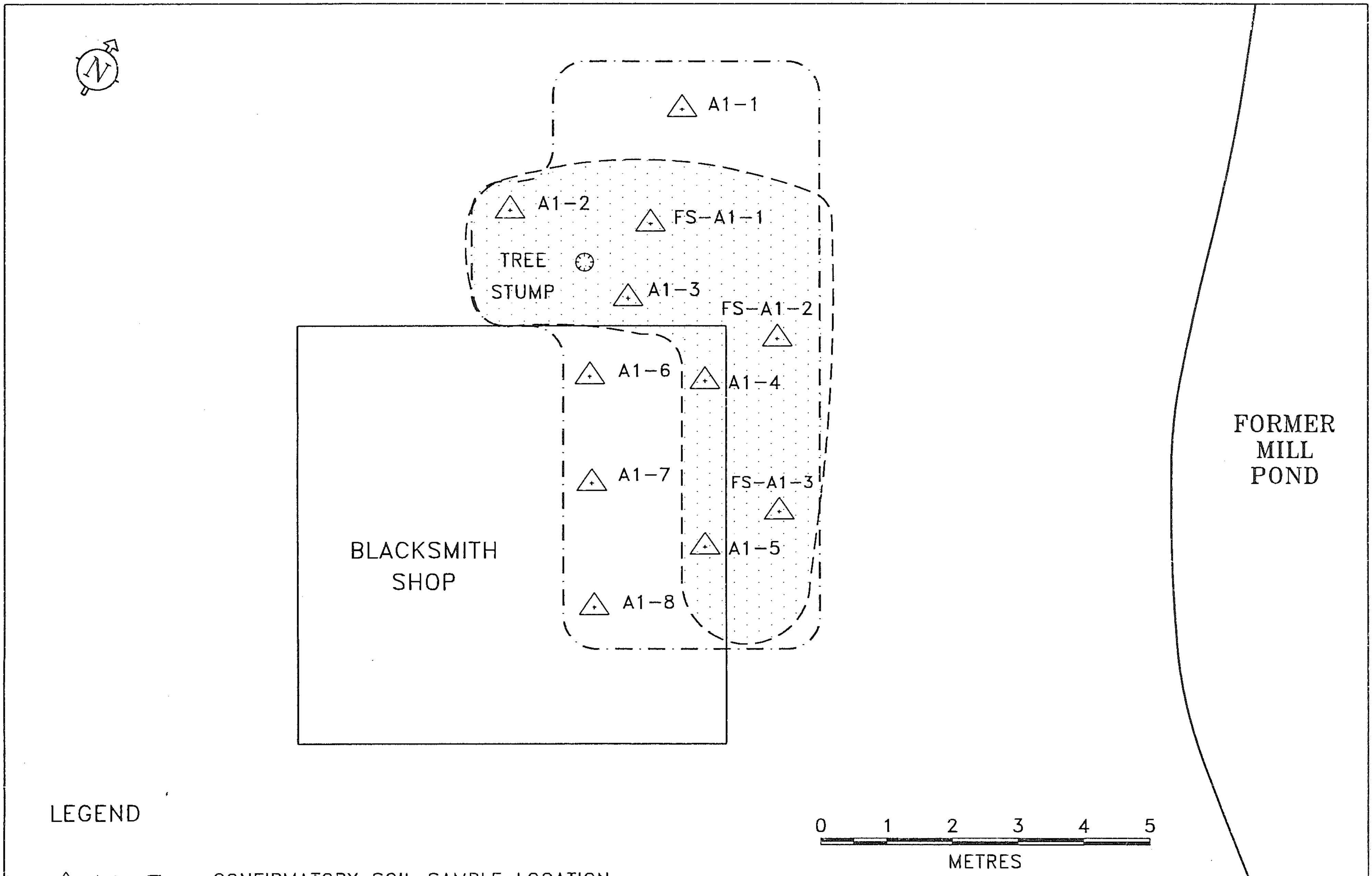
Excavation Activities

Area 1: Blacksmith Shop

The results of the contamination assessment identified several soil samples containing individual metal concentrations, including lead, copper and zinc which were in excess of the CCME and B.C. Environment industrial remediation criteria. The metal contamination was associated with slag/fill materials from the blacksmith operation and could be identified visually as the excavation proceeded. Therefore, detailed in-situ characterization sampling prior to excavation was not deemed necessary. Metal contaminated surface soils in the vicinity of the blacksmith shop were excavated from the northwest exterior corner of the building and from within the enclosed rear of the shop as shown in Figure 2. The total estimated volume of material scraped from the vicinity of the blacksmith shop was approximately 10 m^3. The soil was excavated in 1 x 1 meter grid increments in lifts of 10 cm to a final excavation depth of approximately 30 cm. Excavated soil was screened to ensure all artifacts were recorded by the on-site archeologist.

Confirmatory Sampling Results

The results of confirmatory soil sampling from the walls and the floor of the excavation are shown in Table 1. The soil samples are designated A1-1 to A1-8 as shown in Figure 2. Based on the initial results of metal analysis of composite samples A1-2 + A1-3 and A1-4 + A1-5 which contained zinc concentrations in excess of the B.C. Environment Level C criteria, an additional layer of soil was scraped from the excavation surface. Three confirmatory samples were taken from the final surface (FS-A1-1, FS-A1-2 and FS-A1-3) following the additional excavation. The results indicate that all metal concentrations in the final surface samples were less than Level C. The excavated area was backfilled with clean material.



LEGEND

A1-7 CONFIRMATORY SOIL SAMPLE LOCATION

INITIAL SCRAPE

ADDITIONAL SCRAPE

Envirochem

SUPERVISOR:	LJE/EG	DATE OF WORK:	1995
DRAWN BY:	PW	DATE DRAWN:	30-JUN-95
REVISED BY:		DATE REVISED:	
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-06

TITLE: AREA 1 BLACKSMITH SHOP CONFIRMATORY SAMPLE LOCATIONS

PROJECT: McLEAN MILL NATIONAL HISTORIC SITE

FIGURE: 2

TABLE 1: RESULTS OF METALS ANALYSES
McLean Mill National Historic Site
Soil Samples (ug/g)

Sample ID / Date: 1995 / Sample Type:	A1-1	A1-2& A1-3	A1-4 &A1-5	A1-6	A1-7	A1-8	BC MOE CRITERIA Level B	BC MOE CRITERIA Level C
Date: 1995	21-Feb	21-Feb	21-Feb	21-Feb	28-Feb	28-Feb		
Sample Type:	confirmatory	confirmatory	confirmatory	confirmatory	confirmatory	confirmatory		
Arsenic	<30	<30	<30	<30	<30	<30	30	50
Barium	569	1760	503	75	279	140	500	2000
Cadmium	<0.25	1.1	1	<0.25	<0.25	0.3	5	20
Chromium	32	36	24	97	78	98	250	800
Cobalt	10	11	9	26	27	34	50	300
Copper	93	200	95	105	119	154	100	500
Lead	99	803	735	4	39	171	500	1000
Mercury	0.011	0.086	0.077	0.042	0.026	0.094	2	10
Molybdenum	<4	<4	<4	<4	<4	<4	10	40
Nickel	24	37	28	28	55	63	100	500
Selenium	<3	<3	<3	<3	<3	<3	3	10
Silver	<2	<2	<2	<2	<2	<2	20	40
Tin	22	190	98	7	11	69	50	300
Zinc	51	1690	3880	90	134	107	500	1500

Exceeds BC MOE Level B Criteria
Exceeds BC MOE Level C Criteria

TABLE 1: RESULTS OF METALS ANALYSES
McLean Mill National Historic Site
Soil Samples (ug/g)

Sample ID	SA1 -(1,2,3)	SA1-4	FS-A1-1	FS-A1-2	FS-A1-3	BC MOE CRITERIA	
Date: 1995	21-Feb	28-Feb	25-Mar	25-Mar	25-Mar	Level B	Level C
Sample Type:	stockpile	stockpile	final surface	final surface	final surface		
Arsenic	<30	<30	<30	<30	<30	30	50
Barium	587	642	1150	156	81	500	2000
Cadmium	1.1	<0.25	<0.25	0.33	<0.25	5	20
Chromium	68	30	30	81	81	250	800
Cobalt	16	12	9	23	26	50	300
Copper	205	101	162	111	108	100	500
Lead	634	114	86	251	16	500	1000
Mercury	0.084	0.018	0.012	0.06	0.085	2	10
Molybdenum	<4	<4	<4	<4	<4	10	40
Nickel	62	27	37	49	50	100	500
Selenium	<3	<3	<3	<3	<3	3	10
Silver	<2	<2	<2	<2	<2	20	40
Tin	213	12	11	<5	7	50	300
Zinc	1490	90	81	117	105	500	1500

Exceeds BC MOE Level B Criteria
Exceeds BC MOE Level C Criteria

(LE/3791TBL/1.xl)

Stockpile Sampling Results

Excavated soil was placed on a lined, bermed pad and covered with polyethylene pending the receipt of the stockpile sample analysis results. Composite samples of the excavated material (SA1-1+SA1-2+SA1-3) as well as a discrete grab sample SA1-4 were analyzed for metals. The results are shown in Table 1. The excavated material was found to contain metal concentrations below the BC Environment Level C criteria and was therefore disposed of at the Port Alberni Regional Landfill. Written approval was obtained from BC Environment and the Port Alberni Regional Landfill prior to disposal of the metal contaminated soil.

Area 2: Grease Pit

Based on the results of the previous contaminant assessment, soils beneath the grease rack contained mineral oil and grease concentrations in excess of the B.C. Ministry of Environment Special Waste levels. Approximately 5 m^3 of petroleum hydrocarbon contaminated soil was excavated in the vicinity of the grease pits.

Confirmatory Sampling Results

The confirmatory sampling results are shown in Table 2 and sampling locations are shown in Figure 3. Following the initial excavation in the grease pit area, confirmatory samples denoted GP-1 to GP- 7 were taken to determine the extent of residual contamination. Based on the initial sampling results, additional excavation beneath the grease pit was conducted. Final surface confirmatory samples were taken following the additional excavation (FS-A2-1, FS-A2-2, and FS-A2-3) and indicate that residual soil concentrations of mineral oil and grease are less than the BC Environment Level C criteria. On the basis of these results, the excavated area was backfilled with clean soil material.

Stockpile Sampling Results

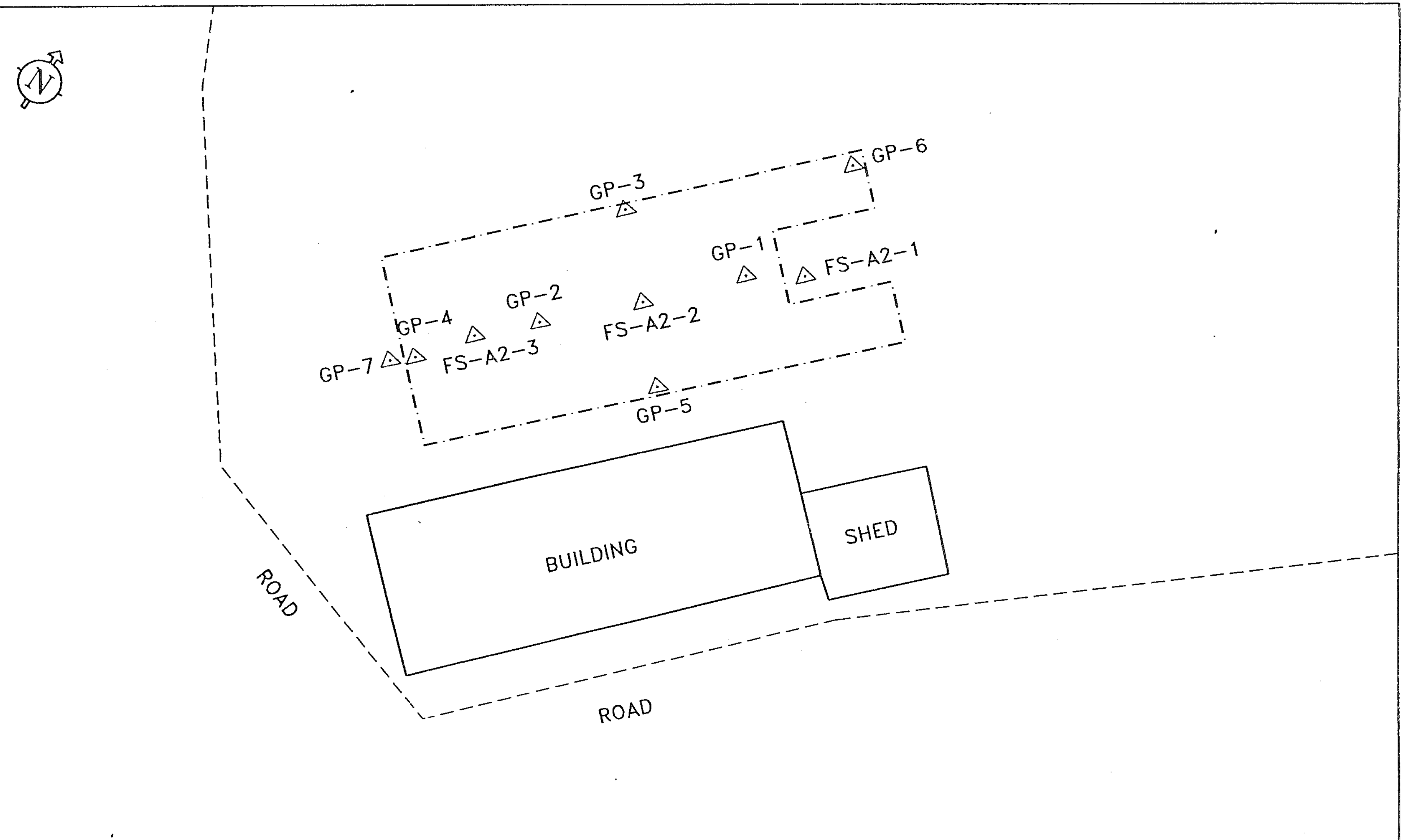
The results of the mineral oil and grease analysis of the stockpile composite sample GP-8-9C is shown in Table 2. Based on the composite sample results, the concentration of mineral oil and grease in the excavated material is in excess of the Special Waste level which classifies the soil as a Section 41.1 'Hydrocarbon Contaminated Soil'.

TABLE 2: RESULTS OF MINERAL OIL & GREASE, and TPH ANALYSES
McLean Mill National Historic Site
Soil Samples (mg/kg)

Sample ID	Date	Sample Type	Mineral Oil & Grease	Total Petroleum Hydrocarbons
GP - 1	17-Mar-95	Grease pit confirmatory	29,900	-
GP - 2	17-Mar-95	Grease pit confirmatory	950	-
GP - 3	17-Mar-95	Grease pit confirmatory	18,000	-
GP - 4	17-Mar-95	Grease pit confirmatory	8,550	-
GP - 5	17-Mar-95	Grease pit confirmatory	77,300	-
GP - 6	17-Mar-95	Grease pit confirmatory	32,800	-
GP - 7	17-Mar-95	Grease pit confirmatory	669	-
GP - 8 - 9C	17-Mar-95	Stockpile composite	64,200	-
FS - A2 - 1	25-Mar-95	Grease pit final surface	403	-
FS - A2 -2	25-Mar-95	Grease pit final surface	785	-
FS - A2 -3	25-Mar-95	Grease pit final surface	1,720	-
A3 - C (1,2,3)	27-Feb-95	Cell 1 stockpile composite	148,000	-
A3 - 4	27-Feb-95	Confirmatory 0.5 - 0.7	238,000	-
SP3 - C	17-Mar-95	Cell 3 composite	179,000	61,100
M - 1	17-Mar-95	Mill confirmatory	280,000	67,700
M - 2	17-Mar-95	Mill confirmatory	10,700	-
M - 3	17-Mar-95	Mill confirmatory	92,800	-
M - 4	17-Mar-95	Mill confirmatory	196,000	-
M - 5	17-Mar-95	Mill confirmatory	212,000	-
M - 6	17-Mar-95	Mill confirmatory	12,000	-
M - 7	17-Mar-95	Mill confirmatory	126,000	-
M - 8	17-Mar-95	Mill confirmatory	143,000	-
M - 9	17-Mar-95	Mill confirmatory	121,000	-
FS - A3 - 1	25-Mar-95	Mill final surface	134,000	-
FS - A3 - 2	25-Mar-95	Mill final surface	17,500	-
FS - A3 - 3	25-Mar-95	Mill final surface	808	-
FS - A3 - 4	25-Mar-95	Mill final surface	19,500	-
FS - A3 - 5	25-Mar-95	Mill final surface	53,000	-
FS - A3 -6	25-Mar-95	Mill final surface	28,600	-
FS - A3 - 7	25-Mar-95	Mill final surface	69,200	11,900
FS - A3 - 8	25-Mar-95	Mill final surface	71,200	-
FS - A3 - 9	25-Mar-95	Mill final surface	67,400	-
FS - A3 - 10	25-Mar-95	Mill final surface	29,200	-
FS - A3 - 11	25-Mar-95	Mill final surface	28,800	-
BC MOE Criteria				
Level B			1,000	400
Level C			5,000	2,000
Special Waste			30,000	-

Exceeds BC MOE Level B Criteria
Exceeds BC MOE Level C Criteria
Exceeds BC MOE Special Waste Level

(LE/ts/3791TBL/2.xl)



0 1 2 3 4 5

METRES

LEGEND

△ GP-1 CONFIRMATORY SOIL SAMPLE LOCATION

—·—·—·— SCRAPED AREA

EXCAVATED TO 0.3 metres DEPTH

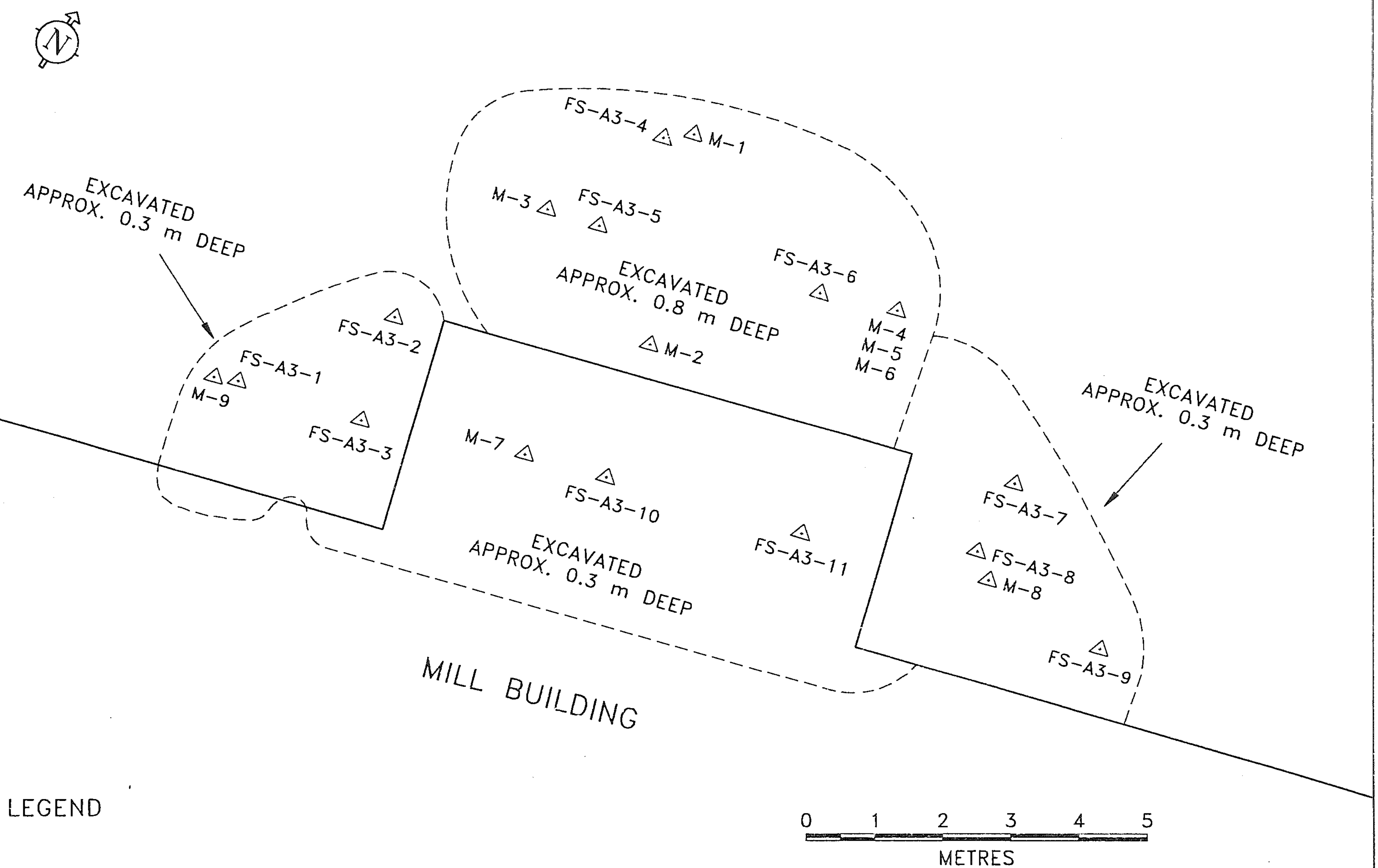
Envirochem				TITLE: AREA 2 GREASE PIT CONFIRMATORY SAMPLE LOCATIONS	
SUPERVISOR:	LJE/EG	DATE OF WORK:	1995	PROJECT: McLEAN MILL NATIONAL HISTORIC SITE	FIGURE: 3
DRAWN BY:	PW	DATE DRAWN:	30-JUN-95		
REVISED BY:		DATE REVISED:			
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-07		

Area 3: Mill Area

Based on the contaminant assessment results petroleum hydrocarbon contaminated soil, in excess of the B.C. Special Waste level of 3%, was found in the vicinity of the mill area adjacent to the secondary steam engine to a depth up to 0.3 meters. Upon excavation, it was discovered that the petroleum hydrocarbon contamination was present to depths of up to one meter in limited areas and extended in discontinuous thin layers beneath the mill. Following a week of difficult manual excavation to depths up to 0.8 meters, a decision was made to cease the excavation and leave the residual contamination in place due to concerns regarding the structural integrity of mill piles. The original objective of removing the petroleum hydrocarbon contaminated soil was to remove any risk to the public from contaminated surficial soils as well as to minimize the risk of degrading the downgradient surface drainage creek water quality from contaminated surface runoff. These risks have been minimized by excavating the contaminated surface soils and therefore should not pose a further source of concern. As mentioned earlier, the oil contaminated soil contains a heavy weathered oil and does not contain volatile compounds or significant concentrations of PAHs minimizing potential impacts to human health and the environment. The excavation was backfilled with clean, relatively low permeability material reducing infiltration from precipitation.

Confirmatory Sampling Results

The confirmatory sampling results are shown in Table 2. The sampling locations are shown in Figure 4. Following the initial excavation to a depth of approximately 0.3 meters in the mill area, confirmatory samples denoted M-1 to M-9 were taken to determine the severity and extent of remaining contamination. Based on the initial sampling results, seven of the nine samples analyzed contained a mineral oil and grease concentration in excess of the Special Waste level of 3% and therefore additional excavation was conducted. Final surface confirmatory samples were taken following the additional excavation (FS-A3-1 to FS-A3-11) and indicate that the average residual soil concentrations of mineral oil and grease is 5 % (generally 1.75% to 6.92%).



LEGEND

△ M-1 CONFIRMATORY SOIL SAMPLE LOCATION

- - - - - - - SCRAPED AREA

Envirochem

TITLE: AREA 3 MILL AREA CONFIRMATORY SAMPLE LOCATIONS

SUPERVISOR:	LJE/EG	DATE OF WORK:	1995
DRAWN BY:	PW	DATE DRAWN:	30-JUN-95
REVISED BY:		DATE REVISED:	
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-08

PROJECT: McLEAN MILL NATIONAL HISTORIC SITE

FIGURE: 4

Stockpile Sampling Results

The results of the mineral oil and grease and total petroleum hydrocarbon (TPH) analyses of the stockpile composite samples A3-C(1,2,3) and SP3-C are shown in Table 2. The results of the composite sample analysi indicated that some soil in the vicinity of the mill area contained mineral oil and grease concentrations in excess of 10%. However, further analysis to determine the concentration of Total Petroleum Hydrocarbons (TPH) suggests that less than one third of the mineral oil and grease concentration is contributed from petroleum hydrocarbons and the remainder is likely contributed by the high organic content of the soil. On this basis, the soil could be classified as a Special Waste 'Hydrocarbon Contaminated Soil' in accordance with Section 41.1 of the *Special Waste Regulation* which contains a provision for the treatment of the contaminated soils on-site.

On-Site Bioremediation

The excavated soil from the area of the grease pit and the mill were placed into a bioremediation treatment cell on the site. The treatment cell was constructed with a heavy polyethylene liner and bermed using logs. The polyethylene liner is continuous with no seams. Sheets of plywood were placed on top of the liner to protect the plastic when the soil pile is turned. The contaminated soil was placed on top of the plywood, properly sloped to enhance surface runoff and covered with a clear polyethylene sheet to prevent infiltration of precipitation.

Soil amendments were added by McLean Mill staff under the direction of Envirochem and included ammonium nitrate and ammonium phosphate fertilizers, cow manure, wood chips and water, as required.

Ongoing bioremediation activities would include: uncovering the soil pile to expose the contaminated soils to direct sunlight in order to enhance aeration and photolysis; ensuring the soil pile is covered with the polyethylene liner during inclement weather; tilling the soil approximately every two weeks, adjusting the moisture and pH of the soil pile as necessary, and; collecting composite samples in the fall to monitor the progress of the bioremediation program.

LABORATORY ANALYSIS

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	March 10, 1995
Date of Sampling:	February 27, 1995
Date of Analysis:	March 3, 1995
Report On:	Gravimetric Mineral Oil and Grease (Sediment)
Project:	McLean Mill #3791
Attention:	Linda Eastcott

Methodology:
The samples are extracted for 4 hours with hexane/acetone in a soxhlet extractor. The extract is cleaned up by silica gel, rota-evaporated to dryness and weighed to determine gravimetric mineral oil and grease.

Results of Analysis:
Results are presented in the attached table.

Mike Zitka BSc
Environmental Scientist
ENVIROCHEM ANALYTICAL DEPARTMENT

RESULTS OF ANALYSIS

SAMPLE IDENTIFICATION	Mineral Oil and Grease (mg/Kg of dry sample)
A3 - C (1,2,3)	148 000
A3 - 4	238 000
Blank	< 100
Spike	93% Recovery

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	March 17, 1995
Date of Sampling:	March 9, 1995
Date of Analysis:	March 16, 1995
Report On:	Total Petroleum Hydrocarbons in Sediment
Project:	City of Pt. Alberni -McLean Mill, #3790
Attention:	James Smith

Methodology:
The samples are extracted for 4 hours with hexane/acetone in a soxhlet extractor. The extracts are cleaned up by silica gel, evaporated to dryness and made up to volume with hexane. The final extracts are analyzed using a Hewlett-Packard 5890 Series II gas chromatograph equipped with a flame ionization detector. Petroleum hydrocarbons are quantified by use of a diesel fuel standard.

Results of Analysis:
Results are presented in the attached table. The chromatograms of sample M-1 and SP3-C resemble the bunker C oil standard except for the absence of the lighter hyrocarbons (C11-C16). These samples might be contaminated with weathered bunker C or some waste oil with similar temperature distillation range.

Fragrance Chen
Analytical Chemist
ENVIROCHEM SERVICES ANALYTICAL DEPARTMENT

RESULTS OF ANALYSIS

SAMPLE IDENTIFICATION	TPH (mg/Kg of dry sample)
M-1	67,700
SP3-C	61,100
Blank	<20
Spike	84%

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	March 21, 1995
Date of Sampling:	March 17, 1995
Date of Analysis:	March 21, 1995
Report On:	Gravimetric Mineral Oil and Grease (Sediment)
Project:	City of Pt. Alberni, #3790
Attention:	Linda Eastcott

Methodology:
The samples are extracted for 4 hours with hexane/acetone in a soxhlet extractor. The extract is cleaned up by silica gel, rota-evaporated to dryness and weighed to determine gravimetric mineral oil and grease.

Results of Analysis:
Results are presented in the attached table.

Mike Zitka BSc
Environmental Scientist
ENVIROCHEM ANALYTICAL DEPARTMENT

RESULTS OF ANALYSIS

SAMPLE IDENTIFICATION	Mineral Oil and Grease (mg/Kg of dry sample)
M - 1	280, 000
M - 2	10, 700
M - 3	92, 800
M - 4	196, 000
M - 5	212, 000
M - 6	12, 000
M - 7	126, 000
M - 8	143, 000
M - 9	121, 000
SP - 3 - C	179, 000
GP - 1	29, 900
GP - 2	950
GP - 3	18, 000
GP - 4	8, 550
GP - 5	77, 300
GP - 6	32, 800
GP - 7	669
GP - 8 - 9C	64, 200
GP - 8 - 9C duplicate	60, 300
Blank	< 100
Spike	98% Recovery

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report:	March 31, 1995
Date of Sampling:	March 25, 1995
Date of Analysis:	March 27, 1995
Report On:	Gravimetric Mineral Oil and Grease (Sediment)
Project:	City of Port Alberni - McClean Mill, # 3790
Attention:	Linda Eastcott

Methodology:
The samples are extracted for 4 hours with hexane/acetone in a soxhlet extractor. The extract is cleaned up by silica gel, evaporated to dryness, and weighed to determine gravimetric mineral oil and grease.

Results of Analysis:
Results are presented in the attached table.

Brian S. Custer BSc
Environmental Scientist
ENVIROCHEM ANALYTICAL DEPARTMENT

Results of Analysis:

Sample Identification	Mineral Oil and Grease (mg/Kg of dry sample)
FS-A2-1	403
FS-A2-1 Duplicate	542
FS-A2-2	785
FS-A2-3	1, 720
FS-A3-1	134, 000
FS-A3-2	17, 500
FS-A3-3	808
FS-A3-4	19, 500
FS-A3-5	53, 000
FS-A3-6	28, 600
FS-A3-6 Duplicate	33, 700
FS-A3-7	69, 200
FS-A3-8	71, 200
FS-A3-9	67, 400
FS-A3-10	29, 200
FS-A3-11	28, 800
Blank	< 100
Spike	98% Recovery

Envirochem Special Projects Inc.
310 EAST ESPLANADE
NORTH VANCOUVER, B.C.
V7L 1A4

CHEMICAL ANALYSIS REPORT

Date of Report: March 31, 1995

Date of Sampling: March 25, 1995

Date of Analysis: March 30, 1995

Report On: Total Petroleum Hydrocarbons in Sediment

Project: City of Pt. Alberni -McLean Mill, #3790

Attention: Linda Eastcott

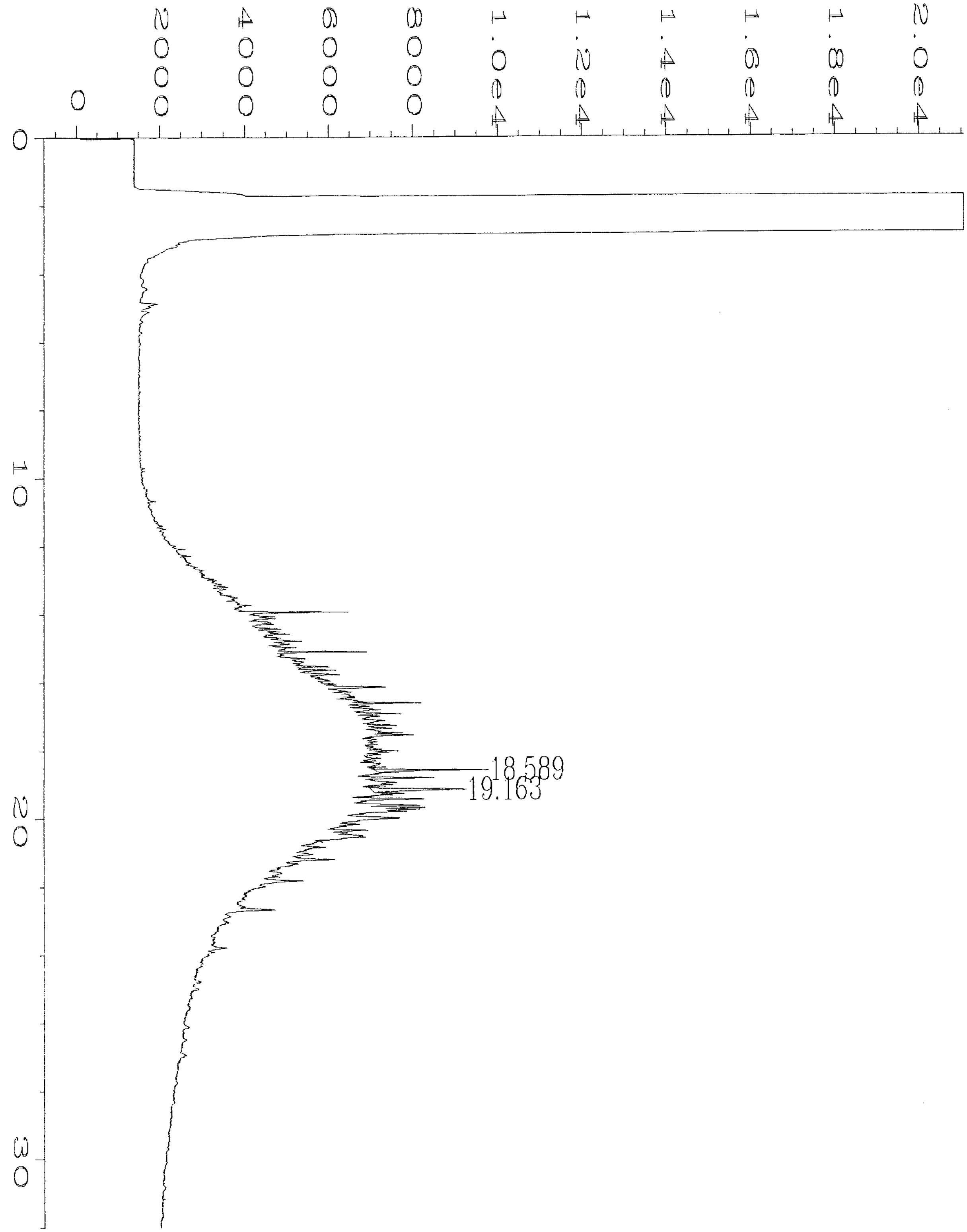
Methodology:
The samples are extracted for 4 hours with hexane/acetone in a soxhlet extractor. The extracts are cleaned up by silica gel, evaporated to dryness and made up to volume with hexane. The final extracts are analyzed using a Hewlett-Packard 5890 Series II gas chromatograph equipped with a flame ionization detector. Petroleum hydrocarbons are quantified by use of a diesel fuel standard.

Results of Analysis:
Results are presented in the attached table. The chromatogram of sample FS-A3-7 resembles the bunker C oil standard except for the absence of the lighter hyrocarbons (C11-C16). This sample might be contaminated with weathered bunker C or some waste oil with similar temperature distillation range.

SAMPLE IDENTIFICATION	TPH (mg/Kg of dry sample)
FS-A3-7	11,900

Fragrance Chen
Analytical Chemist
ENVIROCHEM SERVICES ANALYTICAL DEPARTMENT

TPH #3790 Mclean Mill
city of Pt. Alberni



ata File Name	: D:\HPCHEM\1\DATA\DDAC\H0082B.D		
Operator	: Fragrance	Page Number	: 1
Instrument	: GC1	Vial Number	:
ample Name	: #3790 FS-A3-7	Injection Number	:
Run Time Bar Code	:	Sequence Line	:
Acquired on	: 30 Mar 95 02:05 PM	Instrument Method	: H-C.MTH
eport Created on	: 30 Mar 95 02:37 PM	Analysis Method	: H-C.MTH
ast Recalib on	: 05 AUG 93 02:21 PM	Sample Amount	: 0
Multiplier	: 1	ISTD Amount	:

Envirochem

RECEIVED APR 19 1995

Analysis Report

CANTEST

CanTest Ltd

Professional
Analytical
Services

1523 West 3rd Ave
Vancouver, BC
V6J 1J8

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Envirochem Services
310 East Esplanade
North Vancouver, B.C.
V7L 1A4

Att'n: Ms. Linda Eastcott

PROJECT NUMBER: 3790
P.O. NUMBER: 225953

NUMBER OF SAMPLES: 3

REPORT DATE: March 31, 1995

DATE SUBMITTED: March 27, 1995

GROUP NUMBER: 5032706

SAMPLE TYPE: Soil

TEST METHODS:

Metals in Soil - Undried representative samples were digested with a mixture of nitric acid and hydrochloric acid ("Aqua Regia"). Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described. Moisture was determined gravimetrically at 105 C on a separate sample portion.

Cadmium in Soil - Analysis by background-corrected Flame Atomic Absorption Spectrophotometry.

Lead in Soil - Analysis by background-corrected Flame Atomic Absorption Spectrophotometry.

Mercury in Soil - Analysis by Cold Vapour Atomic Absorption Spectrophotometry.

Selenium in Soil - Analysis by Zeeman background-corrected Graphite Furnace Atomic Absorption Spectrophotometry.

TEST RESULTS:

(See following page)

CAN TEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: Envirochem Services

REPORT DATE: March 31, 1995

GROUP NUMBER: 5032706

CANTEST

Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		FS-A1-1	FS-A1-2	FS-A1-3	DETECTION LIMIT	UNITS
DATE SAMPLED:		Mar 25/95	Mar 25/95	Mar 25/95		
CAN TEST ID:		503270013	503270014	503270015		
Metals Analysis						
Moisture		48.4	25.7	14.8	0.01	%
Arsenic	As	<	<	<	30	μg/g
Barium	Ba	1150	156	81	0.1	μg/g
Cadmium	Cd	<	0.33	<	0.25	μg/g
Chromium	Cr	30	81	81	2	μg/g
Cobalt	Co	9	23	26	1	μg/g
Copper	Cu	162	111	108	1	μg/g
Lead	Pb	86	251	16	1	μg/g
Mercury	Hg	0.012	0.060	0.085	0.001	μg/g
Molybdenum	Mo	<	<	<	4	μg/g
Nickel	Ni	37	49	50	2	μg/g
Selenium	Se	<	<	<	3	μg/g
Silver	Ag	<	<	<	2	μg/g
Tin	Sn	11	<	7	5	μg/g
Zinc	Zn	81	117	105	1	μg/g
Aluminum	Al	19100	37600	30200	10	μg/g
Antimony	Sb	<	<	<	10	μg/g
Beryllium	Be	<	<	<	1	μg/g
Boron	B	83	23	24	0.5	μg/g
Calcium	Ca	151000	5800	7350	1	μg/g
Iron	Fe	44400	58500	62200	2	μg/g
Magnesium	Mg	9340	13200	12100	0.1	μg/g
Manganese	Mn	5710	1120	1050	0.2	μg/g
Phosphorus	PO4	15900	1300	790	20	μg/g
Sodium	Na	1090	158	407	5	μg/g
Strontium	Sr	718	15	23	0.1	μg/g
Titanium	Ti	97	1230	548	0.3	μg/g
Vanadium	V	50	124	123	0.5	μg/g

% = percent

< = Less than detection limit

μg/g = micrograms per gram, on a dry weight basis.

CANTEST

QUALITY ASSURANCE / QUALITY CONTROL DATA

CANTEST

Client: Envirochem Services
File: 5032706
Date: March 28, 1995

Sample I.D.		503270015 FS–A1–3	503270015' FS–A1–3 Duplicate	503270015 FS–A1–3 Average	RPD	Detection Limit
% Moisture	H2O	14.8%	–	14.8%		
Arsenic	As	<	<	<		30
Barium	Ba	82	80	81	2.6%	0.1
Cadmium	Cd	<	<	<		0.25
Chromium	Cr	82	80	81	3.5%	2
Cobalt	Co	28	25	26	13%	1
Copper	Cu	110	107	108	2.6%	1
Lead	Pb	14	17	15	17%	1
Mercury	Hg	0.089	0.080	0.085	11%	0.001
Molybdenum	Mo	<	<	<		4
Nickel	Ni	54	46	50	15%	2
Selenium	Se	<	<	<		3
Silver	Ag	<	<	<		2
Tin	Sn	6	7	7	20%	5
Zinc	Zn	113	98	105	14%	1
Aluminum	Al	32300	28100	30200	14%	10
Antimony	Sb	<	<	<		10
Beryllium	Be	<	<	<		1
Boron	B	27	21	24	22%	0.5
Calcium	Ca	7750	6950	7350	11%	1
Iron	Fe	64200	60200	62200	6.3%	2
Magnesium	Mg	12500	11600	12100	7.1%	0.1
Manganese	Mn	1064	1036	1050	2.6%	0.2
Phosphorus	PO4	810	770	790	5.2%	20
Sodium	Na	419	394	407	5.9%	5
Strontium	Sr	23	23	23	0.3%	0.1
Titanium	Ti	528	568	548	7.3%	0.3
Vanadium	V	122	124	123	1.2%	0.5

All results expressed as micrograms per gram (μg/g) on a dry weight basis.

QA/QC 2B DUPLICAT\5032706.WK1

CANTEST

Client: Envirochem Services
File: 5032706
Date: March 28, 1995

Cantest I.D. / Client I.D.		Digestion Blank #1	Digestion Blank #2	Digestion Blank #3	Detection Limit
Aluminum	Al	<	<	<	0.15
Antimony	Sb	<	<	<	0.15
Arsenic	As	<	<	<	0.01
Barium	Ba	0.024	0.013	0.003	0.001
Beryllium	Be	<	<	<	0.006
Boron	B	0.07	0.04	0.05	0.010
Cadmium	Cd	<	<	<	0.005
Calcium	Ca	0.06	0.06	0.04	0.01
Chromium	Cr	<	<	<	0.03
Cobalt	Co	<	<	<	0.02
Copper	Cu	<	<	<	0.015
Iron	Fe	0.19	0.05	<	0.030
Lead	Pb	<	<	<	0.08
Magnesium	Mg	0.01	0.01	0.01	0.001
Manganese	Mn	0.01	0.02	<	0.003
Mercury	Hg	<	<	<	0.0002
Molybdenum	Mo	<	<	<	0.04
Nickel	Ni	<	<	<	0.025
Phosphorus	PO4	<	<	<	0.4
Potassium	K	<	<	<	1
Selenium	Se	<	<	<	0.05
Silver	Ag	<	<	<	0.03
Sodium	Na	<	0.1	<	0.1
Strontium	Sr	<	<	<	0.001
Tin	Sn	<	<	<	0.03
Titanium	Ti	0.026	0.008	<	0.006
Vanadium	V	<	<	<	0.010
Zinc	Zn	0.03	<	<	0.015

Results expressed as milligrams per litre (mg/L).

< = Less than

QA/QC 28 BLANKS\03-28.WK1

CANTEST

Client: Envirochem Services
File: 5032706
Date: March 28, 1995

National Research Council Canada (NRC)
Certified Reference Material

PACS–1

COMPONENT		RESULT	PERCENT RECOVERY	CERTIFIED VALUE
Major Components (%)				
Silica	SiO2	–		55.7 ±0.5
Alumina	Al2O3	5.14	42%	12.23 ±0.22
Iron	Fe2O3	6.61	95%	6.96 ±0.12
Calcium	CaO	1.72	59%	2.92 ±0.09
Magnesium	MgO	1.94	80%	2.41 ±0.09
Sodium	Na2O	2.48	56%	4.40 ±0.11
Potassium	K2O	0.60	40%	1.50 ±0.09
L.O.I.		–		
Trace Components (ug/g)				
Antimony	Sb	25	15%	171. ±14.
Arsenic	As	180	85%	211. ±11.
Barium	Ba	405		–
Beryllium	Be	<3.0		–
Boron	B	74		–
Cadmium	Cd	2.45	103%	2.38 ±0.20
Chromium	Cr	57.0	50%	113. ±8.
Cobalt	Co	16.0	91%	17.5 ±1.1
Copper	Cu	460	102%	452. ±16.
Lead	Pb	414	103%	404. ±20.
Manganese	Mn	340	72%	470. ±12.
Mercury	Hg	3.90	85%	4.57 ±0.16
Molybdenum	Mo	5.5	43%	12.9 ±0.9
Nickel	Ni	33.0	75%	44.1 ±2.0
Phosphorous	PO4	3050	98%	3110. ±240.
Selenium	Se	<1.0		1.09 ±0.11
Silver	Ag	<15		–
Strontium	Sr	100.0	36%	277. ±11.
Tin	Sn	21.5	52%	41.1 ±3.1
Titanium	Ti	1900	45%	4210. ±66.
Vanadium	V	95	75%	127. ±5.
Zinc	Zn	850	103%	824. ±22.

< = Not detected
% = Percent
μg/g = micrograms per gram

QA/QC 28 PACS1\03–28.WK1

AND CHAIN OF CUSTODY FORM

ENVIROCHEM SPECIAL PROJECTS INC.
310 East Esplanade North Vancouver, B.C.
Tel: (604) 986-0233, Fax: (604) 986-8583

To: CANTEST

Attention: DON NOOT

Project No: 3790

Envirochem Contact: LINDA EASTCOTT

Purchase Order: 225953

Date: 27/3/95

Results required by: Mar. 31/95

Number of Samples: Water ______ Sediment 3 Other ______

Sample Identification	Sample Date	Sample Type	Parameter					Detect. Level
FS-A1-1	25/3/95	SOIL	METALS					
FS-A1-2	✓	✓	✓					
FS-A1-3	✓	✓	✓					

Date	Time	Relinquished By (Name & Affil.)	Relinquished To (Name & Affil.)
27/3/95	09:00	[signature]	[signature] @ CTL

N.B. Analyses are to be conducted as per " Sample Transmittal Notes " (see over).

Special Instructions: ______

RECEIVED MAR 3 1995

Analysis Report

CANTEST

CanTest Ltd

Professional
Analytical
Services

1523 West 3rd Ave
Vancouver, BC
V6J 1J8

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Envirochem Services
310 East Esplanade
North Vancouver, B.C.
V7L 1A4

Att'n: Ms. Linda Eastcott

PROJECT NUMBER: 3790

NUMBER OF SAMPLES: 5

REPORT DATE: February 27, 1995

DATE SUBMITTED: February 22, 1995

GROUP NUMBER: 5022223

SAMPLE TYPE: Soil

TEST METHODS:

Metals in Soil - Undried representative samples were digested with a mixture of nitric acid and hydrochloric acid ("Aqua Regia"). Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described. Moisture was determined gravimetrically at 105 C on a separate sample portion.

Cadmium in Soil - Analysis by background-corrected Flame Atomic Absorption Spectrophotometry.

Lead in Soil - Analysis by background-corrected Flame Atomic Absorption Spectrophotometry.

Mercury in Soil - Analysis by Cold Vapour Atomic Absorption Spectrophotometry.

Selenium in Soil - Analysis by Zeeman background-corrected Graphite Furnace Atomic Absorption Spectrophotometry.

TEST RESULTS:

(See following pages)

CAN TEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: Envirochem Services

REPORT DATE: February 27, 1995

GROUP NUMBER: 5022223

CANTEST

Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		A1-1	A1-2 & A1-3	A1-4 & A1-5	SA1-1 & SA1-2 & SA1-3		
DATE SAMPLED:		Feb 21/95	Feb 21/95	Feb 21/95	Feb 21/95	DETECTION LIMIT	UNITS
CAN TEST ID:		502220053	502220054	502220055	502220056		
Metals Analysis							
Moisture		60.6	52.0	69.0	43.3	0.01	%
Arsenic	As	<	<	<	<	30	μg/g
Barium	Ba	569	1760	503	587	0.1	μg/g
Cadmium	Cd	<	1.1	1.0	1.1	0.25	μg/g
Chromium	Cr	32	36	24	68	2	μg/g
Cobalt	Co	10	11	9	16	1	μg/g
Copper	Cu	93	200	95	205	1	μg/g
Lead	Pb	99	803	735	634	1	μg/g
Mercury	Hg	0.011	0.086	0.077	0.084	0.001	μg/g
Molybdenum	Mo	<	<	<	<	4	μg/g
Nickel	Ni	24	37	28	62	2	μg/g
Selenium	Se	<	<	<	<	3	μg/g
Silver	Ag	<	<	<	<	2	μg/g
Tin	Sn	22	190	98	213	5	μg/g
Zinc	Zn	51	1690	3880	1490	1	μg/g
Aluminum	Al	18400	28700	13400	21800	10	μg/g
Antimony	Sb	<	83	85	40	10	μg/g
Beryllium	Be	<	<	<	<	1	μg/g
Boron	B	44	64	44	68	0.5	μg/g
Calcium	Ca	79100	140000	33400	58600	1	μg/g
Iron	Fe	27000	49400	51400	88700	2	μg/g
Magnesium	Mg	5400	12600	4750	9520	0.1	μg/g
Manganese	Mn	2710	7420	2600	3100	0.2	μg/g
Phosphorus	PO4	8240	22600	8730	8300	20	μg/g
Sodium	Na	991	819	624	978	5	μg/g
Strontium	Sr	388	696	202	304	0.1	μg/g
Titanium	Ti	415	210	711	271	0.3	μg/g
Vanadium	V	55	60	41	67	0.5	μg/g

% = percent
< = Less than detection limit

μg/g = micrograms per gram, on a dry weight basis.

REPORTED TO: Envirochem Services

REPORT DATE: February 27, 1995

GROUP NUMBER: 5022223

CANTEST

Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		A1-6		
DATE SAMPLED:		Feb 21/95		
CAN TEST ID:		502220057	DETECTION LIMIT	UNITS
Metals Analysis				
Moisture		16.9	0.01	%
Arsenic	As	<	30	μg/g
Barium	Ba	75	0.1	μg/g
Cadmium	Cd	<	0.25	μg/g
Chromium	Cr	97	2	μg/g
Cobalt	Co	26	1	μg/g
Copper	Cu	105	1	μg/g
Lead	Pb	4	1	μg/g
Mercury	Hg	0.042	0.001	μg/g
Molybdenum	Mo	<	4	μg/g
Nickel	Ni	28	2	μg/g
Selenium	Se	<	3	μg/g
Silver	Ag	<	2	μg/g
Tin	Sn	7	5	μg/g
Zinc	Zn	90	1	μg/g
Aluminum	Al	55300	10	μg/g
Antimony	Sb	<	10	μg/g
Beryllium	Be	<	1	μg/g
Boron	B	28	0.5	μg/g
Calcium	Ca	6620	1	μg/g
Iron	Fe	76000	2	μg/g
Magnesium	Mg	12700	0.1	μg/g
Manganese	Mn	1020	0.2	μg/g
Phosphorus	PO4	880	20	μg/g
Sodium	Na	183	5	μg/g
Strontium	Sr	14	0.1	μg/g
Titanium	Ti	1460	0.3	μg/g
Vanadium	V	149	0.5	μg/g

% = percent
< = Less than detection limit

μg/g = micrograms per gram, on a dry weight basis.

CANTEST

QUALITY ASSURANCE / QUALITY CONTROL DATA

CANTEST

Client: Envirochem Services
File: 5022223
Date: February 22, 1995

Sample I.D.		502220054 A1-2 & A1-3	502220054' A1-2 & A1-3 Duplicate	502220054 A1-2 & A1-3 Average	RPD	Detection Limit
% Moisture	H2O	52.0%	–	52.0%		
Arsenic	As	<	<	<		30
Barium	Ba	1800	1720	1760	4.7%	0.1
Cadmium	Cd	1.1	0.91	1.0	23%	0.25
Chromium	Cr	36	36	36	0.1%	2
Cobalt	Co	10	12	11	15%	1
Copper	Cu	208	192	200	8.0%	1
Lead	Pb	1080	526	803	69%	1
Mercury	Hg	0.089	0.083	0.086	7.7%	0.001
Molybdenum	Mo	<	<	<		4
Nickel	Ni	36	37	37	2.6%	2
Selenium	Se	<	<	<		3
Silver	Ag	<	<	<		2
Tin	Sn	260	121	190	73%	5
Zinc	Zn	2020	1370	1690	38%	1
Aluminum	Al	28600	28900	28700	1.0%	10
Antimony	Sb	125	40	83	102%	10
Beryllium	Be	<	<	<		1
Boron	B	63	65	64	1.9%	0.5
Calcium	Ca	144000	135000	140000	6.6%	1
Iron	Fe	47400	51500	49400	8.3%	2
Magnesium	Mg	12700	12500	12600	1.3%	0.1
Manganese	Mn	7593	7254	7424	4.6%	0.2
Phosphorus	PO4	22700	22500	22600	1.1%	20
Sodium	Na	699	938	819	29%	5
Strontium	Sr	706	686	696	2.9%	0.1
Titanium	Ti	239	182	210	27%	0.3
Vanadium	V	59	62	60	3.9%	0.5

All results expressed as micrograms per gram (μg/g) on a dry weight basis.

TRACE METALS '95 QA\QC 1B DUPLICAT\5022223.WK1

CANTEST

Client: Envirochem Services
File: 5022223
Date: February 22, 1995

Cantest I.D. Client I.D.		Digestion Blank #1	Digestion Blank #2	Digestion Blank #3	Detection Limit
Aluminum	Al	<	<	<	0.15
Antimony	Sb	<	<	<	0.15
Arsenic	As	<	<	<	0.01
Barium	Ba	<	<	<	0.001
Beryllium	Be	<	<	<	0.006
Boron	B	<	0.04	0.04	0.010
Cadmium	Cd	<	<	<	0.005
Calcium	Ca	0.01	1.26	0.19	0.01
Chromium	Cr	<	<	<	0.03
Cobalt	Co	<	<	<	0.02
Copper	Cu	<	<	<	0.015
Iron	Fe	0.04	0.08	0.04	0.030
Lead	Pb	<	<	<	0.08
Magnesium	Mg	0.01	<	<	0.001
Manganese	Mn	<	<	<	0.003
Mercury	Hg	<	<	<	0.0002
Molybdenum	Mo	<	<	<	0.04
Nickel	Ni	<	<	<	0.025
Phosphorus	PO4	<	<	<	0.4
Potassium	K	<	<	<	1
Selenium	Se	<	<	<	0.05
Silver	Ag	<	<	<	0.03
Sodium	Na	<	<	<	0.1
Strontium	Sr	<	0.001	<	0.001
Tin	Sn	<	<	<	0.03
Titanium	Ti	<	<	<	0.006
Vanadium	V	<	<	<	0.010
Zinc	Zn	<	0.06	0.03	0.015

Results expressed as milligrams per litre (mg/L).

< = Less than

TRACE METALS '95 QA/QC 1B BLANKS\02-22.WK1

CANTEST

Client: Envirochem Services
File: 5022223
Date: February 22, 1995

National Research Council Canada (NRC)
Certified Reference Material

PACS−1

COMPONENT		RESULT	PERCENT RECOVERY	CERTIFIED VALUE
Major Components (%)				
Silica	SiO2	–		55.7 ±0.5
Alumina	Al2O3	4.61	38%	12.23 ±0.22
Iron	Fe2O3	6.46	93%	6.96 ±0.12
Calcium	CaO	1.45	50%	2.92 ±0.09
Magnesium	MgO	1.75	73%	2.41 ±0.09
Sodium	Na2O	2.22	50%	4.40 ±0.11
Potassium	K2O	0.43	29%	1.50 ±0.09
L.O.I.		–		
Trace Components (ug/g)				
Antimony	Sb	80	47%	171. ±14.
Arsenic	As	205	97%	211. ±11.
Barium	Ba	345		–
Beryllium	Be	< 3.0		–
Boron	B	70		–
Cadmium	Cd	2.75	116%	2.38 ±0.20
Chromium	Cr	62.5	55%	113. ±8.
Cobalt	Co	16.0	91%	17.5 ±1.1
Copper	Cu	420	93%	452. ±16.
Lead	Pb	390	97%	404. ±20.
Manganese	Mn	300	64%	470. ±12.
Mercury	Hg	5.20	114%	4.57 ±0.16
Molybdenum	Mo	8.5	66%	12.9 ±0.9
Nickel	Ni	37.0	84%	44.1 ±2.0
Phosphorous	PO4	3100	100%	3110. ±240.
Selenium	Se	–		1.09 ±0.11
Silver	Ag	< 15		–
Strontium	Sr	85.0	31%	277. ±11.
Tin	Sn	41.0	100%	41.1 ±3.1
Titanium	Ti	1400	33%	4210. ±66.
Vanadium	V	85	67%	127. ±5.
Zinc	Zn	845	103%	824. ±22.

< = Not detected
% = Percent
$\mu g/g$ = micrograms per gram

TRACE METALS '95 QA\QC 1B PACS1\02−22.WK1

AND CHAIN OF CUSTODY FORM

ENVIROCHEM SPECIAL PROJECTS INC.
310 East Esplanade North Vancouver, B.C.
Tel: (604) 986-0233, Fax: (604) 986-8583

To: CANTEST

Attention: RICHARD JORNITZ

Project No: 3790

Envirochem Contact: LINDA

Purchase Order: 225637

Date: 22 FEB 95

Results required by: 5-7 days *

Number of Samples: Water ______ Sediment ______ Other ______

Sample Identification	Sample Date	Sample Type	Parameter: ICP metals					Detect. Level
A1-1	21 Feb	Soil	✓					B
A1-2 + A1-3	"	"	✓					"
A1-4 + A1-5	"	"	✓					"
A1-~~3~~6	"	"	✓					"
SA1-1 + SA1-2 + SA1-3	"	"	✓					"

Date	Time	Relinquished By (Name & Affil.)	Relinquished To (Name & Affil.)
Feb 22/95	13:35		@ CTL

N.B. Analyses are to be conducted as per " Sample Transmittal Notes ". (see over).

Special Instructions: * is it possible to get prelim data on A1-1 and A1-2+A1-3 by Friday at noon

Analysis Report

RECEIVED MAR 15 1995

CANTEST

CanTest Ltd

Professional Analytical Services

1523 West 3rd Ave
Vancouver, BC
V6J 1J8

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Results of Testing

REPORTED TO: Envirochem Services
310 East Esplanade
North Vancouver, B.C.
V7L 1A4

Att'n: Mr. James Smith

PROJECT NUMBER: 3791

NUMBER OF SAMPLES: 3

REPORT DATE: March 2, 1995

DATE SUBMITTED: February 1, 1995 - March 28, 1995

GROUP NUMBER: 5030107

SAMPLE TYPE: Soil

TEST METHODS:

Metals in Soil - Undried representative samples were digested with a mixture of nitric acid and hydrochloric acid ("Aqua Regia"). Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described. Moisture was determined gravimetrically at 105 C on a separate sample portion.

Cadmium in Soil - Analysis by background-corrected Flame Atomic Absorption Spectrophotometry.

Lead in Soil - Analysis by background-corrected Flame Atomic Absorption Spectrophotometry.

Mercury in Soil - Analysis by Cold Vapour Atomic Absorption Spectrophotometry.

Selenium in Soil - Analysis by Zeeman background-corrected Graphite Furnace Atomic Absorption Spectrophotometry.

TEST RESULTS:

(See following page)

CAN TEST LTD.

Richard

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: Envirochem Services

REPORT DATE: March 2, 1995

GROUP NUMBER: 5030107

CANTEST

Metals Analysis in Soil

mislabelled by laboratory, - submitted ID SA1-4

CLIENT SAMPLE IDENTIFICATION:		A1-7	A1-8	A2-4		
DATE SAMPLED:		Feb 28/95	Feb 28/95	Feb 28/95	DETECTION LIMIT	UNITS
CAN TEST ID:		503010014	503010015	503010016		
Metals Analysis						
Moisture		31.2	16.0	48.9	0.01	%
Arsenic	As	<	<	<	30	μg/g
Barium	Ba	279	140	642	0.1	μg/g
Cadmium	Cd	<	0.30	<	0.25	μg/g
Chromium	Cr	78	98	30	2	μg/g
Cobalt	Co	27	34	12	1	μg/g
Copper	Cu	119	154	101	1	μg/g
Lead	Pb	39	171	114	1	μg/g
Mercury	Hg	0.026	0.094	0.018	0.001	μg/g
Molybdenum	Mo	<	<	<	4	μg/g
Nickel	Ni	55	63	27	2	μg/g
Selenium	Se	<	<	<	3	μg/g
Silver	Ag	<	<	<	2	μg/g
Tin	Sn	11	69	12	5	μg/g
Zinc	Zn	134	107	90	1	μg/g
Aluminum	Al	41200	38400	16200	10	μg/g
Antimony	Sb	<	<	<	10	μg/g
Beryllium	Be	<	<	<	1	μg/g
Boron	B	45	29	31	0.5	μg/g
Calcium	Ca	30600	10300	41100	1	μg/g
Iron	Fe	72400	76200	27700	2	μg/g
Magnesium	Mg	14800	15700	5400	0.1	μg/g
Manganese	Mn	2110	1040	2650	0.2	μg/g
Phosphorus	PO4	1030	1380	5470	20	μg/g
Sodium	Na	845	445	1160	5	μg/g
Strontium	Sr	138	41	257	0.1	μg/g
Titanium	Ti	1340	84	109	0.3	μg/g
Vanadium	V	197	14	47	0.5	μg/g

% = percent
< = Less than detection limit

μg/g = micrograms per gram, on a dry weight basis.

CANTEST

QUALITY ASSURANCE / QUALITY CONTROL DATA

CANTEST

Client: Envirochem Services
File: 5030107
Date: March 1, 1995

Sample I.D.		503010014 A1-7	503010014' A1-7 Duplicate	503010014 A1-7 Average	RPD	Detection Limit
% Moisture	H2O	31.2%	–	31.2%		
Arsenic	As	<	<	<		30
Barium	Ba	274	283	279	3.3%	0.1
Cadmium	Cd	<	<	<		0.25
Chromium	Cr	80	77	78	3.1%	2
Cobalt	Co	28	25	27	12%	1
Copper	Cu	128	111	119	14%	1
Lead	Pb	32	45	38	33%	1
Mercury	Hg	0.027	0.024	0.026	13%	0.001
Molybdenum	Mo	<	<	<		4
Nickel	Ni	58	53	55	9.0%	2
Selenium	Se	<	<	<		3
Silver	Ag	<	<	<		2
Tin	Sn	13	10	11	23%	5
Zinc	Zn	143	125	134	13%	1
Aluminum	Al	42400	40000	41200	6.0%	10
Antimony	Sb	<	<	<		10
Beryllium	Be	<	<	<		1
Boron	B	47	44	45	5.1%	0.5
Calcium	Ca	30900	30300	30600	2.0%	1
Iron	Fe	75100	69800	72400	7.4%	2
Magnesium	Mg	15400	14200	14800	8.3%	0.1
Manganese	Mn	2080	2140	2110	2.7%	0.2
Phosphorus	PO4	1140	920	1030	21%	20
Sodium	Na	850	840	845	1.2%	5
Strontium	Sr	137	138	138	1.0%	0.1
Titanium	Ti	1630	1050	1340	43%	0.3
Vanadium	V	210	185	197	13%	0.5

All results expressed as micrograms per gram (μg/g) on a dry weight basis.

QA\QC 2B DUPLICAT\5030107.WK1

CANTEST

Client: Envirochem Services
File: 5030107
Date: March 1, 1995

Cantest I.D. Client I.D.		Digestion Blank #1	Digestion Blank #2	Digestion Blank #3	Detection Limit
Aluminum	Al	<	<	<	0.15
Antimony	Sb	<	<	<	0.15
Arsenic	As	<	<	<	0.01
Barium	Ba	0.002	0.001	<	0.001
Beryllium	Be	<	<	<	0.006
Boron	B	0.03	0.08	0.02	0.010
Cadmium	Cd	<	<	<	0.005
Calcium	Ca	0.04	0.03	0.01	0.01
Chromium	Cr	<	<	<	0.03
Cobalt	Co	<	<	<	0.02
Copper	Cu	<	<	<	0.015
Iron	Fe	0.04	<	<	0.030
Lead	Pb	<	<	<	0.08
Magnesium	Mg	0.02	<	<	0.001
Manganese	Mn	<	<	<	0.003
Mercury	Hg	<	<	<	0.0002
Molybdenum	Mo	<	<	<	0.04
Nickel	Ni	<	<	<	0.025
Phosphorus	PO4	<	<	<	0.4
Potassium	K	<	<	<	1
Selenium	Se	<	<	<	0.05
Silver	Ag	<	<	<	0.03
Sodium	Na	<	0.1	<	0.1
Strontium	Sr	<	<	<	0.001
Tin	Sn	<	<	<	0.03
Titanium	Ti	<	0.019	<	0.006
Vanadium	V	<	<	<	0.010
Zinc	Zn	0.02	0.02	<	0.015

Results expressed as milligrams per litre (mg/L).

< = Less than

QA\QC 2B BLANKS\03-01.WK1

CANTEST

Client: Envirochem Services
File: 5030107
Date: March 1, 1995

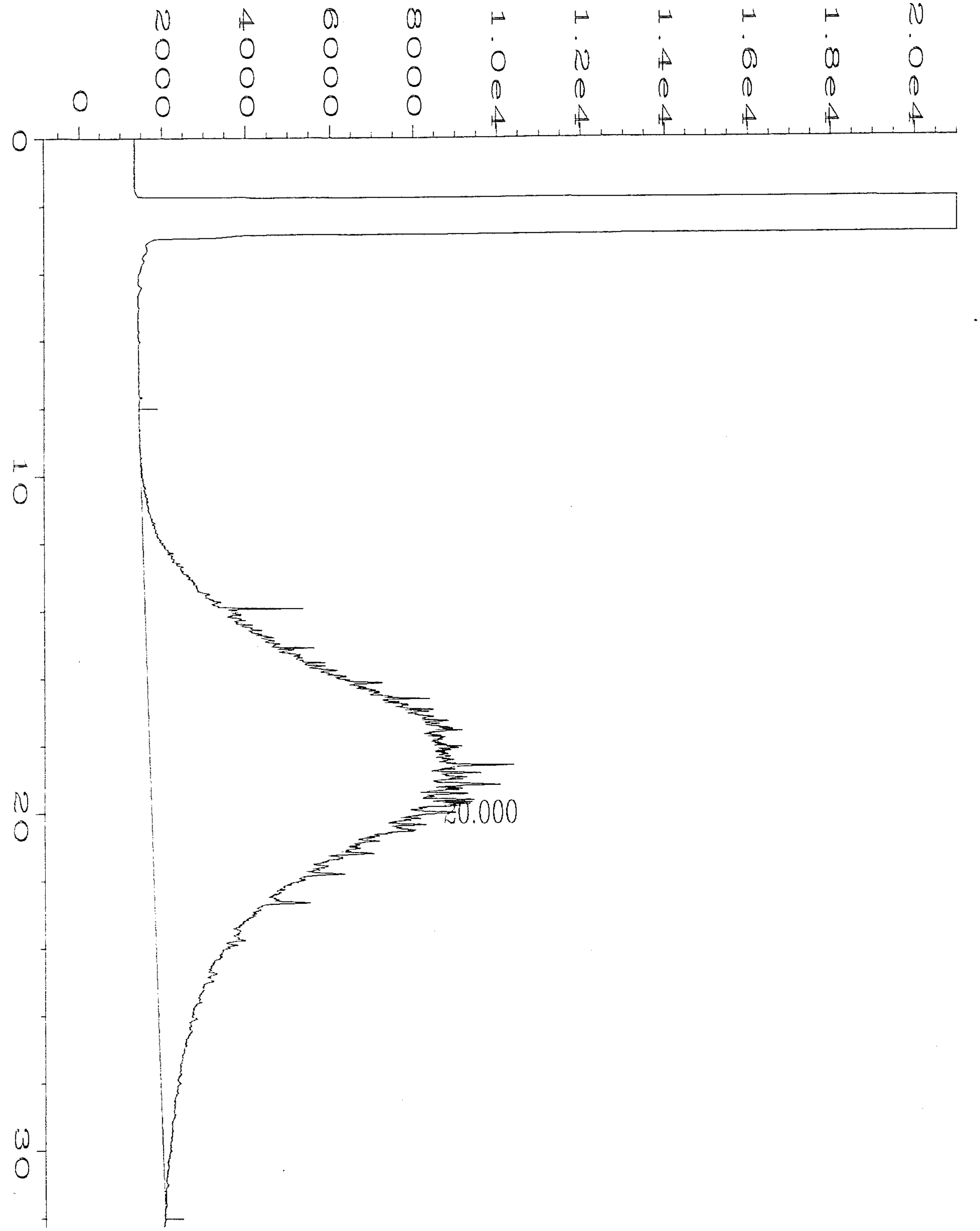
National Research Council Canada (NRC)
Certified Reference Material

PACS−1

COMPONENT		RESULT	PERCENT RECOVERY	CERTIFIED VALUE
Major Components (%)				
Silica	SiO2	−		55.7 ±0.5
Alumina	Al2O3	4.70	38%	12.23 ±0.22
Iron	Fe2O3	6.69	96%	6.96 ±0.12
Calcium	CaO	1.66	57%	2.92 ±0.09
Magnesium	MgO	1.87	78%	2.41 ±0.09
Sodium	Na2O	2.43	55%	4.40 ±0.11
Potassium	K2O	0.63	42%	1.50 ±0.09
L.O.I.		−		
Trace Components (ug/g)				
Antimony	Sb	50	29%	171. ±14.
Arsenic	As	186	88%	211. ±11.
Barium	Ba	390		−
Beryllium	Be	<3.0		−
Boron	B	70		−
Cadmium	Cd	2.40	101%	2.38 ±0.20
Chromium	Cr	70.0	62%	113. ±8.
Cobalt	Co	18.5	106%	17.5 ±1.1
Copper	Cu	442	98%	452. ±16.
Lead	Pb	378	93%	404. ±20.
Manganese	Mn	325	69%	470. ±12.
Mercury	Hg	4.70	103%	4.57 ±0.16
Molybdenum	Mo	14.0	109%	12.9 ±0.9
Nickel	Ni	39.5	90%	44.1 ±2.0
Phosphorous	PO4	3150	101%	3110. ±240.
Selenium	Se	−		1.09 ±0.11
Silver	Ag	<15		−
Strontium	Sr	100.0	36%	277. ±11.
Tin	Sn	25.5	62%	41.1 ±3.1
Titanium	Ti	1750	42%	4210. ±66.
Vanadium	V	96	76%	127. ±5.
Zinc	Zn	797	97%	824. ±22.

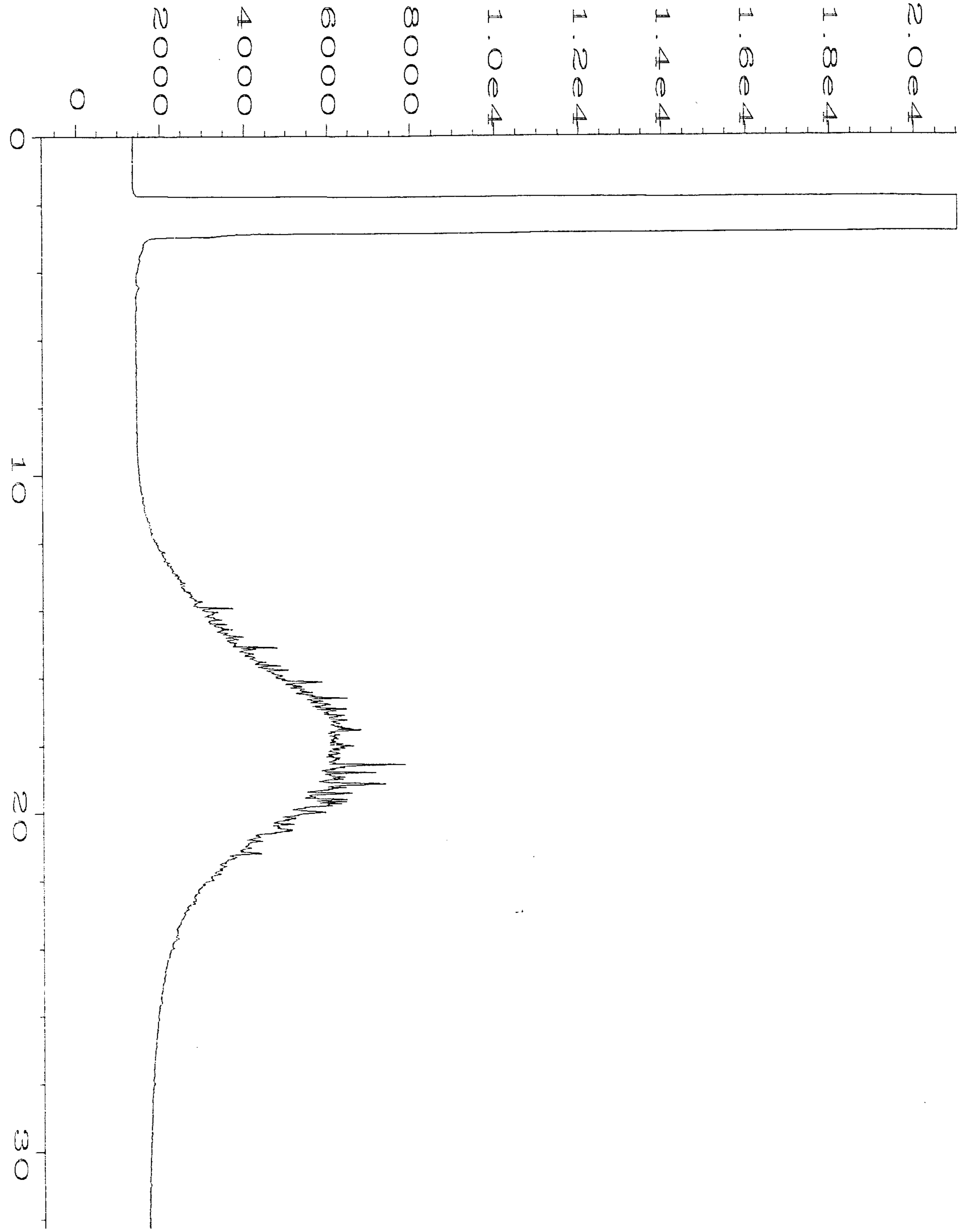
< = Not detected
% = Percent
μg/g = micrograms per gram

CA\QC 2B PACS1\03−01.WK1



Data File Name : D:\HPCHEM\1\DATA\TEH\H0081B.D
Operator : Fragrance
Instrument : GC1
Sample Name : 3790 Sp3-c 250x
Run Time Bar Code:
Acquired on : 16 Mar 95 01:45 PM
Report Created on: 16 Mar 95 02:20 PM
Last Recalib on : 05 AUG 93 02:21 PM
Multiplier : 1

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: H-C.MTH
Analysis Method : H-C.MTH
Sample Amount : 0
ISTD Amount :



Data File Name : D:\HPCHEM\1\DATA\TEH\H0081A.D
Operator : Fragrance
Instrument : GC1
Sample Name : 3790 M-1 500xdil
Run Time Bar Code:
Acquired on : 16 Mar 95 12:36 PM
Report Created on: 16 Mar 95 01:09 PM
Last Recalib on : 05 AUG 93 02:21 PM
Multiplier : 1

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: H-C.MTH
Analysis Method : H-C.MTH
Sample Amount : 0
ISTD Amount :

APPENDIX E.

3.2.10 Metal Contaminated Soil Disposal-McLean Mill Historic Site, Port Alberni, B.C. 1995. Envirochem Special Projects. (Envirochem)

Envirochem
SPECIAL PROJECTS INC.

310 EAST ESPLANADE ☐ NORTH VANCOUVER, BRITISH COLUMBIA V7L 1A4 ☐ (604) 986-0233 ☐ FAX: (604) 986-8583 ☐

March 29, 1995

FAX reply.

Mr. Barry Patten
B.C. Ministry of Environment
Vancouver Island Regional Headquarters
2569 Kenworth Road
Nanaimo, B.C.
V9T 4P7

Dear Mr. Patten:

Re: Metal Contaminated Soil Disposal - McLean Mill Historic Site

Envirochem Special Projects Inc. (Envirochem), is requesting permission to dispose of metal contaminated soil in excess of the B.C. Environment CMCS Level B criteria for barium, copper, lead, tin and zinc, to the Port Alberni Regional Landfill. The soil was generated from the excavation of a small area in the vicinity of the former blacksmith shop at the McLean Mill National Historic Site, approximately 15 km northeast of Port Alberni.

Contamination was previously identified at the site during a Phase II Environmental Site Assessment, conducted by Envirochem in 1994 on behalf of the City of Port Alberni. In-situ concentrations of metals in the soil sampled in the vicinity of the blacksmith shop (see attached figure and table) indicated barium, copper, lead, tin and zinc at levels in excess of the Level B criteria, and a small portion of lead, tin and zinc concentrations were found slightly in excess of Level C. One soil sample was submitted for a leachate extraction procedure and all metal concentrations were found less than the B.C. Environment Leachate Quality Standards. ✓

The excavated material represents a final volume of approximately 6 m^3 (one truck load). Excavation was conducted by hand with shovels in 1 x 1 m cell increments with an archeologist present. Therefore, the contaminated material has not been diluted from over-excavation. ✓

The analytical results of the composite sample of the stockpiled material is attached. Based on the analytical results the 6 m^3 of soil contains metal concentrations less than Level C and is therefore suitable for disposal to the Port Alberni Regional Landfill. ✓

I trust this provides you with sufficient information to grant permission to dispose of this material. The landfill requires written authorization to accept this material. The City of Port Alberni is anxious to dispose of this material as soon as possible in order to include the disposal cost into this fiscal year.

Thank you for your attention to this matter.

Yours truly,

ENVIROCHEM SPECIAL PROJECTS INC.

Linda J. Eastcott, M.A.Sc., P.Eng.
Project Manager

LJE/gb

Encl. Laboratory Results
Excerpts from Phase II Investigation

RECEIVED MAR 9 - 1995

An...ysis Report

CAN TEST

CanTest Ltd
Professional Analytical Services
1523 West 3rd Ave
Vancouver, BC
V6J 1J8
Fax: 604 731 2386
Tel: 604 734 7276
1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Envirochem Services
310 East Esplanade
North Vancouver, B.C.
V7L 1A4

Att'n: Ms. Linda Eastcott

PROJECT NUMBER: 3790

NUMBER OF SAMPLES: 5

REPORT DATE: February 27, 1995

DATE SUBMITTED: February 22, 1995

GROUP NUMBER: 5022223

SAMPLE TYPE: Soil

TEST METHODS:

Metals in Soil - Undried representative samples were digested with a mixture of nitric acid and hydrochloric acid ("Aqua Regia"). Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described. Moisture was determined gravimetrically at 105 C on a separate sample portion.

Cadmium in Soil - Analysis by background-corrected Flame Atomic Absorption Spectrophotometry.

Lead in Soil - Analysis by background-corrected Flame Atomic Absorption Spectrophotometry.

Mercury in Soil - Analysis by Cold Vapour Atomic Absorption Spectrophotometry.

Selenium in Soil - Analysis by Zeeman background-corrected Graphite Furnace Atomic Absorption Spectrophotometry.

TEST RESULTS:

(See following pages)

CAN TEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: Envirochem S[illegible]es

REPORT DATE: February 27, 1995

GROUP NUMBER: 5022223

CAN TEST

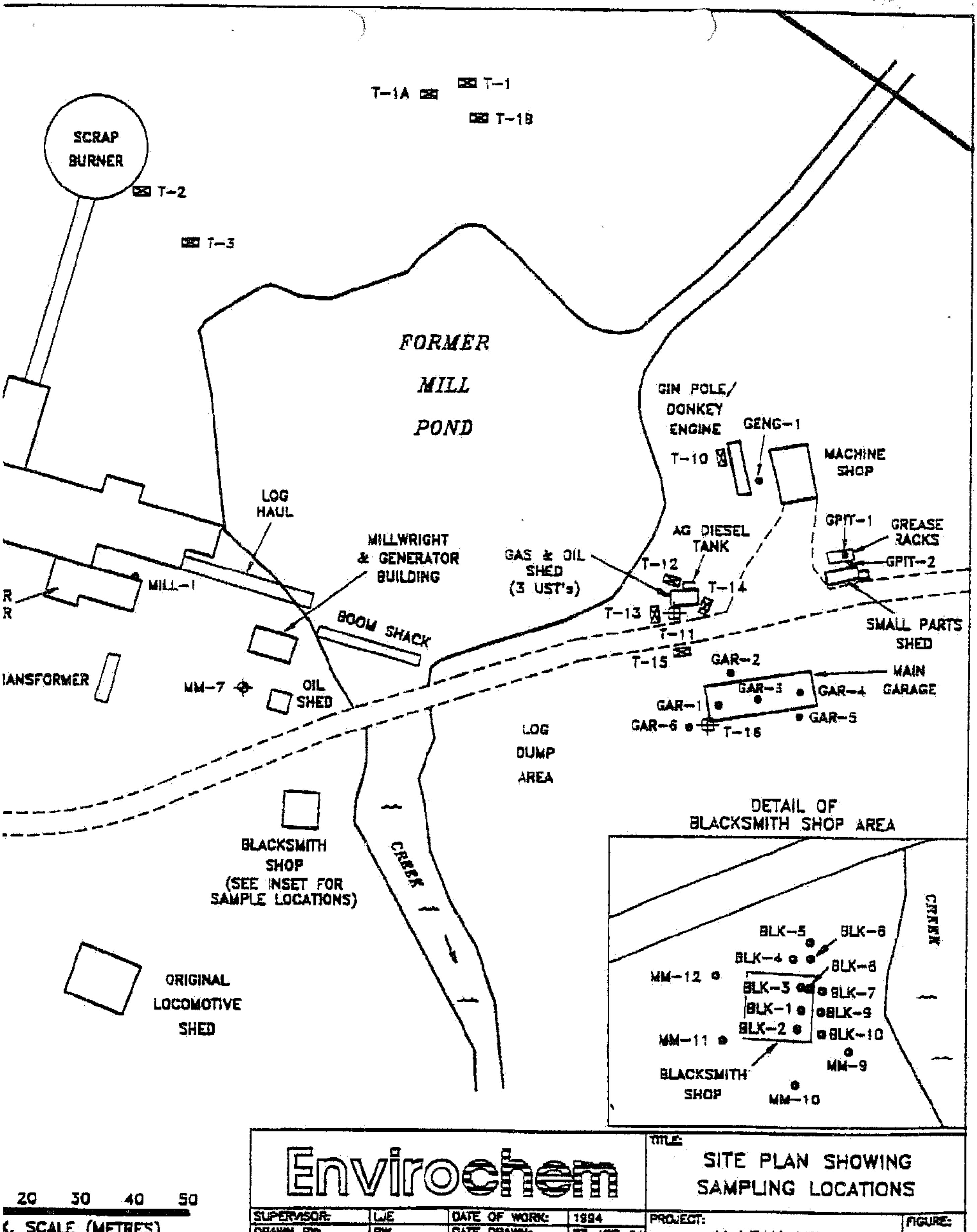
Metals Analysis in Soil

BLACKSMITH SHOP STOCKPILED SOIL

CLIENT SAMPLE IDENTIFICATION:		A1-1	A1-2 & A1-3	A1-4 & A1-5	SA1-1 & SA1-2 & SA1-3	DETECTION LIMIT	UNITS
DATE SAMPLED:		Feb 21/95	Feb 21/95	Feb 2[illegible]5	Feb 21/95		
CAN TEST ID:		502220053	502220054	5022[illegible]55	502220056		
Metals Analysis							
Moisture		60.6	52.0	69[illegible]	43.3	0.01	%
Arsenic	As	<	<	<	<	30	µg/g
Barium	Ba	569	1760	50[illegible]	587	0.1	µg/g
Cadmium	Cd	<	1.1	1.[illegible]	1.1	0.25	µg/g
Chromium	Cr	32	36	24[illegible]	68	2	µg/g
Cobalt	Co	10	11	9[illegible]	16	1	µg/g
Copper	Cu	93	200	95[illegible]	205	1	µg/g
Lead	Pb	99	803	73[illegible]	634	1	µg/g
Mercury	Hg	0.011	0.086	0.[illegible]	0.084	0.001	µg/g
Molybdenum	Mo	<	<	<	<	4	µg/g
Nickel	Ni	24	37	2[illegible]	62	2	µg/g
Selenium	Se	<	<	<	<	3	µg/g
Silver	Ag	<	<	<	<	2	µg/g
Tin	Sn	22	190	9[illegible]	213	5	µg/g
Zinc	Zn	51	1690	3[illegible]	1490	1	µg/g
Aluminum	Al	18400	28700	1[illegible]0	21800	10	µg/g
Antimony	Sb	<	83	8[illegible]	40	10	µg/g
Beryllium	Be	<	<	<	<	1	µg/g
Boron	B	44	64	4[illegible]	68	0.5	µg/g
Calcium	Ca	79100	140000	3[illegible]0	58600	1	µg/g
Iron	Fe	27000	49400	5[illegible]0	88700	2	µg/g
Magnesium	Mg	5400	12600	47[illegible]	9520	0.1	µg/g
Manganese	Mn	2710	7420	26[illegible]	3100	0.2	µg/g
Phosphorus	PO4	8240	22600	87[illegible]	8300	20	µg/g
Sodium	Na	991	819	62[illegible]	978	5	µg/g
Strontium	Sr	388	696	202	304	0.1	µg/g
Titanium	Ti	415	210	711	271	0.3	µg/g
Vanadium	V	55	60	41	67	0.5	µg/g

% = percent
< = Less than detection limit

µg/g = microgra[illegible] per gram, [illegible] dry weight basis.



Envirochem

TITLE: SITE PLAN SHOWING SAMPLING LOCATIONS

SUPERVISOR:	LJE	DATE OF WORK:	1994
DRAWN BY:	PW.	DATE DRAWN:	27-APR-94
REVISED BY:	LJE	DATE REVISED:	04-AUG-94
PROJECT NUMBER:	3790	DRAWING NUMBER:	3790-02

PROJECT: McLEAN MILL NATIONAL HISTORIC SITE

FIGURE: 4

TABLE 2: RESULTS OF METALS ANALYSES
City of Port Alberni - McLean Mill
Surface Soil Sample (mg/kg)

Sample	GPIT-1	GPIT-1	GPIT-2	BLK-1	BLK-2	BLK-3	BLK-4	BLK-5	BLK-6	BLK-7	CCME Criteria	
Depth (m)	0	0.1-0.15	0.1	0.2	0-0.2	0-0.2	0-0.1	0-0.2	0-0.1	0.1-0.2	Residential	Industrial
Arsenic	3.3	3.41	11.1	6.5	7.5	18.2	8	4.82	17.5	3.39	30	50
Barium	218	100	403	656	705	650	176	896	1220	137	500	2000
Cadmium	1.6	0.27	1.47	1.4	1.4	0.72	1	<0.25	0.9	0.75	5	20
Chromium	61.1	107	40	32.8	48.5	42	15.1	22	30.4	10.6	250	800
Cobalt	7.8	28.2	13.9	8.2	13.5	11.1	4.3	7.1	8.4	3.3	50	300
Copper	556	104	232	155	163	228	71.6	80.2	198	50.6	100	500
Lead	8270	90.5	565	483	204	1800	390	26.4	2290	293	500	1000
Mercury	<0.07	0.066	0.1	0.1	<0.05	0.036	0.1	0.009	<0.05	0.056	2	10
Molybdenum	31	<4	<4	<1	<1	<4	<1	<4	<1	<4	10	40
Nickel	23.5	53.9	34.1	30	37.6	34.7	10.7	21.4	26.1	12.1	100	500
Selenium	<0.1	<0.5	<0.5	0.1	<0.1	<0.5	<0.1	<0.5	<0.1	<0.5	3	10
Silver	< 0.5	<1.5	<1.5	<0.5	< 0.5	<1.5	< 0.5	<1.5	< 0.5	<1.5	20	40
Tin	<0.1	5.1	2.9	<1	17	540	< 1	10	<1	203	50	300
Zinc	764	139	231	687	405	1160	1290	63.3	908	1700	500	1500

BLK-4 - surface sample

Exceeds CCME Interim residential/parkland criteria
Exceeds CCME Interim industrial/commercial criteria

TABLE 2 continued: RESULTS OF METALS ANALYSES
City of Port Alberni - McLean Mill
Surface Soil Sample (mg/kg)

Sample	BLK-9	BLK-10	GAR-1	GAR-3	GAR-4	MILL-1A	MILL-1B	MILL-1	MILL-3	CCME Criteria	
Depth (m)	0-0.2	0-0.1	0	0	0	0-0.1	0-0.1	0.2-0.3	0-0.1	Residential	Industrial
Arsenic	8.3	6.77	6.3	5.5	4.8	58	3.89	10.8	10.6	30	50
Barium	382	362	198	49.8	77.9	65.8	53.5	156	38.8	500	2000
Cadmium	2.6	0.89	1.5	1.3	1.5	0.9	<0.25	0.42	<0.25	5	20
Chromium	16.9	50	66.3	70	82	63	31	103	40.8	250	800
Cobalt	4.9	15.6	19.3	18.2	20.2	17.9	6.4	24.1	10.7	50	300
Copper	67.2	103	135	109	121	83.3	41	134	71.6	100	500
Lead	140	232	1010	112	860	16	21.3	84	175	500	1000
Mercury	<0.05	0.052	0.1	0.2	0.1	0.2	0.065	0.19	0.064	2	10
Molybdenum	<1	<4	< 1	< 1	< 1	< 1	<4	<4	<4	10	40
Nickel	16.7	39.5	38	37.7	43.2	34.3	15.8	49.2	24..5	100	500
Selenium	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	3	10
Silver	< 0.5	<1.5	< 0.5	< 0.5	< 0.5	< 0.5	<1.5	<1.5	<1.5	20	40
Tin	<1	57.5	< 1	< 1	< 1	< 1	13.4	9	22.9	50	300
Zinc	1610	616	121	122	158	197	443	603	396	500	1500

BLK-4 - surface sample

Exceeds CCME Interim residential/parkland criteria
Exceeds CCME Interim industrial/commercial criteria

APPENDIX E.

3.2.11 Restoration of McLean Mill National Historic Site, Phase 1 1995-96, Mill Pond Reconstruction. July 1995. Canadian Heritage Professional & Technical Services Pacific and Yukon Region

SCREENING REPORT July 1995

RESTORATION OF MCLEAN MILL NATIONAL HISTORIC SITE

PHASE I 1995-96

MILLPOND RECONSTRUCTION

Prepared by:

Steve Oates
Canadian Heritage
Professional & Technical Services
Pacific and Yukon Region

RAREFERENCE # PACYUKRO - 00001

TABLE OF CONTENTS

1.0 INTRODUCTION

McLean Mill was designated a National Historic Site in 1989. The site is owned by the City of Port Alberni and managed on a partnership basis. Partners include the City, the provincial and federal governments, and local historical societies. The Mill operated from 1926-1965. Now the site contains a collection of buildings and other structures in various stages of disrepair. Some structures have undergone archaeological inventory work and structural stabilization.

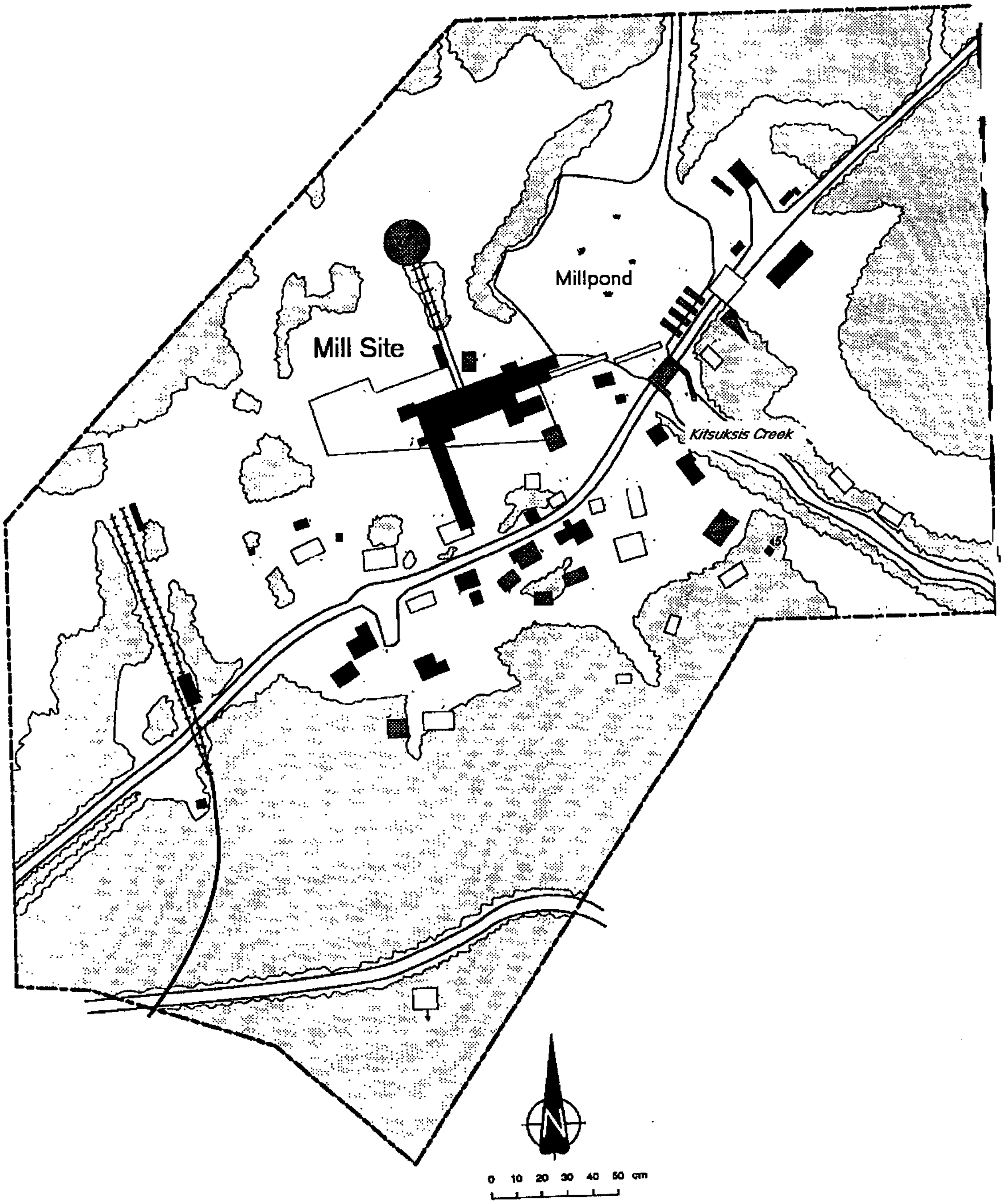
A draft Management Plan for McLean Mill National Historic Site (MMNHS) outlines how the site will be restored and operated. The intent is to restore the mill and manage the site as a heritage attraction. Restoration of the dam structure and associated Millpond is the first large scale project to be undertaken. Once the site is fully restored, it will have the capacity to operate as a sawmill. The mill will process very small quantities of mill logs on a demonstration basis for the education and enjoyment of site visitors.

The Department of Canadian Heritage is a proponent and financial contributor to the project. This triggers the Canadian Environmental Assessment Act (CEAA) and makes Canadian Heritage a Responsible Authority for this project. The Department of Fisheries and Oceans (DFO) is also a responsible Authority as a statutory approval is required pursuant to the Fisheries Act for any work which disrupts fish habitat. Canadian Heritage took a lead role in preparing the environmental assessment for this project. Fisheries and Oceans, and the BC Ministry of Environment Land and Parks (Fisheries), reviewed the assessment to ensure that it adequately addressed their responsibilities and concerns. A letter of advice from DFO is attached as Appendix 2.

Millpond restoration, or similar projects, are not listed on the Comprehensive Study List Regulations of CEAA. A screening will therefore be conducted for this project. All work related to the restoration of the millpond has been assessed within the scope of this screening. Project work will be tendered and constructed as two separate contract packages: Millpond excavation; dam repair, spillway and fish ladder construction. The results of the environmental assessment are presented in this screening report.

1.1 Project Location

McLean Mill National Historic Site is located about 10 kilometres northwest of Port Alberni on Vancouver Island. The 13 hectare site is owned by the City of Port Alberni. The Douglas Fir, Western Hemlock forest in the area was initially logged late in the nineteenth century. Presently the region supports a second growth red alder, western hemlock forest.



Existing site conditions at McLean Mill National Historic Site
(adopted from Draft Management Plan, April 1994)

1.2 Project Description

In 1991 the dam on Kitsuksis Creek failed in flood conditions and the pond drained. The Management Plan proposes the restoration of the dam structure on Kitsuksis Creek to reestablish the millpond. The work consists of three distinct sub-projects, millpond excavation, dam repair, and spillway and fish ladder construction. These are described individually in the following section.

1.2.1 Millpond Excavation

A mixture of sawdust, bark, sand, silt, and detritus accumulated in the pond during it use. To provide sufficient depth for millponding, these materials will be excavated to a depth of 0.5-1.5m below the present surface grade. An excavator will load the materials directly into trucks for removal from the site. If stockpiling is necessary, the materials will be placed in a location that prevents siltation of Kitsuksis creek. Since dam failure, Kitsuksis creek has incised a channel approximately 1.5m deep where it traverses the millpond area. Millpond excavation will be the first project component undertaken (see section 1.3 below for complete project schedule).

Photo by S. Oates 19 April 1995.

View of the millpond at McLean Mill. Note Kitsuksis creek channel in foreground and mill machinery behind.

1.2.2 Dam Repair

The breach in the dam will be repaired with a concrete dam, cribwork, and sluiceway. A concrete cut-off wall will be installed on the upstream side of the dam. The remainder of the existing dam structure (wooden crib and earth fill) will remain in place. Concrete dam construction will be tendered and built in two stages from opposite sides of the breach, to ensure that natural flows are maintained in Kitsuksis creek.

View looking upstream of breach in millpond dam on Kitsuksis creek. The fish ladder in the right portion of the photo will be removed and replaced with a combination spillway and fish ladder.

1.2.3 Spillway and Fish ladder Construction

The existing spillway structure and fish ladder will be removed. Replacement structures of a similar design will be constructed in the same location. As outlined in the contract specification, spillway construction involves excavation, forming, backfilling, and concrete work. The timber sluiceway and fish ladder is designed to operate at all water levels.

1.3 Project Schedule

DATE	ACTIVITY
July 24 - September 30, 1995	excavate millpond
August 1 - 10	construct section 1 of concrete dam with 900mm diversion conduit and gate
August 11 - 29	construct section 2 of concrete dam and reinforced section of concrete cutoff wall west and east of concrete dam
August 30 - September 20	construct a timber crib upstream and downstream of concrete dam with fill, outlet structure, gate, and bridge
August 28 - September 8	install rip rap on channel banks at downstream end of outlet structure, spillway, and fish ladder. Excavate upstream and
September 20 - 30	construct spillway No. 1 concrete control section base and walls. Construct bridge and install fish ladder culvert across
September 30 - October 20	construct timber portion of spillway No. 1 and fish ladder
October 16 - 20	remove cofferdam at downstream end if spillway and install rip rap. Backfill behind spillway and fish ladder walls
October 20 - 25	excavate spillway No. 2 channel through dam at elevation 113.0 m
October 25 - 30	close diversion gate and raise millpond level to Full Supply Level of 113.0

Source: *Al Sippola, Structural Engineer, Architectural and Engineering Services, Public Works and Government Services Canada, Calgary.*

2.0 BIOPHYSICAL SYNOPSIS

Logging and milling activities have highly modified McLean Mill National Historic Site from natural conditions. Remnant portions of second growth Western Hemlock (*Tsuga heterophylla*), Douglas Fir (*Pseudotsuga menziesii*) forest occurs around the outer edge of the site. The mill machinery and associated buildings are located in a clearing near the geographic centre of MMNHS (see site map on page 2). This area is the mostly highly modified environment. A ground cover of introduced grasses and a few mature forest trees are the only vegetation found here. The millpond is a prominent feature in this area (photo 1). Commonwealth Historic Resource Management Limited (1992) classified the MMNHS into 5 biophysical units based upon vegetation characteristics:

1. riverine (Kitsuksis Creek aquatic habitat)
2. riparian (along Kitsuksis Creek)
3. marsh (mill pond)
4. disturbed (mill site area and railway right-of-way)
5. second-growth coniferous forest

The millpond restoration project involves three biophysical units, riverine, riparian, and marsh. Individual units are described in the following section.

2.1 Riverine Biophysical Unit

Kitsuksis creek flows through the millpond area of MMNHS on its way to tide water near Port Alberni, BC. Data from the water Survey of Canada shows Kitsuksis creek is a typical coastal stream. Low flows occur during the summer drought in July and August, and peak flows during winter. The stream discharge responds rapidly to rainfall events as the basin has little storage capacity. This has been incorporated into the design of the dam based upon a hydrological analysis by Al Sippola, Structural Engineer, Public Works and Government Services, Calgary. This is the most important resource value associated with the millpond restoration project. Use of the creek by other fish species is largely

Downstream view of Kitsuksis Creek from breach in dam.

undocumented. Observations made during a stream inspection on 6 November 1991 indicate that steelhead occasionally use the stream. Envirochem Special Projects Inc. undertook a contamination assessment of MMNHS in 1994. Their results suggest that water quality in Kitsuksis Creek is unchanged by traversing the mill site.

2.2 Riparian Biophysical Unit

Kitsuksis creek has a riparian corridor along most of its length. In the millpond area a small riparian zone has developed where the stream has incised into the millpond deposits. This vegetation is dominated by Reed Grass (*Calamagrostis canadensis).* Small amounts of willows, alders, and other shrubby vegetation have also become established. The riparian zone is largely intact both upstream and downstream of the millpond. This is an important biophysical resource for both aquatic and terrestrial animal species. Ungulates such as Blacktailed deer use these areas as travel corridors. Riparian areas are important to fish as they provide the nutrients, food, and cover, necessary in rearing areas.

2.3 Marsh (Millpond) Biophysical Unit

The natural resources of the millpond are highly modified from a natural state. Flooding and subsequent draining of the area has produced a grassy meadow dominated by Reed Grass (*Calamagrostis canadensis*), and Canary Grass (*Phalaris sp.*). Minor amounts of freshwater marsh species such as cattail (*Typha latifolia),* Hardhack (*Spirea douglasii*), and sedges occur as well. Birds and wildlife make little use of this site at the present time.

ERRATUM

section 2.1 Riverine Biophysical Unit
should read as follows:

..........This has been incorporated into the design of the dam based upon a hydrological analysis by Al Sippola, Structural Engineer, Public Works and Government Services, Calgary. **An estimated 200 Coho salmon spawn annually in Kitsuksis creek.** This is the most important resource value associated with the millpond restoration project....................

3.0 ENVIRONMENTAL EFFECTS

Millpond restoration has the potential to produce environmental effects in the Kitsuksis creek drainage. The effects can be eliminated or mitigated to insignificance. Mitigations designed to lessen the impact of the restoration are listed below in Section 4.0.

There is potential for dam restoration activities (excavation, trenching, backfilling, concrete work) to impact the water quality and fishery resources of Kitsuksis creek. Direct or indirect sediment inputs, and spills of toxic chemicals (fuels, oils, wood preservatives, etc.) may occur.

If the fishery resources of Kitsuksis creek are impacted by restoring the millpond, socio-economic impacts in the local salmon fishery are likely.

Repairing the dam may impede upstream and downstream fish movements in Kitsuksis creek. Construction of a fish ladder will mitigate this environmental effect. The fish ladder will be monitored and adjustments made as necessary to ensure it operates effectively.

Riparian habitat along the edge of Kitsuksis creek in the millpond area will be lost by millpond excavation and subsequent flooding. Development of fish rearing habitat in the millpond area will compensate for this loss.

There are no cumulative environmental effects associated with project.

4.0 MITIGATION MEASURES

The following mitigating measures will reduce the impact of millpond reconstruction:

all work within the wetted perimeter of Kitsuksis creek must be completed on or before 15 September 1995. Upon commencement of instream work (within wetted perimeter), the contractor shall work diligently to ensure expedient project completion.

excavation and construction sites shall be separated from the flowing stream at all times. Cofferdams may be used to isolate work site(s) from the flowing stream. These will be made of materials free of silt and resistant to erosion.

All fish confined to waters behind cofferdams must be relocated to a safe area beyond the influence of the work site. A qualified electro-shock contractor must be hired to conduct this work.

During millpond excavation, a buffer strip two to five meters wide will be left adjacent to the edge of Kitsuksis creek. No material will be removed from this area. The depth of pond excavation must be above the elevation of the creek bed to prevent dewatering of Kitsuksis creek.

an archaeologist from IR Wilson Consultants Limited will be on site during the excavation of the millpond to ensure significant resources are not damaged or lost.

construction methods must ensure that no fresh concrete, lime, cement, or other material enters the watercourse.

equipment required to work next to a water body shall be mechanically sound, having no leaking fuel tanks or hydraulic connections.

dam repair will be undertaken in two phases from opposite sides of the breach to ensure stream flows adequate for fish passage in Kitsuksis creek are constantly maintained. The creek will not be completely blocked at any time during the construction, or operation, of the millpond dam.

machinery (e.g. concrete trucks) shall not be washed out within 50 m of a water body or in an area where wash water will enter the water body.

all operations shall be conducted in a way that minimizes the siltation and disturbance to adjacent and downstream areas.

a fish ladder, designed to operate at all flow rates, will be constructed to allow both upstream and downstream fish passage around the millpond dam. The fish ladder design was developed in conjunction with staff from Salmonid Enhancement Program, Department of Fisheries and Oceans.

the effectiveness of the fish ladder will be monitored and necessary changes in design or operation made as required.

guidelines for millpond use will be developed to minimise the impact of milling operations on the aquatic resources of Kitsuksis Creek. Guidelines will ensure: logs are placed ("soft watered") into the pond by self loading log trucks or similar technology; no log watering occurs near the fish ladder entry into the millpond; watered logs are confined to a boom pocket to restrict the area of impact; the number of logs and their residence time in the millpond is minimised to lessen the impact upon the aquatic resources of the millpond.

riverine and riparian habitat lost during millpond excavation and flooding will be replaced by approximately 0.5 hectares of migration and rearing habitat. Millpond Use Guidelines will minimise impacts upon fishery resources.

all machine work shall be carried out from the watercourse banks unless permission has been granted by the engineer to operate in the watercourse.

if fording Kitsuksis Creek is necessary during millpond excavation, a single location at right angles to the stream banks will be established. The ford width shall be no more than 1.5 times the equipment width. To prevent silt tracking use 75 mm stone, corduroy, or brushmats to stabilize both sides of the ford. Any materials placed in the stream to improve the crossing site are to be clean, erosion resistant, and non-toxic to aquatic life (a minimum water depth of 20 cm should be maintained where flows permit). Any materials placed in or near the ford must be removed upon project completion

the toe and the embankments of all spillways shall be protected with material satisfactory to the engineer to prevent scour or erosion due to waves, ice, currents, or fish spawning activities.

sediment traps or filters shall be placed in the downstream portion of Kitsuksis Creek channel before excavation of the millpond area.

excavated material shall either be immediately removed from the site or located in an area that minimises the potential for silt transport due to storm water runoff.

all excavation dewatering must be treated for silt removal. No water will be pumped directly into a watercourse.

when filling the millpond, a continuous maintenance flow is required downstream of the dam to protect fishery resources.

project surveillance will ensure that mitigations and contract specifications are followed. Surveillance will be provided by the McLean Mill site Manager Dave Lowe, Project Engineer Al Sippola, Environmental Assessment Officer Steve Oates, and occasional site visits from DFO staff from the Port Alberni office.

Note: *additional mitigative measures are provided in the contract specification document entitled "McLean Mill National Historic Site Dam Repair. Most of these are located in Section 01565 Environmental and Aesthetic Protection.*

5.0 CONCLUSIONS

The restoration of the McLean Mill millpond will not likely produce significant adverse environmental effects. The potential for environmental effects is limited as the site previously operated as a sawmill and is already fully developed. Restoring the millpond will not require development of any new facilities. Kitsuksis creek has valuable aquatic resources as it supports a spawning population of Coho salmon. The potential environmental effects upon the aquatic resources of Kitsuksis creek can be mitigated to insignificance.

Contactors working on the millpond restoration must be briefed on the importance of adhering to the mitigations in this screening report and in the contract specifications. All contract work must be closely supervised to ensure that mitigations are adhered to.

The effectiveness of the fish ladder will be monitored and necessary changes made to ensure it allows efficient upstream and downstream passage of fish. Development of McLean Mill National Historic Site will positively impact the economy of the Port Alberni region. No cumulative environmental effects are associated with this project.

6.0 AGENCIES AND INDIVIDUALS CONTACTED

The following individuals and agencies were contacted regarding the proposed millpond restoration at McLean Mill National Historic Site:

BC Environment - Fisheries Branch

George Reid
Head Fisheries Section
Vancouver Island Regional Headquarters
2569 Kenworth Road
Nanaimo, BC
V9T 4P7
ph: 604 751-3228

BC Environment - Water Management

Alan Boom
Dam Safety Officer
Vancouver Island regional Headquarters
2569 Kenworth Road
Nanaimo, BC
V9T 4P7
ph: 604 751-3100

Department of Fisheries and Oceans

Russ Doucet
Senior Project Engineer
Salmonid Enhancement Program
Pacific Region Headquarters
400-555 West Hastings Street
Vancouver, BC
V6B 5G3
ph: 604 666-6244

Rob Russell
Acting Habitat Chief
South Coast Division
3225 Stephenson Point Road
Nanaimo, BC
V9T 1K3
ph: 604 756-7291

Department of Canadian Heritage

Al Sippola
Structural Engineer
Architectural and Engineering Services
Public Works and Government Services
Room 520, 220-4th Avenue S.E.
Calgary, Alberta
T2P 3H8
ph: 403 292-4714

David Whiting
Restoration Architect
Architectural & Engineering Services
Public Works & Government Services
Room 520, 220-4th Avenue S.E.
Calgary, Alberta
T2P 3H8
ph: 403 292-4715

7.0 DEPARTMENTAL CONTACT

If further information is required on the environmental screening for Millpond Restoration, please contact:

Steve Oates
Environmental Assessment Officer
Pacific and Yukon Region
Canadian Heritage
Suite 300-300 West Georgia Street
Vancouver, BC
V6B 6C6

ph: 604 666-0286
fx: 604 666-7957

8.0 REFERENCES

Anonymous. **McLean Mill National Historic Site Draft Management Plan**, 1994, 62 pgs.

Canadian Heritage, Parks Canada. **Environmental Mitigation Manual**, 1993, 200 pgs.

Chilibeck, B. **Land Development Guidelines For The Protection Of Aquatic Habitat**, 1992, 127 pgs.

Commonwealth Historic Resource Management Limited, **Discussion Paper: A Management plan for the R.B. McLean Lumber Co. National Historic Site,** 1992, 87 pgs. + app.

Commonwealth Historic Resource Management Limited, **A Management Plan For The McLean Mill National Historic Site Port Alberni, British Columbia**, 1993, 140 pgs. + app.

EBA Engineering Consultants Ltd. **Geotechnical Assessment of Dam Reconstruction McLean Mill National Historic Site Port Alberni, BC**, 1995, 13 pgs. + app.

Envirochem. **McLean Mill National Historic Site Port Alberni, B.C. Contamination Assessment**, 1994, 54 pgs. + app.

Fisheries and Oceans. **Province of Nova Scotia Environmental Construction Practice Specifications**, 1981, 40 pgs.

Fisheries and Oceans. **Dam Construction Environmental Guidelines**, 1987, 35 pgs.

Katopodis, C. **Introduction to Fishway Design**, Freshwater Institute, 53 pgs.

Public Works And Government Services Canada, **McLean Mill National Historic Site Dam Repair: Specifications and Drawings**, 45 pgs.

Samis, S.C., M.D. Nassichuk and B.J. Reid. **Guidelines for the Protection of Fish and Fish Habitat During Bridge Maintenance Operations in British Columbia,** Can. Tech. Rept. Fish. Aquat. Sci. #1692, 1991, 64 pgs.

Sippola, A. **R.B. McLean Mill National Historic Site Kistsuksis Creek Stream Hydrology**, 1995, 3 pgs.

APPENDIX 1

CANADIAN HERITAGE SCREENING FORM

C.E.A.A. SCREENING #:	PARK SCREENING #: MMNHS95-01
FIELD SITE: McLean Mill National Historic Site	
1. RA REFERENCE #: PACYUKRO-00001	
2. TITLE (Eng): McLean Mill Millpond Restoration	
3. TITLE (Fr): Reparation du Reservoir du Moulin McLean	
4. SUBJECT DESCRIPTOR (minimum of one):	
a) parks	b)
c)	d)
5. EA TYPE: screening	
6. PHYSICAL ACTIVITY CODE: draining or altering of water levels of a water body: Fisheries Act (ss. 35(2)	
7. PRIMARY UNDERTAKING (minimum of one):	
a) repair	b) construction
c)	d)
8. PHYSICAL WORK (Eng): lock and dam	
9. PHYSICAL WORK (Fr): barrages / digues / ecluses	
10. EA START DATE (yy mm dd): 95/05/03	
11. EA TRIGGER CODE: proponent	
12. GEOGRAPHIC LOCATION: Port Alberni	
13. EA DETERMINATION: effects not likely significant	
14. DEADLINE FOR PUBLIC INPUT (if public component)(yy mm dd): N/A	
15. EA DETERMINATION DATE (yy mm dd): 95/07/26	
16. ORGANIZATION: Parks Canada	
17. CONTACT PERSON FOR EA: Steve Oates	
18. DOCUMENT REGISTER CONTACT: Steve Oates	
19. FILE LOCATOR (file name & number): Screening of McLean Mill Millpond Restoration. PACYUKRO-00001	
20. GENERAL COMMENTS:	

5:26PM

Post-it™ Fax Note 7671E	Date July 27 # of pages ▸ /
To STEVE OATES	From BRUCE LUND
Co./Dept.	Co.
Phone # 666 7957	Phone #
Fax #	Fax #

CANADIAN HERITAGE SCREENING I

C.E.A.A. SCREENING #: **PARK SCREENING #:** MMNHS95-01

PROJECT DESCRIPTION: Excavation of millpond sediments; repair of dam breach; reconstruction of fish ladder and spillway

PROJECT MANAGER: Bruce Lund, BC Coast/Interior District Office, Canadian Heritage

NATURE & EXTENT OF ADVERSE ENVIRONMENTAL EFFECTS, INCLUDING CUMULATIVE EFFECTS:

Adherence to mitigations will prevent adverse environmental effects.

No cumulative effects involved with this project.

MITIGATIVE MEASURES:

Specific mitigative measures which address individual environmental effects are listed in the attached Screening Report.

SIGNIFICANCE OF THE ADVERSE ENVIRONMENTAL EFFECTS:

No adverse environmental effects are likely given adherence to mitigations.

PROJECT SURVEILLANCE: NO____ YES_X__ (attach details & schedule)

RESPONSIBLE OFFICER: Dave Lowe / Al Sippola / Steve Oates. Project surveillance will be shared between the above three individuals. Dave Lowe will be on site every day during millpond restoration.

FOLLOW-UP: NO_X__ YES____ (attach details & schedule)
RESPONSIBLE OFFICER:

AGENCIES & INDIVIDUALS CONSULTED: See Section 6.0 of the attached screening report

REFERENCE DOCUMENTS USED: See Section 8.0 of the attached screening report

PUBLIC CONCERNS: N/A

SCREENING DONE BY: Steve Oates

DETERMINATION: Effects not likely significant

SIGNATURE OF RCM:

Bruce Lund

Bruce Lund - Acting Director BC Coast / Interior District Office

July 27, 95
Date

APPENDIX 2

Fisheries and Oceans | Pêches et Océans

Habitat and Enhancement Branch
3019 4th Avenue
Port Alberni, B.C. V9Y 2B8

UNCLASSIFIED

Your file Votre référence

Our file Notre référence

CITYPA\MCMILL
95-HPAC-PA3-068-135

August 2, 1995

Canadian Heritage
B.C. Coast/Interior District Office
#250 - 1675 Douglas Street
Victoria, B.C. V8W 2G5

Attention: Bruce Lund
Acting Director

Dear Sir:

Re: McLean Mill National Historic Site Restoration - Kitsucksis Creek

I have reviewed the Screening Report prepared by Steve Oates, Environmental Assessment Officer, for this project. I have also reviewed Rob Russell's (DFO Habitat Biologist) suggestions for mitigative measures.

The mitigative measures included in the Screening Report and Rob Russell's Memorandum to the Acting Habitat Chief (attached) are to be followed at all times.

I have a concern with regard to construction timing. Instream works for this area must be completed by September 15, as adult coho salmon begin their upstream migration soon after this date. Some of the work is proposed to be carried out as late as October 30 (Section 1.3 of the Screening Report -*Project Schedule*). It must be ensured that any instream works that are required for work proposed after September 15 are done before this date, unless the work site can be completely isolated from flowing water so as not to disturb upstream migrating salmon. A site inspection by the undersigned may be required to determine if any proposed work after September 15 can be carried out in an acceptable manner.

COPY

................................../2

CITYPA\MCMILL

I will be meeting with Al Sippola, Structural Engineer for Public Works on August 2, 1995 at McLean Mill and will discuss the schedule of works at that time. Please contact the undersigned if you have any concerns (ph. 723-5063, fax 724-2555). A copy of this letter and all mitigative measures required is to be kept at the work site for inspection by a Fishery Officer/Conservation Officer.

Yours sincerely

B. Rushton, AScT
Habitat Management Technologist
Port Alberni Field Office

BR/

c.c. B. Hillaby, SCD Habitat
B. Cerenzia, MOELP Port Alberni
S. Oates, Canadian Heritage, Vancouver
A. Sippola, Public Works, Calgary

COPY

Repairing the dam may impede upstream and downstream fish movements in Kitsuksis creek. Construction of a fish ladder will mitigate this environmental effect. The fish ladder will be monitored and adjustments made as necessary to ensure it operates effectively.

Riparian habitat along the edge of Kitsuksis creek in the millpond area will be lost by millpond excavation and subsequent flooding. Development of fish rearing habitat in the millpond area will compensate for this loss.

There are no cumulative environmental effects associated with project.

4.0 MITIGATION MEASURES

The following mitigating measures will reduce the impact of millpond reconstruction:

- all work within the wetted perimeter of Kitsuksis creek must be completed on or before 15 September 1995. Upon commencement of instream work (within wetted perimeter), the contractor shall work diligently to ensure expedient project completion.

- excavation and construction sites shall be separated from the flowing stream at all times. Cofferdams may be used to isolate work site(s) from the flowing stream. These will be made of materials free of silt and resistant to erosion.

- All fish confined to waters behind cofferdams must be relocated to a safe area beyond the influence of the work site. A qualified electro-shock contractor must be hired to conduct this work.

- During millpond excavation, a buffer strip two to five meters wide will be left adjacent to the edge of Kitsuksis creek. No material will be removed from this area. The depth of pond excavation must be above the elevation of the creek bed to prevent dewatering of Kitsuksis creek.

- an archaeologist from IR Wilson Consultants Limited will be on site during the excavation of the millpond to ensure significant resources are not damaged or lost.

- construction methods must ensure that no fresh concrete, lime, cement, or other material enters the watercourse.

- equipment required to work next to a water body shall be mechanically sound, having no leaking fuel tanks or hydraulic connections.

- dam repair will be undertaken in two phases from opposite sides of the breach to ensure stream flows adequate for fish passage in Kitsuksis creek are constantly maintained. The creek will not be completely blocked at any time during the construction, or operation, of the millpond dam.

- machinery (e.g. concrete trucks) shall not be washed out within 50 m of a water body or in an area where wash water will enter the water body.

- all operations shall be conducted in a way that minimizes the siltation and disturbance to adjacent and downstream areas.

- a fish ladder, designed to operate at all flow rates, will be constructed to allow both upstream and downstream fish passage around the millpond dam. The fish ladder design was developed in conjunction with staff from Salmonid Enhancement Program, Department of Fisheries and Oceans.

- the effectiveness of the fish ladder will be monitored and necessary changes in design or operation made as required.

- guidelines for millpond use will be developed to minimise the impact of milling operations on the aquatic resources of Kitsuksis Creek. Guidelines will ensure: logs are placed ("soft watered") into the pond by self loading log trucks or similar technology; no log watering occurs near the fish ladder entry into the millpond; watered logs are confined to a boom pocket to restrict the area of impact; the number of logs and their residence time in the millpond is minimised to lessen the impact upon the aquatic resources of the millpond.

- riverine and riparian habitat lost during millpond excavation and flooding will be replaced by approximately 0.5 hectares of migration and rearing habitat. Millpond Use Guidelines will minimise impacts upon fishery resources.

- all machine work shall be carried out from the watercourse banks unless permission has been granted by the engineer to operate in the watercourse.

- if fording Kitsuksis Creek is necessary during millpond excavation, a single location at right angles to the stream banks will be established. The ford width shall be no more than 1.5 times the equipment width. To prevent silt tracking use 75 mm stone, corduroy, or brushmats to stabilize both sides of the ford. Any materials placed in the stream to improve the crossing site are to be clean, erosion resistant, and non-toxic to aquatic life (a minimum water depth of 20 cm should be maintained where flows permit). Any materials placed in or near the ford must be removed upon project completion

- the toe and the embankments of all spillways shall be protected with material satisfactory to the engineer to prevent scour or erosion due to waves, ice, currents, or fish spawning activities.

- sediment traps or filters shall be placed in the downstream portion of Kitsuksis Creek channel before excavation of the millpond area.

- excavated material shall either be immediately removed from the site or located in an area that minimises the potential for silt transport due to storm water runoff.

- all excavation dewatering must be treated for silt removal. No water will be pumped directly into a watercourse.

- when filling the millpond, a continuous maintenance flow is required downstream of the dam to protect fishery resources.

- project surveillance will ensure that mitigations and contract specifications are followed. Surveillance will be provided by the MClean Mill site Manager Dave Lowe, Project Engineer Al Sippola, Environmental Assessment Officer Steve Oates, and occasional site visits from DFO staff from the Port Alberni office.

Note: additional mitigative measures are provided in the contract specification document entitled "MClean Mill National Historic Site Dam Repair. Most of these are located in Section 01565 Environmental and Aesthetic Protection.

5.0 CONCLUSIONS

The restoration of the MClean Mill millpond will not likely produce significant adverse environmental effects. The potential for environmental effects is limited as the site previously operated as a sawmill and is already fully developed. Restoring the millpond will not require development of any new facilities. Kitsuksis creek has valuable aquatic resources as it supports a spawning population of Coho salmon. The potential environmental effects upon the aquatic resources of Kitsuksis creek can be mitigated to insignificance.

Contactors working on the millpond restoration must be briefed on the importance of adhering to the mitigations in this screening report and in the contract specifications. All contract work must be closely supervised to ensure that mitigations are adhered to.

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

To / À: Acting Habitat Chief(s)
South Coast Division

From / De: Rob Russell, A/Habitat Chief
South Coast Division

Security Classification - Classification de sécurité	**UNCLASSIFIED**
Our File - Notre référence	
Your File - Votre référence	
Date	July 20, 1995

Subject / Objet: **RE-ACTIVATION OF MCLEAN SAWMILL SITE ON KITSUCKSUS CREEK, PORT ALBERNI - DAM AND FISHWAY CONSTRUCTION, RUN OF THE RIVER TYPE**

Steve Oates, Environmental Assessment Officer with Canadian Heritage and Parks Canada and Al Sippola, Structural Engineer with Public Works Canada met with the undersigned July 20, 1995 to discuss the above project. The old McLean sawmill used to operate within Kitsucksus Creek, behind a timber dam between the 1930s and the mid 1960s when the company no longer used the site and the dam failed, allowing the mill pond to empty and the stream to return to confined banks.

The City of Port Alberni owns the property where the remains of the mill still exist, and want to re-construct the site as a tourist attraction. Parks Canada is providing funding for reconstruction of the dam, installation of a fishway, excavation of a new mill pond, and other general site improvements. Their engineers have drawn up detailed plans for the site (attached) which describe the structural implications of the project. Al Sippola explained the details of the structure to me this date, and I made several suggestions regarding construction timing, details related to site isolation, and operational considerations which should be incorporated.

Steve Oates is preparing the Screening Report under CEAA and will be forwarding a copy to this office shortly. He will also be sending a detailed project schedule, which will, they hope, see the construction of the site complete by the end of the Fisheries work window by September 15, 1995.

I made the following suggestions:

1/ No work is to occur within the wetted perimeter of Kitsucksus Creek until a letter of advice is received from DFO. This letter will come from the south coast division office, in consultation with Brad Rushton. We will forward our letter of advice once we have a copy of the screening report and the construction schedule.

The City of Port Alberni intends to begin excavation of the old mill pond site during the week of July 24. Kitsucksus Creek must not be affected in any way while this is occurring. Al Sippola has assured me that the depth of the pond excavation will be above the level of the streambed, to ensure that the streamflows in adjacent Kitsucksus Creek are not affected in any way. All work on the mill pond will occur a minimum of 2 and preferably 5 meters back from the creek.

2/ A portion of Kitsucksus Creek at the dam site will have to be isolated to allow work in the stream channel to proceed. If this portion of the creek is wetted at time of construction, a coffer dam will have to be constructed which will allow fish to pass around the work site. Fish will have to be electro-shocked out of this section of stream and transported away from the site by a qualified contractor hired for the purpose. Under no circumstances are fish or their habitats to be altered, disrupted or destroyed.

3/ No sediment may enter the stream at any time. Sediment abatement devices must be installed wherever necessary to accomplish this.

4/ Dam construction will necessitate excavation, form construction, cement pouring, etc. All cement wastes must be prevented from entering fish-bearing waters. No construction wastes are to enter fish bearing waters.

5/ While the dam is filling in the fall, natural streamflows must be maintained in Kitsucksus Creek at all times. Once the dam is full, water will be diverted over the dam through a fishway designed by DFO SEP engineers. Water will always flow over the dam at the fishway, ensuring fish passage. In high water conditions, various overflow structures will kick in which will direct water through overflow channels back to the creek.

6/ A portion of Kitsucksus Creek will be flooded by this project. Since this is a rearing and migration area of the creek, it is expected that rearing habitat will be more than replaced by the sizable area of the mill pond. Fish passage will be assured by the fishway.

7/ Operation of the sawmill will necessitate log dumping in the mill pond. I have asked that wood be "soft watered" by using self-loading log trucks or similar technology. Sedimentation of the pond must be kept to an absolute minimum to prevent damage to fish habitat. The log watering will occur well away from the fishladder entry point, and careful control of logs within a boom pocket in the pond will isolate the timber handling area from the rest of the pond. Logs should be directed (preferably by hand) to the mill conveyor within the log pocket boom only, thus leaving the balance of the pond to serve as a rearing and migration area for fish.
About 3 logs are expected to be handled daily, necessitating limited log watering.

8/ Since the mill pond will become a fish habitat, every precaution must be taken to ensure that fish and their habitat are not altered, disrupted or destroyed.

9/ Bob Cerenzia, Habitat Technologist, Ministry of Environment, Lands and Parks must be provided all project information prior to any construction at the site. Brad Rushton must be kept informed of the progress of project, so that he may monitor the re-construction as required. As usual, DFO will reserve the right to enforce the Fisheries Act at all times.

L R Russell

Rob Russell, Habitat Biologist
South Coast Division

cc: Brad Rushton, Habitat Technologist, Port Alberni
Steve Oates, Environmental Assessment Officer, Professional and Technical Services, Pacific and Yukon Region, 103-267 West Espalanade, North Vancouver, B.C. V7M 1A5

APPENDIX E.

3.2.12 McLean Mill Dam Retrofit Overview, Final Report. 2009. Northwest Hydraulic Consultants Ltd. (NHC)

ALBERNI VALLEY ENHANCEMENT ASSOCIATION




MCLEAN MILL DAM RETROFIT OVERVIEW
FINAL REPORT

APRIL 2009

nhc northwest hydraulic consultants

Leaders in water resource technology

McLean Mill Dam Retrofit Overview
Final Report

Prepared for:

Alberni Valley Enhancement Association
c/o Dave Clough
6966 Leland Road
Lantzville, V0R 2H0

Prepared by:

Northwest Hydraulic Consultants
202-3150 Island Highway North
Nanaimo, BC, V9T 1V9

April 2009
nhc project: 35137

Credits and Acknowledgements

Numerous meetings and phone conversations with Dave Clough (D.R. Clough Consulting), Brad Remillard (D.R. Clough Consulting), Dave Chitty (AVEA), Neil Malbon (City of Port Alberni), and Barry Cordocedo (DFO).

Notification

Report prepared by:

Graham Hill, P.Eng.

Report reviewed by:

Barry Chilibeck, M.A.Sc., P.Eng.

Citation:

NHC. 2009. *McLean Mill Dam Retrofit Overview Draft Report*. Prepared for the Alberni Valley Enhancement Association. April 2009.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS

LIST OF APPENDICES

1 INTRODUCTION

The R.B. McLean Mill National Historic Site (MMNHS) is located about 9 km North of Port Alberni. The mill was operated by R.B. McLean from 1926 to 1965. In 1989, it was named a National Historic Site to commemorate the history of logging and sawmilling in British Columbia. Since then the sawmill has been rebuilt and restored to operate as it did in 1965.

The sawmill pond was originally created by constructing a timber crib and earth-fill dam across Kitsuksis Creek. In 1995, Public Works and Government Services Canada (PWGSC) dredged the millpond and reconstructed the dam (Dam D710114) with a spillway and fish ladder (PWGSC, 1996). The project restored the dam to near-original conditions with improvements to allow higher flood flows and the incorporation of a fish ladder. The pond water level and dam crest levels are similar to the original project. The design full supply level of the pond is 113.0 m (MSL). In recent years a number of issues and deficiencies regarding the dam have arisen, some of which include:

- The spillway has inadequate conveyance for flood flows, and the road over the dam (emergency spillway) has regularly activated. In November 2006, the dam overtopped with approximately 0.2 m of water. Erosion to the downstream face of the dam was moderate and was repaired with riprap;
- The wooden fish ladder has rotted and needs to be replaced;
- The wooden spillway retaining walls have rotted and need to be replaced;
- The millpond is trapping sediment transported down Kitsuksis Creek and is infilling. The pond is used as a reservoir for fire fighting and there is concern that there is insufficient volume for emergency fire-fighting needs;
- The 914 mm diversion culvert had been filled-in and not operated. When it was functional, the pond water level was difficult to control; and
- The sluiceway has a guillotine gate which is difficult to operate and provides poor water level control; it is seldom operated.

The overall project goal is to improve the operation and safety of the millpond dam. The project must meet the following overall dam safety criteria and objectives:

- Safely convey the Inflow Design Flood (IDF);
- Operate with low maintenance and infrequent operational effort (e.g. self-regulating);
- Provide safe upstream and downstream movement of fish;
- Provide adequate water depth and volume in the millpond for sawmill operations and emergency firefighting needs; and
- Be integrated with the Heritage site needs and conditions.

Note that this report is not a formal dam safety investigation. It is not intended to, and does not address all dam related issues. Work beyond the scope of this report includes seismic design, geotechnical design, structural design, detailed hydrotechnical design, dam safety management, operation and maintenance, emergency preparedness, and other dam related principles. However, any outstanding dam safety issues identified through the course of this study are provided in the following text.

2 HYDROLOGY

The stream gage *Kitsuksis Creek above Cherry Creek* was maintained by Water Survey of Canada from 1978 to 1981. However, this is not an adequate period of data to provide a thorough understanding of the hydrology at this location. Hydrology for the dam reconstruction in 1995 was determined with the rational method, $Q_i = CIA$, where;

Q_i = Flow (m^3/s)
C = Runoff coefficient
I = Rainfall intensity (mm/hour)
A = Watershed area (km^2)

Rainfall IDF data from the Port Alberni Airport for 22 years of records (1969 – 1990) were used in the original hydrology study. The calculated time of concentration was 25.9 minutes.

To verify the hydrology, NHC used several methods including a multivariate hydrology relationship adapted from Sumioka et al (1998), and an empirical method, Creager's plot (Watt et al, 1989). For the multivariate approach, design flood return periods can expressed with the following equation, $Q_i = \alpha\, A^{0.92}\, P^{1.26}$, where;

Q_i = Estimated discharge (m^3/s)
α = Flood coefficient
A = Drainage area (km^2)
P = Mean annual precipitation (mm)

Creager's plot, a common empirical method for rough comparison of extreme flood data, can be used to verify results from other methods. BC coastal systems generally have a Creager's C value between 20 and 30. Plotting flows for the 100-, and 200-year flood events resulted in Creager's C values of 21 and 23 respectively.

On November 16, 2006 a large flood event occurred on Kitsuksis Creek which overtopped the dam. During the event the Diversion Culvert and Sluiceway were closed, and the stoplog was installed in the spillway (Spillway el = 113.2 m). We reconstructed the flood using surveyed high water marks. The dam was modeled as a broad crested weir and the Spillway was modeled as a sharp crested weir (although this may be an overestimate due to backwatering effects).

The Emergency Spillway was more difficult to model because of flow entering the spillway from the pond, as well as from the spillway sides over the top of the dam. To account for the complexity of the Emergency Spillway flood conveyance we calculated a minimum and maximum estimated flow. Note that more accurate modeling techniques are available but would require significantly more time to calculate. For this flood event we calculated the flow to be between 16 and 21 m^3/s which correlate to the 10- to 20-year storm period.

For the McLean Millpond dam we recommend the Inflow Design Flood (IDF) be the 200-year event which is 27.9 m^3/s. A summary of the hydrology is provided in Table 1.

3 SURVEY AND SITE DESCRIPTION

A topographic survey was completed by Transitec Consulting Ltd. on February 24, 2009. The vertical datum was determined by surveying the spillway crest and setting the vertical datum to match the design/as-built elevation of 12.7 m. The horizontal elevation was assumed. The survey is presented in Appendix A.

Kitsuksis Creek Flows into the North end of the millpond. At the time of the survey the water level was 113.1 m (MSL). The pond water depth is typically 1 - 2 m deep near the dam and the maximum depth is 2.9 m below the log skidway at the mill. The pond volume when the water level is at 113.1 m is approximately 3,100 m^3.

The dam crest is 113.8 to 114.0, which is slightly below the dam design elevation of 114.0 m (Photo 1). The dam has a concrete core up to elevation 113.0 m. Original drawings are provided in Appendix B. The water level elevation downstream of the dam is 109.8 m (when surveyed). The dam is classified as Low consequence of failure (J. Baldwin, BC Dam Safety Officer, pers. comm.). The dam has multiple flow control structures as described below.

3.1 DIVERSION CULVERT

The Diversion Culvert was used during construction to divert water under the dam. It is a 914 mm diameter (CSP) culvert (shown at 1500 mm on the as-built drawings) with an Armtec 20-10C cast iron gate on the upstream face (invert el. = 109.74 m; slope = 0 %).

3.2 SLUICEWAY

The Sluiceway is a gated concrete orifice (invert el. = 111.70 m). It has a sloping timber structure (culvert) on the downstream side of the dam core. A guillotine valve (circa 1930 – 1960) on the upstream face controls the flow (Photo 2)

3.3 FISHWAY

The Fishway is a 914 mm diameter (CSP) culvert through the dam (invert el. = 112.21 m; slope = 0%), and a timber step pool structure (pools are 1.2 m wide by 1.8 m long). An aluminium adult fish trap/counter is fitted to the pond end of the culvert. Flows through the fish ladder are controlled by installing stoplogs in the spillway which alters the pond elevation (Photos 3 & 4)

3.4 SPILLWAY

The Spillway is a 3.0 m wide concrete structure with a timber chute beside the fishway. The spillway has reinforced concrete slab covered with timber with vertical timber retaining walls. The concrete sill of the control structure (invert el. = 112.7 m) is fitted with stoplog guides to control the millpond level. At the time of the survey stoplogs were installed to elevation 113.2 m

3.5 EMERGENCY SPILLWAY

The Emergency Spillway originally was an ‘erodible’ dam or fuse plug composed of sand (top el. = 113.8 m; invert el. = 113.0 m; width = 10 m). The design was for the sand wedge to fail during flood events when the capacity of the four other flow conveyance structures was exceeded. Reportedly the sand wedge did not fail during a dam overtopping event and the spillway has subsequently been extensively modified. The current configuration has the sand wedge removed and an armoured channel excavated through the dam (invert el. = 113.4 m; bottom width = 3 - 4 m; side slopes = 15 - 30 %) (Photo 5).

3.6 HATCHERY INTAKE

The Hatchery Intake is located in the Fishway immediately downstream of the culvert. The intake is a screened pipe which crosses the spillway surface and is bedded underground to the hatchery. The pipe diameter is 8” (to be verified) (Photo 6).

4 HYDRAULICS

The original design IDF was 31.5 m^3/s (PWGSC, 1996) and, according to manual, the project can pass the IDF with all five control works open with the pond at elevation 113.85 (approx). However, the Diversion Culvert and Sluiceway are generally not operated (N. Malbon, McLean Mill National Historic Site Operations Manager, pers. comm..). In addition, the Emergency Spillway has been raised and narrowed from its original design elevation of 113.0 m and width of 10 m. The original outlet control conveyance capacity provided in the draft operations manual has been reprinted in Table 2. Table 3 shows the estimated conveyance of the existing structure with the modified spillway and closed Diversion Culvert and Sluiceway.

4.1 FREEBOARD

The freeboard of a structure is the minimal vertical distance between the still pool reservoir level and the crest of the containing structure. Freeboard must be maintained at all times in order to prevent overtopping of the containing structure by waves, including due consideration to wind and wave setup. It also accounts for unsteady hydraulic conditions that may result during extreme flood events, like surging and hydraulic instabilities (e.g. supercritical-subcritical changes).

The minimum specified freeboard depends on the type of structure. Criteria are more stringent for embankment structures that are more likely to fail in case of overtopping than for concrete or other rigid structures that can withstand some overtopping without serious damage.

For the Millpond Dam the concrete core is 1.0 m below the top of the dam, and the dam has not been designed to overtop; therefore, overtopping could lead to significant damage and/or failure. Waves are not significant due to the very limited fetch of the Millpond, thus calculating the minimum freeboard for the dam can not be based on this criterion alone. The stream channel tributary to the dam could be subject to surging debris flood and other events that could cause unsteady hydraulics affecting the dam.

Since the Emergency Spillway outlet of the millpond is similar to a steep river channel, it could be stated that the outlet works should have freeboard, at minimum, equivalent to the provincial dike standards which are the 200-year instantaneous flood level plus 0.3 m freeboard (Golder, 2003). Using the instantaneous estimate of inflows, we recommend a minimum freeboard of 0.3 m above the 200-year flood level, or a maximum water level of 113.7 m during the IDF.

5 PROJECT OPTIONS

This report presents two conceptual options (Figure 1) to improve the dam and to meet the objectives identified in the introduction;

- Option 1: Modify the existing structure including new flow control works.
- Option 2: Isolate the millpond and construct a new river channel.

5.1 OPTION 1: MODIFY EXISTING STRUCTURE

The Emergency Spillway will be reconstructed as the main Outlet Channel to accommodate fish migration and to convey large flood events. The Spillway will be used to assist with conveying flood events. The Fishway will be removed because its function will be incorporated in the Outlet Channel. The Diversion Culvert and Sluiceway will not be used in normal dam operations. The dam crest will be raised to the design elevation of 114.0+ m. The millpond will be excavated down to elevation 110.0 and a sediment trap will be installed at the pond inlet of Kitsuksis Creek. The minimum pond water level will be at elevation 112.7 m. The IDF pond level will be 113.7 m.

The Spillway will require extensive modifications including removing the fishway and constructing vertical concrete walls along the edges to the pool at the base of the dam. The spillway can convey approximately 5 m^3/s with 1.0 m of head. Extensive redesign of the existing Emergency Spillway is required to convey the remainder of the IDF (~ 23 m^3/s). Preliminary hydraulic calculations indicate a rock lined channel with crest elevation 112.7 m and a slope of 4.5% will need to be approximately 15 m wide at the pond outlet to convey the IDF without overtopping the dam (max. water level = 113.7 m).

The outlet channel can be narrowed as the water accelerates down the channel; the channel will need to be approximately 100 m long. A bridge is required over the rock lined channel for access to the North side of the site and the fish hatchery. Fish enumeration will be accomplished by installing a new counting fence in a convenient location to be determined.

Note that during low flow conditions the creek may flow subsurface in the Outlet Channel until some time in the future when silt and algae fill the interstitial spaces in the substrate. Pit run gravel will be installed over the riprap during construction to accelerate this process.

5.2 OPTION 2: ISOLATE THE MILLPOND AND CONSTRUCT A NEW CHANNEL

A dike will be constructed at the upstream end of the Millpond to divert water into a new creek reach on the North side of the Heritage Site and the hatchery. The dike elevation will be determined by the provincial dike standards which is the 200-year flood level plus 0.3 m freeboard. A small pipe with an inlet screen will be used to hydraulically connect the millpond to creek. The restored river reach will be designed to convey the 2-year flood within its banks. Larger ‘channel forming’ floods may be allowed to inundate the banks which is typical for a natural system. A bridge is required over the channel. Fish enumeration will be accomplished by installing a new counting fence in a convenient location to be determined.

The new creek reach will be approximately 320 m long, 8 m wide at the toe, 12 m wide at the top of the banks, and have a 1.5 % slope. The channel will have a natural meander planform and LWD will be installed to provide fish habitat, accelerate natural processes, and help with bank stability.

The dam can be left in place to maintain the Millpond water level but most of the control works will not be required. The Diversion Pipe and Sluiceway can be left closed. The fishway can be left to naturally decay. The Emergency Spillway can probably be decommissioned – to be determined during the final design stage. The Spillway can be used to control the pond surface elevation.

5.3 COSTS SUMMARY

Preliminary costs for each option are as follows:

- Option 1: Modify Existing Structure - $205,000
- Option 2: Isolate the Millpond and Construct a New Channel - $232,000

A breakdown of the costs and a list of assumptions are presented in Appendix C.

6 DISCUSSION

Option 2 provides important advantages over Option 1 including:

1. Natural sediment transport processes are restored in the creek, and sediment is not trapped in the millpond, thus reducing maintenance;
2. Fish access above the dam is not impeded and improved for juvenile fish;
3. Log transport/mill activities in the Millpond will not impact the water quality in the creek;
4. Inspection, maintenance and operation of the dam is simplified;
5. The risk of overtopping and dam failure is reduced significantly;
6. Dam water levels can be operated higher - 113.0 m instead of 112.7 m;
7. Reduced construction and disturbance in the visitor area near the Dam and Emergency Spillway; and
8. The access bridge is located at the edge of the property with less visual impact.

The disadvantages of Option 2 are:

1. Land usage and access to the North edge of the property is impacted; and
2. Costs are about 12 %, or $27,000 greater than Option 1.

Based on the benefits derived in both safety, operations, maintenance and environmental improvements, Option 2 is a better option than Option 1. NHCs recommendation is that a detailed design, budget, and construction program be developed for these works.

6.1 OTHER ISSUES

Note that this report is not a formal dam safety investigation. It is not intended to, and does not address all dam related issues. Work beyond the scope of this report includes seismic design, geotechnical design, structural design, detailed hydrotechnical design, dam safety management, operation and maintenance, emergency preparedness, and other dam related principles. However, several outstanding dam safety issues were identified through the course of this study and are listed below:

- The dam should not have trees or other large vegetation growing on the dam surface (Photo 2), grass is suitable vegetative cover for dams.
- The integrity of the Sluiceway log cribbing and the log bridge over the Spillway were not assessed. Note that these dam components were made with similar wood material as the fishway, and the fishway is approaching the end of its operating life due to decomposition.
- The dam does not have a functional operation and maintenance program. For example, the guillotine valve has not worked effectively for many years and is integral for passing the IDF, yet it has not been replaced.

7 REFERENCES

Baldwin, J. 2009. Personal Communications.

Golder Associates Ltd. and Associated Engineering (B.C.) Ltd. 2003. *Dike Design and Construction Guide Best Management Practices For British Columbia*. Prepared for Flood Hazard Management Section, Environmental Protection Division, Province of BC, Ministry of Water, Land and Air Protection

Malbon, N. 2009. Personal Communications.

Public Works and Government Services Canada, 1996. *R.B. McLean Mill National Historic Site – Draft Operations Manual*.

Sumioka, S., Kresch, D., and K. Kasnick. 1998. *Magnitude and Frequency of Floods in Washington*. US Geological Survey Water Resources Investigation Report 7-4277, 91p.

Watt, E. 1989. *Hydrology of Floods in Canada, A Guide to Planning and Design,* National Research Council of Canada, Associate Committee on Hydrology, Ottawa, 222p.

TABLES

Table 1. Hydrology

Return Period (years)	Original Design (m^3/s)	NHC (m^3/s)	Nov. 16, 2006 Flood Range (m^3/s)
2	12.4	11.9	
5	18.3	n/a	
10	20.6	17.0	16
25	24.8	21.2	21
50	28.1	22.6	
100	31.5	25.4	
200	n/a	27.9	

Table 2. Project Design Conveyance Capacity (From Original Manual)

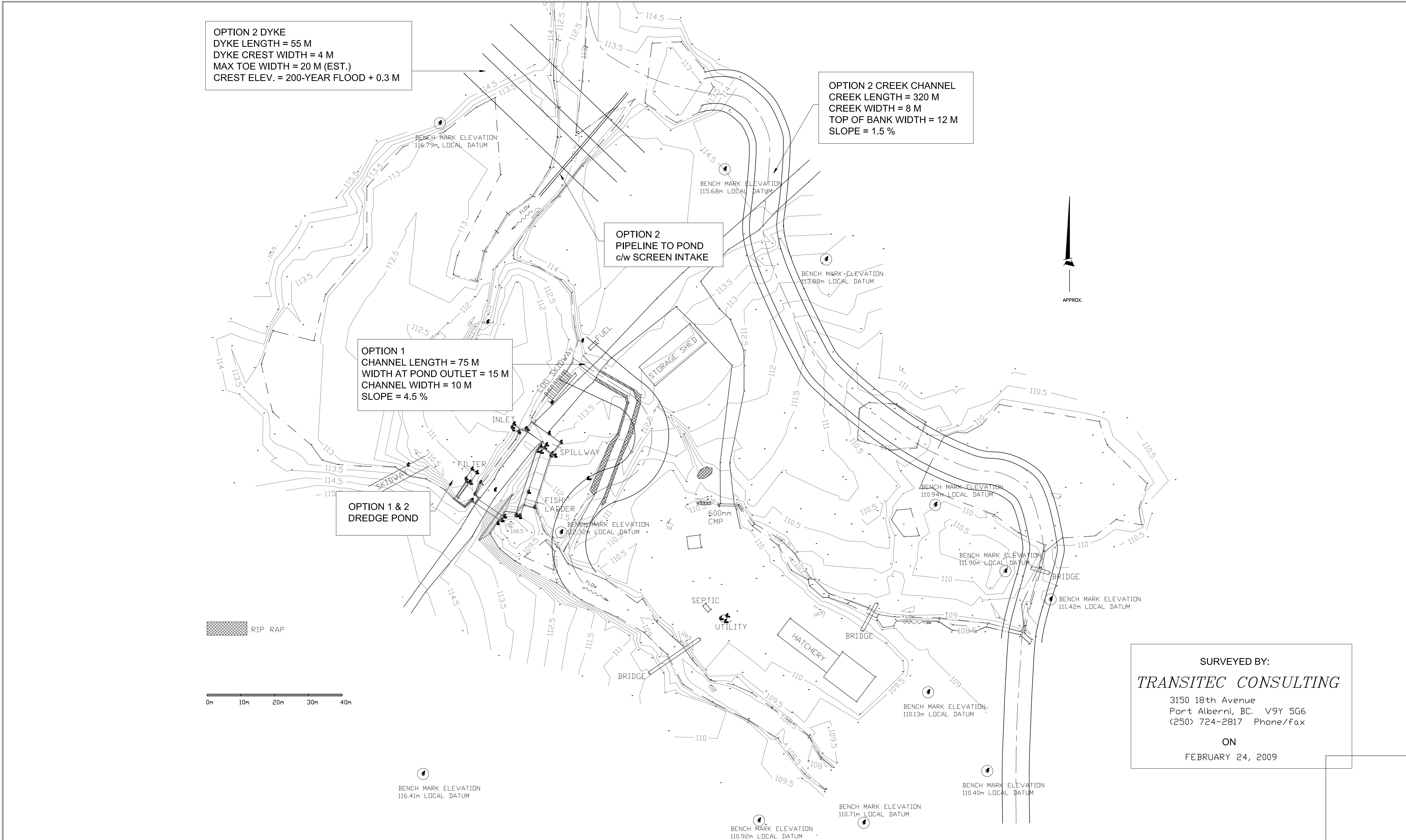
Pond Water Level (m)	Diversion Culvert (m^3/s)	Sluiceway (m^3/s)	Fishway (m^3/s)	Spillway (m^3/s)	Emergency Spillway (m^3/s)	Total (m^3/s)
112.7	3.02	2.08	0.02	0.00		5.1
112.8	3.08	2.40	0.05	0.16		5.7
112.9	3.14	2.73	0.09	0.46		6.4
113.0	3.20	3.08	0.16	0.84		7.3
113.1	3.26	3.44	0.25	1.29	0.50	8.7
113.2	3.31	3.82	0.37	1.81	1.46	10.8
113.3	3.37	4.20	0.58	2.37	2.76	13.3
113.4	3.42	4.60	0.79	2.99	4.37	16.2
113.5	3.47	5.02	0.96	3.65	6.27	19.4
113.6	3.53	5.44	1.12	4.36	8.46	22.9
113.7	3.58	5.87	1.26	5.11	10.93	26.8
113.8	3.63	6.32	1.39	5.89	13.69	30.9
113.9	3.68	6.78	1.52	6.71	16.73	35.4
114.0	3.73	7.24	1.63	7.57	20.06	40.2

Table 3. Estimated Conveyance Capacity of Existing Structure

Pond Water Level (m)	Diversion Culvert (m^3/s)	Sluiceway (m^3/s)	Fishway (m^3/s)*	Spillway (m^3/s)	Emergency Spillway (m^3/s)	Total (m^3/s)
112.7	0.00	0.00	0.02	0.00		0.0
112.8	0.00	0.00	0.05	0.17		0.2
112.9	0.00	0.00	0.09	0.48		0.6
113.0	0.00	0.00	0.16	0.89		1.0
113.1	0.00	0.00	0.25	1.37		1.6
113.2	0.00	0.00	0.37	1.91		2.3
113.3	0.00	0.00	0.50	2.51		3.0
113.4	0.00	0.00	0.50	3.16	0.00	3.7
113.5	0.00	0.00	0.50	3.86	0.20	4.6
113.6	0.00	0.00	0.50	4.61	0.40	5.5
113.7	0.00	0.00	0.50	5.40	0.80	6.7
113.8	0.00	0.00	0.50	6.23	1.25	8.0
113.9	0.00	0.00	0.50	7.10	2.00	9.6
114.0	0.00	0.00	0.50	8.00	3.00	11.5

* Estimated flow

FIGURES



Sheet Reference Number 1 SHEET 1 OF 1	McLEAN MILL DAM RETROFIT OVERVIEW OPTION 1 & 2 CONCEPTUAL PLAN	ALBERNI VALLEY ENHANCEMENT ASSOCIATION c/o D.R. CONSULTING LTD.	nhc Northwest Hydraulic Consultants Ltd 3150 Island Highway North Nanaimo, B.C., Canada V9T 1V9 Office: (250) 758-6425 Fax: (250) 758-9264	Designer: GRH Drafter: Reviewer:	Project Number: 35137 Drawing Date: Drawing File Name:	Drawing Scale: Original Drawing Scale: 0——20mm

REVISIONS

No.	Description	By	Date

PHOTOGRAPHS

Photo 1. Millpond and dam.

Photo 2. Sluiceway and Diversion control works.

Photo 3. Fishway and Spillway with the fish counter.

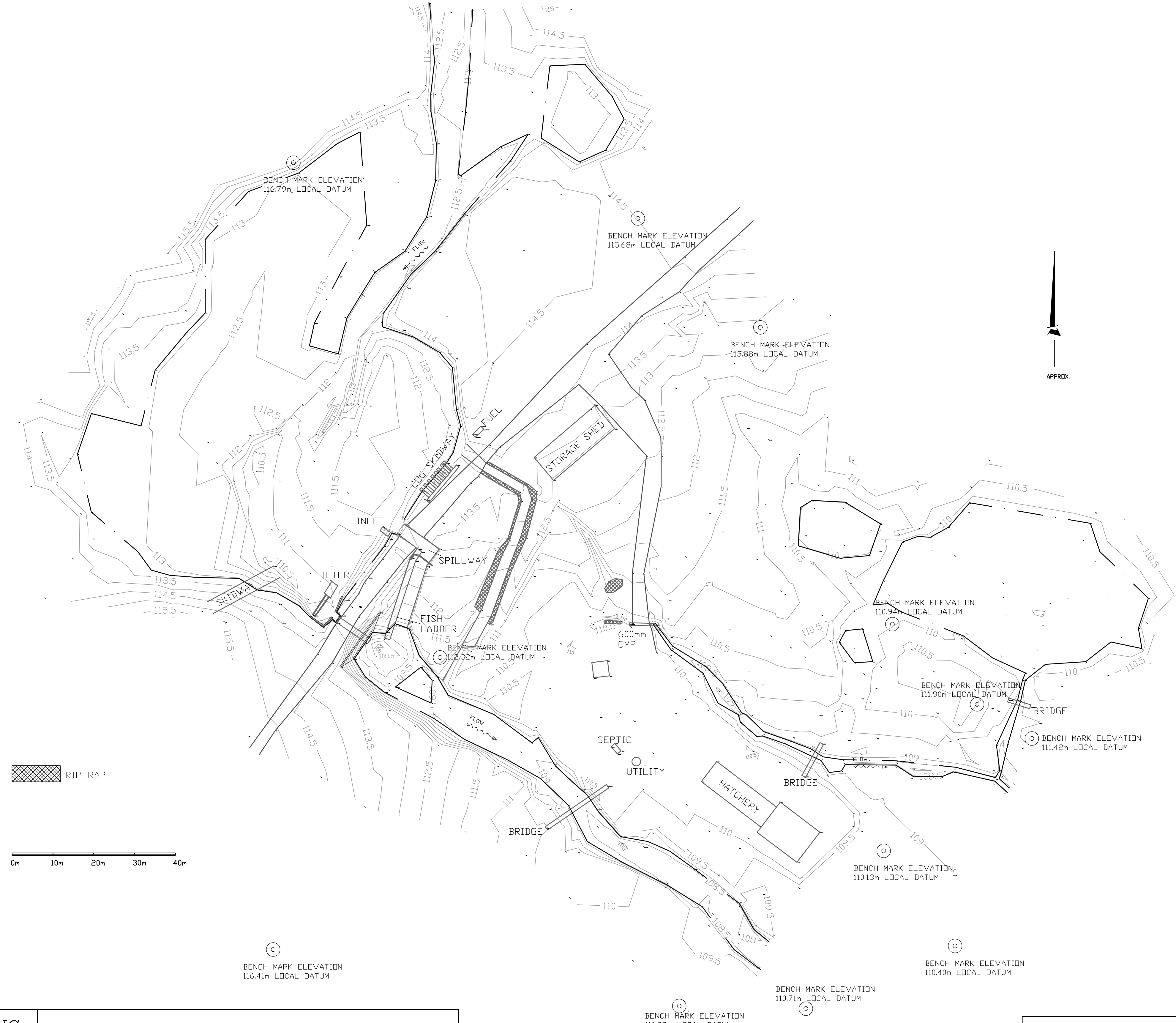
Photo 4. Fishway and Spillway looking upstream from the stilling basin.

Photo 5. Emergency Spillway.

Photo 6. Hatchery Intake (looking down the Fishway and Spillway)

APPENDIX A

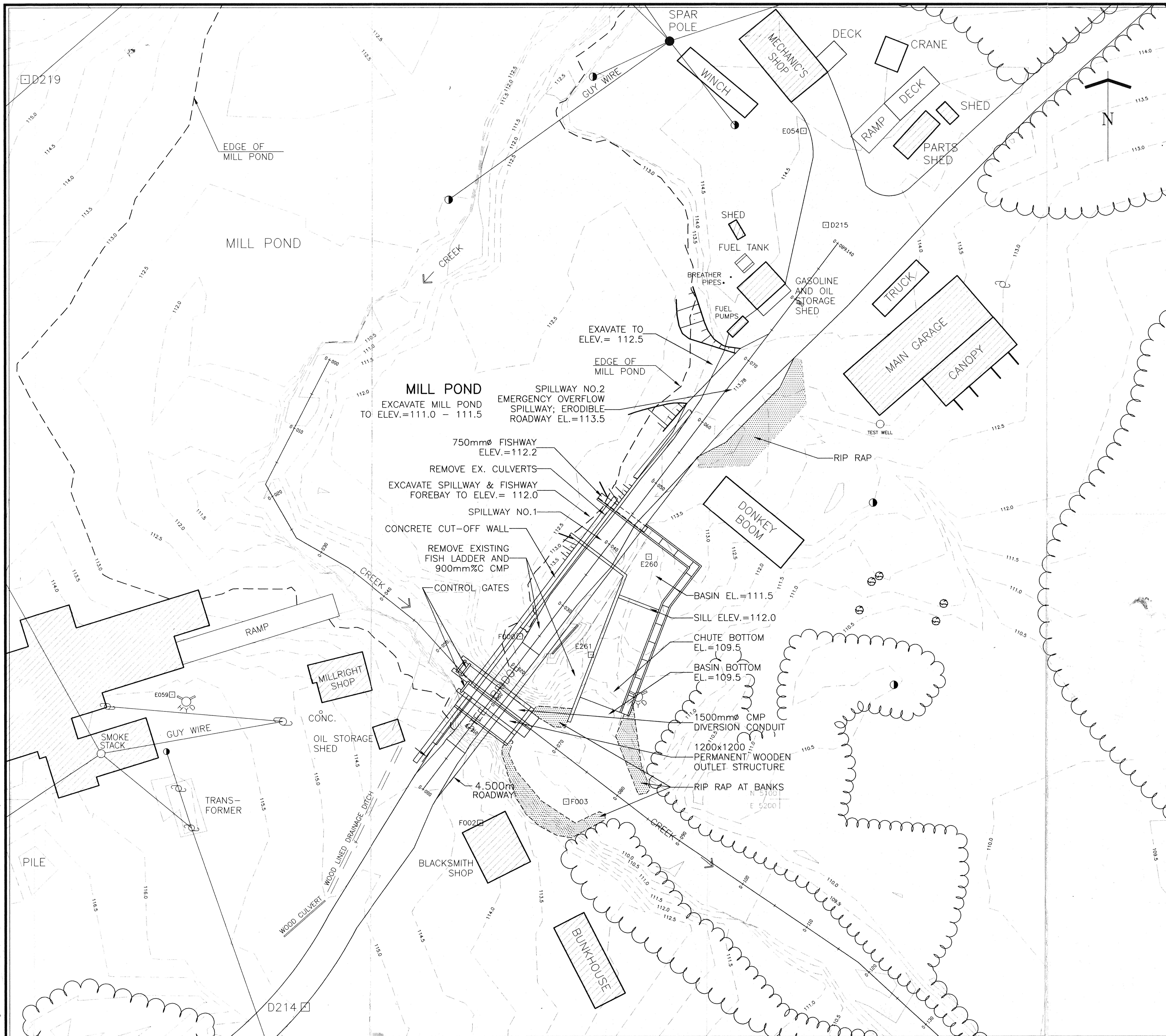
TOPOGRAPHIC SURVEY



TRANSITEC CONSULTING 3150 18th Avenue Port Alberni, BC. V9Y 5G6 (250) 724-2817 Phone/fax	CLIENT: *Northwest Hydraulic Consultants*	TITLE: PLANIMETRIC SITE MAP	DWG. # 001 SITE McLEANS MILL — SCALE 1 : 500 DRAWN BY LARRY DASHCHUK — DATE FEBRUARY 24, 2009

APPENDIX B

ORIGINAL DAM DESIGN (1995)



No.	Date	Description	Drawn by / Dessiné par	Approved / Approuvé
1	5/3 1995	CHANGES, ADDITIONS AND REVISIONS	T.S.	

Revision / Revision

A/B — Detail number / A Numéro de detail; Sheet number / B Numéro de la feuille

Linear dimensions in millimetres — Dimensions linéaires en millimétres

Consultant's Name / Nom de l'expert-conseil

Eng. Stamp / Sceau de l'ingénieur

Public Works and Government Services Canada — Travaux publics et Services gouvernementaux Canada

Architecture and Engineering — Architecture et genie´

Canadä

Client/client

Canadian Heritage — Patrimoine Canadien

Parks Canada — Parcs Canada

Western Region — Région de l'Ouest

Project title/Titre du projet

DAM REPAIRS

R.B. McLEAN MILL N.H.S.

Drawing title/Titre du dessin

SITE PLAN

Surveyed by/Arpenté par B. THRALE	Drawn by/Dessiné par T. SITTER	Date May 4 ~~APRIL 18~~, 1995
Designed by/Concept par A. SIPPOLA	Reviewed by/Revisé par A. SIPPOLA	Scale/Échelle 1:200

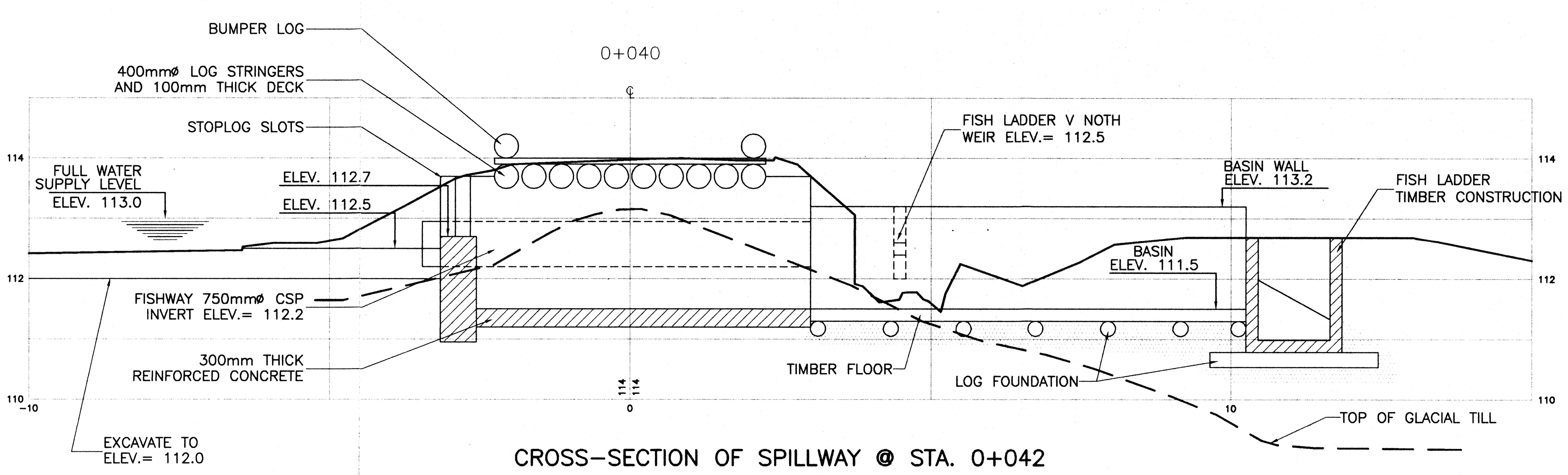
Client Acceptance/Acceptation du client — PARK RESPONSIBLE OFFICER/AGENT RESPONSABLE Date

Approved by/Approuvé par — A & E SERVICES/GÉNIE ET ARCHITECTURE Date

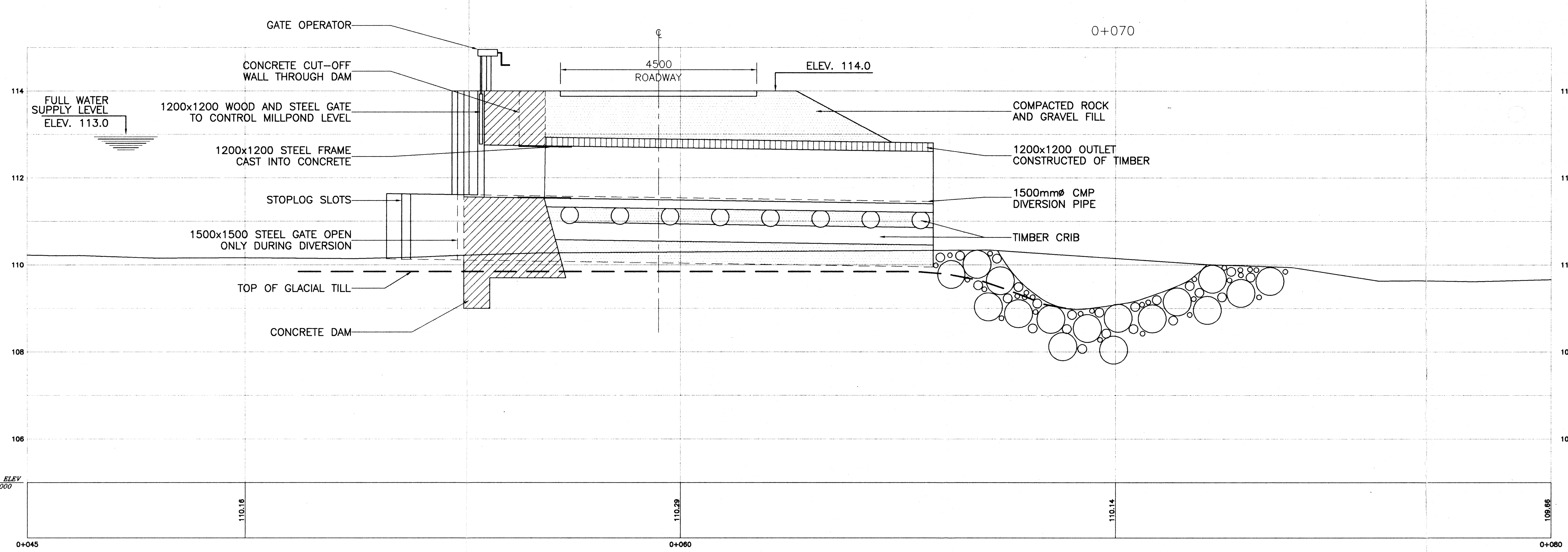
Project No./Nº du projet 76695	Asset No./Nº du-bien 994000300	Sheet No./Nº de la feuille 1of3

Drawing Reference No./Nº de référence du dessin HMM95R3

C:\PROJ\HMM95R21-SITE Thu May 4 15:55:52 1995 PLOTTED BY: T SITTER
HP DesignJet 650C C:\ACAD12\DRV\HPGL2\DNJ650C.CFG !! HP-GL/2 ADI 4.2 Ver 2.0 - by Hewlett-Packard



CROSS-SECTION OF SPILLWAY @ STA. 0+042
H=1:50 / V=1:50



SECTION THROUGH OUTLET STRUCTURE
H=1:50 / V=1:50

No.	Date	Description	Drawn by / Dessiné par	Approved / Approuvé
1	5/3 1995	CHANGES, ADDITIONS AND REVISIONS	T.S.	

Revision / Revision

Detail number — A Numéro de detail
Sheet number — B Numéro de la feuille

Linear dimensions in millimetres — Dimensions linéaires en millimètres

Consultant's Name / Nom de l'expert-conseil

Eng. Stamp / Sceau de l'ingénieur

Public Works and Government Services Canada — Travaux publics et Services gouvernementaux Canada

Architecture and Engineering — Architecture et genie

Canada

Client/client

Canadian Heritage — Patrimoine Canadien

Parks Canada — Parcs Canada

Western Region — Région de l'Ouest

Project title/Titre du projet

DAM REPAIRS

R.B. McLEAN MILL N.H.S.

Drawing title/Titre du dessin

SECTION OF SPILLWAY AND OUTLET STRUCTURE

Surveyed by/Arpenté par	Drawn by/Dessiné par	Date
B. THRALE	T. SITTER	May 4 ~~APRIL 12~~, 1995
Designed by/Concept par	Reviewed by/Revisé par	Scale/Echelle
A. SIPPOLA	A. SIPPOLA	AS NOTED

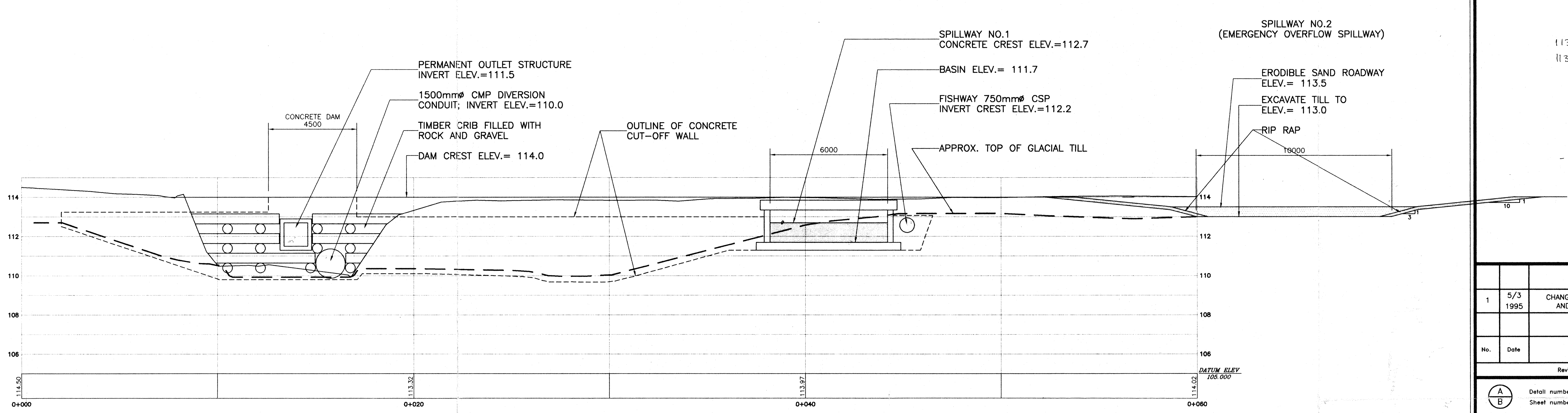
Client Acceptance/Acceptation du client — PARK RESPONSIBLE OFFICER/AGENT RESPONSABLE Date

Approved by/Approuvé par — A & E SERVICES/GÉNIE ET ARCHITECTURE Date

Project No./Nº du projet	Asset No./Nº du-bien	Sheet No./Nº de la feuille
76695	994000300	2of3

Drawing Reference No./Nº de référence du dessin: HMM95R3

C:\PROJ\HMM95R2\23-PROFL Thu May 4 15:30:31 1995 PLOTTED BY : T.SITTER
HP DesignJet 650C C:\ACAD12\DRV\HPGL2\DNJ650C.CFG 11 HP-GL/2 ADI 4.2 Ver 2.0 - by Hewlett-Packard



SECTION OF DAM CENTRELINE
LOOKING UPSTREAM
H=1:100 / V=1:100

113.1 - water level.
113.5 - top of swale.

113.5 − 112.7 = 0.8
113.0 − 112.7 = 0.3

No.	Date	Description	Drawn by / Dessiné par	Approved / Approuvé
1	5/3 1995	CHANGES, ADDITIONS AND REVISIONS	T.S.	

Revision / Revision

A Detail number / A Numéro de détail
B Sheet number / B Numero de la feuille

Linear dimensions in millimetres / Dimensions linéaires en millimètres

Consultant's Name / Nom de l'expert-conseil

Eng. Stamp / Sceau de l'ingénieur

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

Architecture and Engineering / Architecture et genie

Canada

Client/client

Canadian Heritage / Patrimoine Canadien

Parks Canada / Parcs Canada

Western Region / Région de l'Ouest

Project title/Titre du projet

DAM REPAIRS

R.B. McLEAN MILL N.H.S.

Drawing title/Titre du dessin

SECTION OF
DAM CENTRELINE

Surveyed by/Arpenté par: B. THRALE	Drawn by/Dessiné par: T. SITTER	Date: ~~APRIL~~ May 4 12, 1995
Designed by/Concept par: A. SIPPOLA	Reviewed by/Revisé par: A. SIPPOLA	Scale/Echelle: AS NOTED
Client Acceptance/Acceptation du client	Approved by/Approuvé par	
PARK RESPONSIBLE OFFICER/AGENT RESPONSABLE Date	A & E SERVICES/GÉNIE ET ARCHITECTURE Date	
Project No./Nº du projet: 76695	Asset No./Nº du-bien: 994000300	Sheet No./Nºde la feuille: 3of3
Drawing Reference No./Nº de réference du dessin: HMM95R3		

C:\PROJ\HMM95R2\23-PROFL Thu May 4 15:33:36 1995 PLOTTED BY : T.SITTER
HP DesignJet 650C C:\ACAD12\DRV\HPGL2\DNJ650C.CFG !! HP-GL/2 ADI 4.2 Ver 2.0 - by Hewlett-Packard

APPENDIX C

PRELIMINARY COST ESTIMATE

Option	1				
Modify Existing Structure					
Line no.	Description	Quan.	Units	Unit Cost	Line Cost
1	20 t excavator to construct Spillway sidewalls	50	hrs	130	6500
2	20 t excavator to construct Outlet Channel	100	hrs	130	13000
3	20 t excavator to install the bridge abutments	20	hrs	130	2600
4	20 t excavator (dredge pond)	60	hrs	130	7800
5	D5 dozer/backhoe/exc. (spread pile waste/organic mater.)	20	hrs	120	2400
6	Trucks - 2 for 3 days (dredge pond)	60	hrs	90	5400
7	Crane for bridge installation	8	hrs	300	2400
8	Bridge (4 m x 16 m w/ abutments and guardrails)	64	m2	700	44800
9	Lock blocks for Spillway sidewalls (F.O.B. site)	56	ea.	110	6160
10	Riprap for Outlet Channel	780	m3	50	39000
11	Pitrun gravel (sealing Outlet Channel)	150	m3	15	2250
12	Material disposal (old fishway and Spillway sidewalls)	1	ls.	2000	2000
13	Misc materials, equipment, rentals	1	ls.	2000	2000
14	Site Labour (1 person)	10	d	300	3000
15	Site Supervision	25	d	500	12500
16	Engineering (design and construction)	20	d	1000	20000
	Subtotal I				171810
	Contingency (10%)				17181
	Subtotal II				188991
	Tax (assume effective tax rate of 10%)				18899
	Total (rounded)				208000
Assumptions:					
All quantities and costs are approximate only					
A spoil pile area is available on or very near the site					
Fish fence costs are not included					
Revegetation costs are not included					
Signage or security costs are not included					
Geotechnical, structural, seismic, etc design costs are not included					
Dam operating and maintenance manual costs are not included					

Option	2				
Isolate Millpond and Construct New Channel					
Line no.	Description	Quan.	Units	Unit Cost	Line Cost
1	20 t excavator to prepare the site (clear & grub)	50	hrs	130	6500
2	20 t excavator to excavate channel (mater. to dyke)	20	hrs	130	2600
3	20 t excavator to excavate channel (waste/organic)	40	hrs	130	5200
4	20 t excavator wood complexing / cleanup	30	hrs	130	3900
5	20 t excavator pipe installation	20	hrs	130	2600
6	20 t excavator to install the bridge abutments	20	hrs	130	2600
7	20 t excavator (dredge pond)	60	hrs	130	7800
8	D5 dozer/backhoe (spread pile waste/organic mater.)	60	hrs	120	7200
9	D5 dozer/backhoe (spread dyke gravel)	50	hrs	120	6000
10	Roller (dyke compaction)	50	hrs	100	5000
11	Trucks - 2 for 2 days (mater. onsite for dyke)	40	hrs	90	3600
12	Trucks - 3 for 4 days (onsite organic/waste material)	120	hrs	90	10800
13	Trucks - 2 for 4 days (dredge pond)	60	hrs	90	5400
14	Pitrun dyke gravel (F.O.B. site)	1800	m3	15	27000
15	intake box	1	ls	4000	4000
16	intake screen	1	ls	3000	3000
17	pipe crew	2	d	2000	4000
18	Crane for bridge installation	8	hrs	300	2400
19	Bridge (4 m x 16 m w/ abutments and guardrails)	64	m2	700	44800
20	Riprap bridge abutments	50	m3	50	2500
21	Misc materials, equipment, rentals	1	ls.	2000	2000
22	Site Labour (1 person)	10	d	300	3000
23	Site Supervision	25	d	500	12500
24	Engineering (design and construction)	20	d	1000	20000
	Subtotal I				194400
	Contingency (10%)				19440
	Subtotal II				213840
	Tax (assume effective tax rate of 10%)				21384
	Total (rounded)				235000
Assumptions:					
All quantities and costs are approximate only					
A spoil pile area is available on or very near the site					
Fish fence costs are not included					
Revegetation costs are not included					
Signage or security costs are not included					
Geotechnical, structural, seismic, etc design costs are not included					
Dam operating and maintenance manual costs are not included					

APPENDIX E.

3.2.13 McLean Mill Dam- Bypass Channel Construction Report (Draft). 2015. Northwest Hydraulic Consultants Ltd. (NHC)

McLean Mill Dam
Bypass Channel Construction Report
(DRAFT)

Prepared for:

City of Port Alberni
4850 Argyle Street
Port Alberni, BC V9Y 1V8

Prepared by:

Northwest Hydraulic Consultants Ltd.
405 – 495 Dunsmuir Street
Nanaimo, BC V9R 6B9

Project no. 300289

26 February 2015

Table of Contents

Tables

Photographs

LIST OF APPENDICES

1 INTRODUCTION

Northwest Hydraulic Consultants Ltd. (NHC) is pleased to submit this summary of the construction of the McLean Mill Dam bypass channel at the McLean Mill National Historic Site, prepared for the City of Port Alberni, BC. The purpose of the work was to address dam safety concerns of the McLean Mill Dam. A summary of the project goals was as follows:

1. Meet the BC Ministry of Environment (MoE) regulations (BC Reg. 163/2011);
2. Operate with low maintenance and infrequent operational effort;
3. Provide continuous upstream and downstream movement of fish;
4. Provide adequate water depth and volume in the millpond for sawmill operations, fish hatchery requirements, and emergency firefighting needs;
5. Be integrated with the Heritage site needs and conditions with as little disturbance to the existing site plan as possible; and,
6. Provide pedestrian and heavy equipment access to the east side of the structure to the spar tree and equipment barn.

The project that best met the goals outlined above was a creek bypass channel around the Mill Pond, with a diversion pipe installed to maintain the water levels in the pond. The project work included:

1. Preparing the site;
2. Relocating the spar tree;
3. Constructing the fish counting fence;
4. Constructing the bridge;
5. Constructing the bypass channel;
6. Construction the saddle berm and diversion berm; and,
7. Installing the diversion intake and pipe work.

The construction was undertaken by B. Berry Enterprises Ltd. as the general contractor, and was executed between March 2014 and late-October, 2014. Site supervision was provided by DFO (construction), Levelton Engineering Ltd. (geotechnical), and DR Clough Consulting (environmental). NHC provided coordinating professional services and general construction oversight for the project.

The project was completed successfully with no significant environmental issues and no safety issues. The public was generally very cooperative around the project. The progress of the work is presented here primarily with photographs. The technical reports and construction documentation are located in the appendices.

1.1 ACKNOWLEDGEMENTS

An excellent project result was achieved thanks to the efforts of City of Port Alberni; West Coast Aquatics; Western Vancouver Island Industrial Heritage Society (WVIIHS); Alberni Valley Enhancement Society (AVES); Fisheries and Oceans Canada (DFO); Island Timberlands LP; BC Timber Sales (BCTS) and, the various contractors involved in the project. Key people in the development and construction phase included:

- Scott Kenny, Jamie Morton, Brian Mousley, Guy Cicon, and the Bridge Crew from the City of Port Alberni.
- Sheena Falconer from West Coast Aquatics.
- Neil Malbon, Jack James, Hank Bakken, Cliff West, Dave Hooper, the JJ Logging Crew and all the other volunteers from the Western Vancouver Island Industrial Heritage Society (WVIIHS).
- Rod Clarke from BC Timber Sales (and WVIIHS).
- Rod Christie form Island Timberlands LP.
- Jake Leyaanar, Dan Shannon, Phil Edgell and all the other volunteers from the Alberni Valley Enhancement Society (AVES).
- Doug Poole from Fisheries and Oceans Canada (DFO).
- Dave Clough and Brad Remillard from DR Clough Consulting.
- Brad West and Sam Rogers from McGill and Associates Engineering Ltd.
- Don Kaluza and Ryan Bouma from Levelton Consultants Ltd.
- Graham Hill from Northwest Hydraulic Consultants Ltd.
- Brad Berry and Paul Wagner from B. Berry Enterprises Ltd, and the various subcontractors.

2 CONSTRUCTION

Construction commenced March 2014. In-stream work was completed late-October 2014. Weather conditions varied throughout the construction period. Work in the creek at the bypass channel tie-ins was undertaken under the supervision of the Environmental Monitor and DFO staff during dry periods within the fisheries work window of June 1 to September 31.

Record drawings are provided in Appendix A and the geotechnical report is provided in Appendix B.

2.1 SITE PREP AND SPAR TREE RELOCATION

Photo 1. One of the first steps for construction was to relocate some of the heritage equipment. Here a boiler was loaded onto a lowbed using WVIIHS equipment.

Photo 2. The new spar tree location was 75 m northeast of the bypass channel. Trees at the new setting were felled and bucked, then the stumps were removed, chipped and hauled off the site.

Photo 3. The spar tree was moved, re-rigged and stood up at its new location by JJ Logging and crew (Photo by David Hooper).

Photo 4. The new spar tree location was completed with a gravel-surfaced work area and spectator seating for the logging show.

2.2 SADDLE BERM

Photo 5. The saddle berm alignment was cleared and grubbed, then the topsoil was removed down to the glacial till surface.

Photo 6. The glacial till was prepared by scarifying the surface, then 25 mm minus crushed rock was used to construct the saddle berm.

Photo 7. The saddle berm was compacted with a vibratory roller compactor, and then a nuclear densometer was used to test the compaction levels.

Photo 8. The completed saddle berm surface was crowned slightly to reduce rainfall pooling, and the side areas were smoothed out and vegetated with grass seed.

2.3 SEDIMENT POND

Photo 9. The sediment pond was constructed at the downstream extent of the project (Stn 2+72). Soil from the pond excavation was end-hauled to the spoil area.

Photo 10. The completed sediment pond dissipates hydraulic energy and helps to settle sediment from the new channel upstream. It provides a good resting pool for fish too.

2.4 McLean Mill Bridge

Photo 11. BC Timber Sales donated a steel bridge that was refurbished and installed over the bypass channel.

Photo 12. The bypass channel cut through the road to the equipment barn.

Photo 13. The channel was excavated to the subgrade and the bridge abutments were set using crushed rock, geo-grid, and lock blocks.

Photo 14. Riprap was placed around the abutment to protect them from scour.

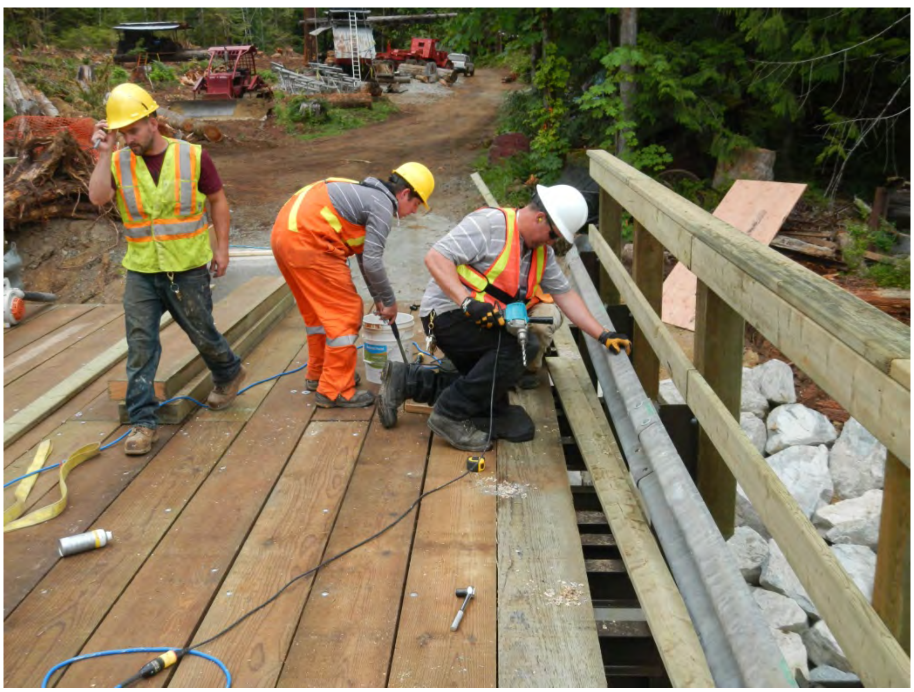


Photo 15. The bridge was widened, sandblasted, and painted. Then City of Port Alberni staff installed the decking, guard rails, and hand rails.

Photo 16. The completed bridge is designed to convey the 200-year flood. Gravel was placed on top of the riprap and the area was vegetated with grass and tree seedlings.

2.5 FISH FENCE AND CHANNEL DOWNSTREAM OF THE BRIDGE

Photo 17. The channel was cleared and grubbed, the photo shows the alignment from Stn 1+30 to 1+70.

Photo 18. The topsoil was stripped down to the glacial till. The excavated material was end-hauled and stockpiled in the spoil area.

Photo 19. The fish fence was layed out on the ground with marker paint and then a small excavator was used to grade the surface.

Photo 20. The formwork and reinforcing were installed in preparation for the concrete pour.

Photo 21. Concrete was poured and finished by Athecon Projects Inc. The concrete cured for a week before it was stripped and backfilled.

Photo 22. The fishway was backfilled with compacted till, and riprap was placed upstream and downstream of the sill. LWD and spawning gravel were placed in the channel upstream and downstream of fish fence.

Photo 23. The aluminum fish screens and the old fish trap box were reused.

Photo 24. Coho salmon were captured for brood stock and/or enumerated and released at the fish fence by AVES volunteers.

Photo 25. A significant flood on December 10th, 2014 tested the project. The fish screens were left in place but were not damaged.

2.6 CHANNEL UPSTREAM OF THE BRIDGE

Photo 26. The Heritage Society artifacts and equipment was relocated in preparation of excavating the channel from Stn 0+50 to 0+90.

Photo 27. A drainage channel was excavated to drain the upstream area near the intake and the diversion berm.

Photo 28. The channel was excavated in the "dry". However groundwater seepage filled up the pools before the creek was diverted. Spawning gravel, habitat boulders, and LWD were placed in the channel to meet the fish habitat objectives.

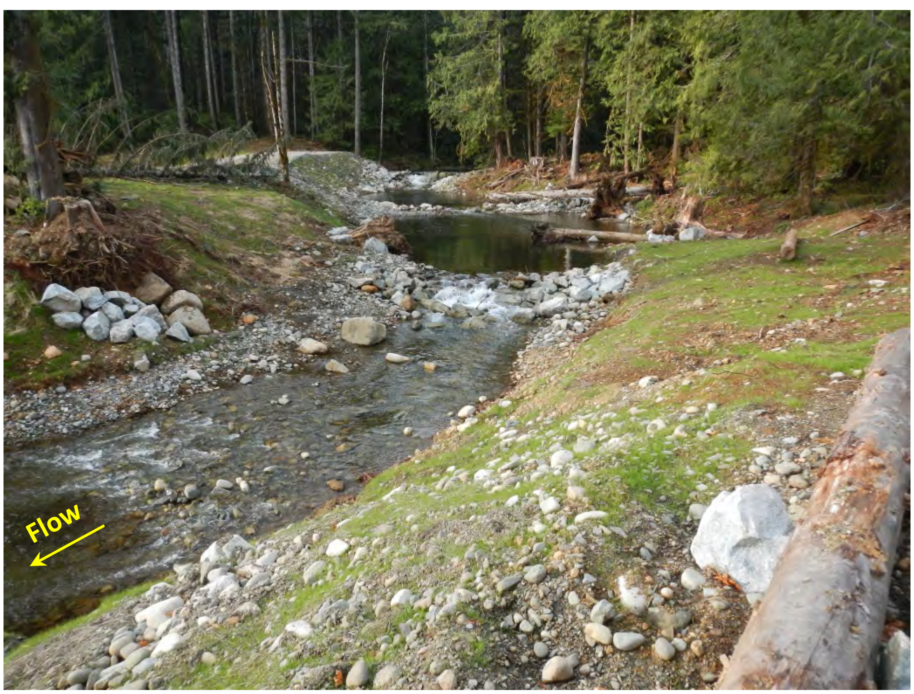


Photo 29. The channel banks were seeded with grass seed to reduce surface erosion, and planted with tree seedlings to help establish a future riparian forest.

Photo 30. A significant flood on December 10th, 2014 caused some minor bank erosion immediately upstream of the bridge near Stn 0+70, but the channel held up well overall.

2.7 DIVERSION BERM AND INTAKE

Photo 31. Prior to construction the diversion berm area was vegetated alluvial deposits overlying glacial till.

Photo 32. Overburden at the diversion berm area end-hauled to the spoil area. The underlying glacial till was exposed and a rock filter was constructed as part of the structure.

Photo 33. The saddle berm was mainly constructed with compacted till excavated from the new bypass channel.

Photo 34. The completed diversion berm had the banks graded at 2:1 slope and the surface covered with 25 mm minus crushed rock with a slight crown to reduce pooling of rain water.

Photo 35. The riprap was keyed into the channel bed and placed up the creek-side slope. The riprap was covered with gravel and vegetated with grass seed.

2.8 POND DIVERSION

Photo 36. A 300 mm diameter steel and HDPE pipe diverts water from Kitsucksis Creek to the Mill Pond. The diversion flow is controlled by the knife gate valve housed in a concrete manhole.

Photo 37. The intake is designed to be mainly self-cleaning, and to facilitate upstream and downstream fish passage. A fine screen keeps fish and coarse sand out of the intake.

Photo 38. The December 10th, 2014 high water event was safely diverted down the new bypass channel. Flow input to the Mill Pond included direct runoff and the intake flow, the Mill Pond water level change during the flood was negligible.

Photo 39. The spillway discharge from the Mill Pond during the December 10th, 2014 flood was almost the same as pre-flood rates.

3 SUMMARY OF REMAINING WORK

The bypass channel construction was substantially completed in 2014. However, there are some modifications that are required to the completed work (Table 1), and there is some remaining work identified in the 2014 work plan that was not undertaken due to budget shortfalls (Table 2). It is recommended that the work outlined below be completed as soon as possible.

Table 1. Summary of recommended modifications to the 2014 completed work.

Line no.	Work Item	Description
1	Bypass channel intake riffle (Stn 0+10 to 0+18)	Add riprap on the downstream slope of the riffle.
2	Bypass channel riffle (Stn 0+38 to 0+48)	Raise the riffle crest 0.5 m and add riprap on the downstream slope of the riffle.
3	Raise the saddle berm	Raise the saddle berm 0.6 m to provide additional freeboard.
4	Lower the outlet riffle (Stn 2+41 to 2+50)	Lower the riffle crest 0.5 m to lower the upstream water level in the natural wetland reach.

Table 2. Summary of remaining work.

Line no.	Work Item	Description
1	Hatchery intake relocation	Relocate the hatchery intake – this is not related to dam safety
2	Sluiceway removal	Remove the guillotine gate and sluiceway, fill the notch in the concrete core, build up the roadway with compacted soil
3	Scour hole fill	Fill the scour hole at the toe of the dam on the downstream side with riprap
4	Fishway decomissioning	Remove the fishway culvert through the dam and fill with concrete, build up the roadway with compacted soil
5	Spillway reinforcement	Construct concrete spillway walls
6	Low flow release valve exercise	Remove debris from the upstream side of the valve, open and close the valve to ensure it operates correctly

APPENDIX A

ISSUED FOR CONSTRUCTION AND RECORD DRAWINGS

APPENDIX B

BRIDGE DRAWINGS

APPENDIX C

GEOTECHNICAL REPORTS

APPENDIX D

ENVIRONMENTAL MONITORING

APPENDIX E

OPERATIONS, MAINTENANCE AND SURVEILLANCE PLAN (DRAFT)

APPENDIX F

EMERGENCY PREPAREDNESS PLAN (DRAFT)

APPENDIX E.

3.2.14 Contaminants on the property designated the McLean Mill National Historic Site. 2017 (states March 26, 2016). Letter from J. Adams to Ministry of Environment, Environmental Protection Division

March 26, 2016

Attention: Coleen Gooderham
Ministry of Environment – Environmental Protection Division

<u>Re: Contaminants on the property designated the McLean Mill National Historic Site</u>

Dear Coleen:

My wife contacted the B.C. Ministry of Environment office at Nanaimo in August of 2016. She spoke to a biologist in the office who told her that they would send someone out to Port Alberni for an investigation if we paid the costs. Subsequently, fisheries advised me that it was a matter of jurisdiction – Environment rather than Fisheries – and that my query should be directed to the Ministry of the Environment.

In early November of 2016, I telephoned the Nanaimo office for the Ministry of Environment, and spoke to a gentleman by the name of Brian Vroon. He asked me why I was talking to him. He was not very pleasant, very difficult to contact, and not very helpful.

In my pursuit of looking for a copy of the environmental assessment for the McLean Mill property, I came into contact with Katelyn Dick from the B.C. Ministry of Environment. My first email exchange with her was on December 6, 2016 regarding how to get access to information. She was very helpful, courteous and professional. From that initial contact, we progressed at a snail's pace, but progress was being made.

On Wednesday March 15, 2017, I received an email message from Katelyn in which she forwarded to me a response from Envirochem Services Inc. in regards to my concerns about contaminants at the McLean Mill site. In a subsequent telephone conversation, she advised me that the tentative plans to have Mr. Hebert from the mainland inspect the McLean Mill site had been cancelled. Mr. Hebert's credentials and experience with contaminated sites was extensive. Until this time, the journey was painfully slow, but productive. Katelyn Dick advised me the file was to be transferred to Nanaimo and a person named Genevieve Huneault would take care of me. I objected and asked who her boss was. I was told, "Leslie Payette." I expressed that I did not want a newly hired employee that would act as a liaison, that I wanted **<u>production!</u>** Leslie Payette telephoned me and said that she would be my contact.

Problems started with Ms. Payette telling me, "I'll tell you how things go here." I told her I was not happy with the transfer and further delays. She led me to believe that an inspector would go to the McLean Mill site either Thursday March 16, Friday March 17, or early during the week beginning Monday March 20.

I contacted Federal Fisheries to see if they had been contacted by the Ministry of Environment about having a fisheries officer attend the site visit concurrently with the inspector from the Ministry of Environment. Fisheries confirmed they had been contacted by the Ministry of Environment about the matter, but told me they would not be conducting a site visitation on the

16th or 17th of March. It would be the end of the next week, as the date had been set by the Ministry of Environment.

I telephoned Leslie Payette on Monday March 20 at noon and questioned her on this information. She said, "How does fisheries know what we are doing? I told my inspector to be on site early this week." I told her that Katelyn Dick and Leila Aus thought if the two agencies did the site visit together, that it would be a benefit. This was set up before the transfer. Ms. Payette said she would check into the status of the site visit and phone me the next day. I asked her for a time and she said in the afternoon. I suggested she could email me, so I provided her with my email address.

The next day, Tuesday March 21, I had **no** contact from Leslie Payette. The next morning, Wednesday March 22, I phoned her cell number, and her office. I left a message for her to phone me. From there I phoned Katelyn Dick to express my concerns and that things were not going well due to delays, not being phoned back and being referred to Tuesday. Consequently, I phoned the office of the Deputy Minister of Environment.

My concerns are as follows:

- Fish kill in pond.
- Railroad ties when track removed in front of mill building. Where did those ties go?
- Old mill decking (treated wood) and support pilings, also treated wood. Where did this material go?
- Level of pond is raised, creating a higher water table under the mill in a very toxic area.
- Drainage from the dip tank, formerly used to treat lumber with pentachlorophenol, actually went towards the pond. Check for overgrown culvert. No tests done in soil in the direction of the pond, or done on the wooden dip tank itself.
- Underground fuel tanks and waste oil tank on site 10 feet from the pond.
- No tests for dioxons and furans that could still be in the ground. These compounds are regulated in park zonings.
- Two full barrels on the site that contain creosote are actively leaking.
- Full sized former rail car tanker is/was used on site as a septic tank for the watch keeper's trailer. What does it contain? It is leaking.
- Ten plus years of operating a commercial sawmill with no B.C. Environment or WorkSafe B.C. on site.
- Full sized bunker C rail car tanker used on site with signs of accumulated spills or leaking in the immediate vicinity of the rail car tanker.
- Creek was relocated as part of the mill pond dam remediation. Were there any environmental tests, and what was the oversight?
- Two cells of toxic soil remediated on site. Where did those cells go?
- Hauling soil from contaminated site to private properties.
- Dug through pond during installation of 12" water intake to hatchery. Were any tests done? Was anyone from the environment ministry on site?
- Bricks and garbage in creek on my property from the mill site.
- Sewage problems. Contact V.I.H.A.

- Burning of treated lumber on the McLean Mill site.
- Sawmill tailings in open burn bin next to pond contain plastics, etc.

Note that within the Kitsuksis watershed area, 7 human fatalities have occurred from brain tumors and brain cancer, 4 have occurred from other cancers and 2 individuals have crippling diseases. Three of the ill or deceased played at the mill site as children. There is more information available that has previously been forwarded to the proper authorities, but I suspect all are related to contaminate spreading from the McLean Mill site.

Around my farm, I note that voles (small rodents) are gone. Slugs are mostly absent. I've had an abnormal calf born. Heifer came in to heat at 3 ½ months. I have much more information available to discuss. See the photos at the end of this document that help to identify some of the concerns I have expressed in this letter.

If I have to beg for assistance, it will not happen. I offered to work with the B.C Ministry of the Environment, to go on site at the McLean Mill, to provide observations and timelines, etc.

My entire farm is downstream from the McLean Mill property. About 30 acres of my farm land is flooded in winter. Much of the other 100 acres is subject to the watershed. I am a licenced farm, and I sell food to people. I intend to serve my customers in a proper and safe manner.

Coleen, would you please forward copies of this letter to all the persons that will attend the conference call? In the meantime, you may contact me by telephone at 250-723-9107 or by email to j-sadams@telus.net.

Thank you for your time and consideration of my letter.

Yours truly,
John and Sharron Adams

APPENDIX E.

3.2.15 Compliance Notice Letter, McLean Mill National Historic Site, 5633 Smith Road, Port Alberni, B.C. 2017. Ministry of Environment, Environmental Protection Division. Letter to City of Port Alberni

Report Date:April 12, 2017

File:UA49250

Report Number:049250

City of Port Alberni

re: McLean Mill National Historic Site

5633 Smith Road, Port Alberni, BC, V9Y 8M1

Attn: Timothy Pley

Re: Compliance Notice Letter, File UA49250, McLean Mill National Historic Site, 5633 Smith Rd, Port Alberni, BC V9Y 8M1

On March 29, 2017, Ministry of Environment, Environmental Protection Division staff conducted an inspection of your facility, McLean Mill National Historic Site located at 5633 Smith Rd, Port Alberni, BC. Ministry staff were accompanied on site by Deanna Beaudoin, Executive Director, McLean Mill Society; Mark Zenko, City of Port Alberni Facilities Manager; and Jamie Morton, Alberni Valley Museum.

Inspection Details:

Requirement Description:	**Environmental Management Act** 6 (4): (4) Subject to subsection (5), a person must not introduce waste into the environment in such a manner or quantity as to cause pollution.
Details/Findings:	Site was inspected on 2017-03-29, following up on a complaint alleging leaking barrels, fish kill in pond, sewage containment leaks, leaking fuel bunker C rail car, burning of rail ties. Other concerns noted in the complaint are not evaluated in this inspection. Barrels viewed were filled with rail plates or were empty; none were noted to be leaking (see Photos 1 and 2). Salvage metal and other "boneyard" type items were noted in various areas around the site (Photo 2). Much of the salvage items are stored for and reused by the Alberni Pacific Railway (APR). Beaudoin notes that significant housekeeping will be taking place at the site over the next several months, including removal/organisation of most of the salvage metal, fencing off of some areas and new signage. There was no evidence of a recent fish kill in the pond, nor were the site reps aware of one. A railcar historically used as a septic tank is empty, though venting allows in rainwater, which may drain to ground. There was no evidence that fuel was leaking below the fuel supply rail car (no hydrocarbon sheen on standing water), but a spill kit and spill management plan are in place (see Photo 4). Site reps indicate that rail ties are not burned at the site, and no evidence of tie burning was noted. Many of the rails at the site are stacked and stored for re-use by the APR.
Compliance:	In
Actions to be taken:	

Ministry of Environment

Compliance

Environmental Protection Division

Mailing Address:
2080-A
Labieux Rd
Nanaimo BC V9E 6J9

Telephone: 250 751 3100
Facsimile: 250 751 3103
Website: www.gov.bc.ca/env

Below are attachments related to this inspection.

If you have any questions about this letter, please contact the undersigned.

Yours truly,

Laura Hunse

Environmental Protection Officer

cc: Deanna Beaudoin, Executive Director, Mclean Mill Society

Attachments:
1) IR Photo Record.pdf 2017-03-29 Inspection Photo Record

Deliver via:
Email: X **Fax:** **Mail:**
Registered Mail: **Hand Delivery:**

DISCLAIMER:
Please note that sections of the permit, regulation or code of practice referenced in this inspection record are for guidance and are not the official version. Please refer to the original permit, regulation or code of practice.

To see the most up to date version of the regulations and codes of practices please visit http://www.bclaws.ca

If you require a copy of the original permit, please contact the inspector noted on this inspection record or visit:
http://www2.gov.bc.ca/gov/topic.page?id=DF89089126D042FD96DF5D8C1D8B1E41&title=Publically%20Viewable%20Authorizations

It is also important to note that this inspection record does not necessarily reflect each requirement or condition of the authorization therefore compliance is noted only for the requirements or conditions listed in the inspection record.

Authorization: UA49250	Client Name: McLean Mill National Historic Site
NRIS IR #: 49250	2017-03-29 Site Inspection Photos

Photo 1 Empty barrels	
Photo 2 Foreground barrels under black tarp filled with rail tie plates; tanks in background are an oil/water separating system	

Authorization: UA49250	Client Name: McLean Mill National Historic Site
NRIS IR #: 49250	2017-03-29 Site Inspection Photos

Photo 3

Rail ties and salvage

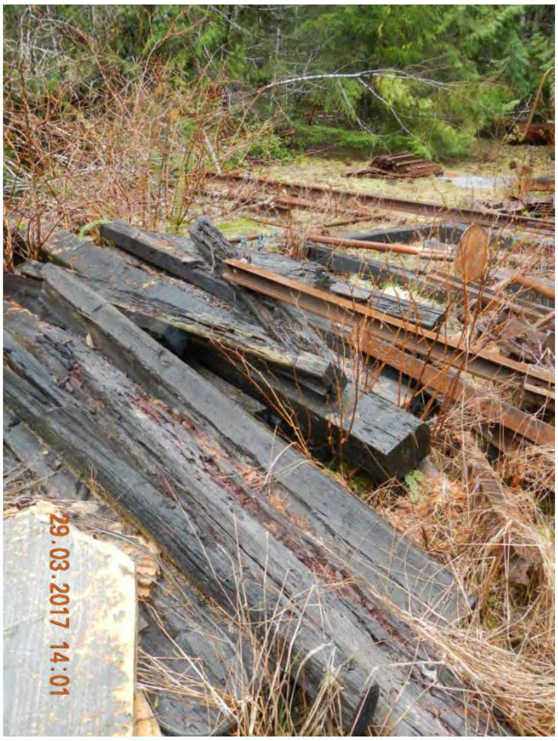


Photo 4

Bunker C fuel car

APPENDIX E.

3.2.16 Environmental Review and Opinion-McLean Mill National Historic Site, Port Alberni, B.C. 2017. Envirochem Services Inc. (Envirochem)

Envirochem Services Inc.
#206 – 267 West Esplanade
North Vancouver, BC V7M 1A5
Tel.:   604-986-0233
www.envirochem.com
response@envirochem.com

March 7, 2017

City of Port Alberni
4850 Argyle Street
Port Alberni, BC V9Y 1V8

Via e-mail: timothy_pley@portalberni.ca

Attention: Mr. Timothy Pley, CAO

Dear Mr. Pley:

RE: Environmental Review and Opinion
McLean Mill National Historic Site, Port Alberni, BC

INTRODUCTION

The McLean Mill National Historic Site (the "site") is located on a 12.81 hectare site approximately 15km northwest of Port Alberni, BC, and is the location of a former steam-powered, sawmill which operated from 1926 to 1965. The site has been inactive since that time, and through the cooperation of three agencies – The City of Port Alberni, British Columbia Heritage Trust, and Parks Canada – the site's historic resources have been preserved and restored as a heritage tourist attraction (and a national historic site). The site is surrounded by land used primarily for rural agricultural purposes. An aerial photo of the site and property boundary is shown on Figure 1 below.

Currently, a member of the public (a property owner >250 m to the south-east of the site) has raised potential concerns to the provincial Ministry of Environment (MOE), Environmental Protection Division, regarding potential environmental impact downstream onto the property owned by them. A previously completed environmental site investigation in 1994 and remediation completed in 1995 of the McLean Mill National Historic Site for the City of Port Alberni were completed by Envirochem Special Projects Inc. To support a review of the environmental conditions of the site as they relate to neighbouring properties, the City of Port Alberni (the Client) retained Envirochem Services Inc. (Envirochem) to review the previous environmental reports completed and support answering potential questions and/or concerns raised by the aforementioned member of the public.

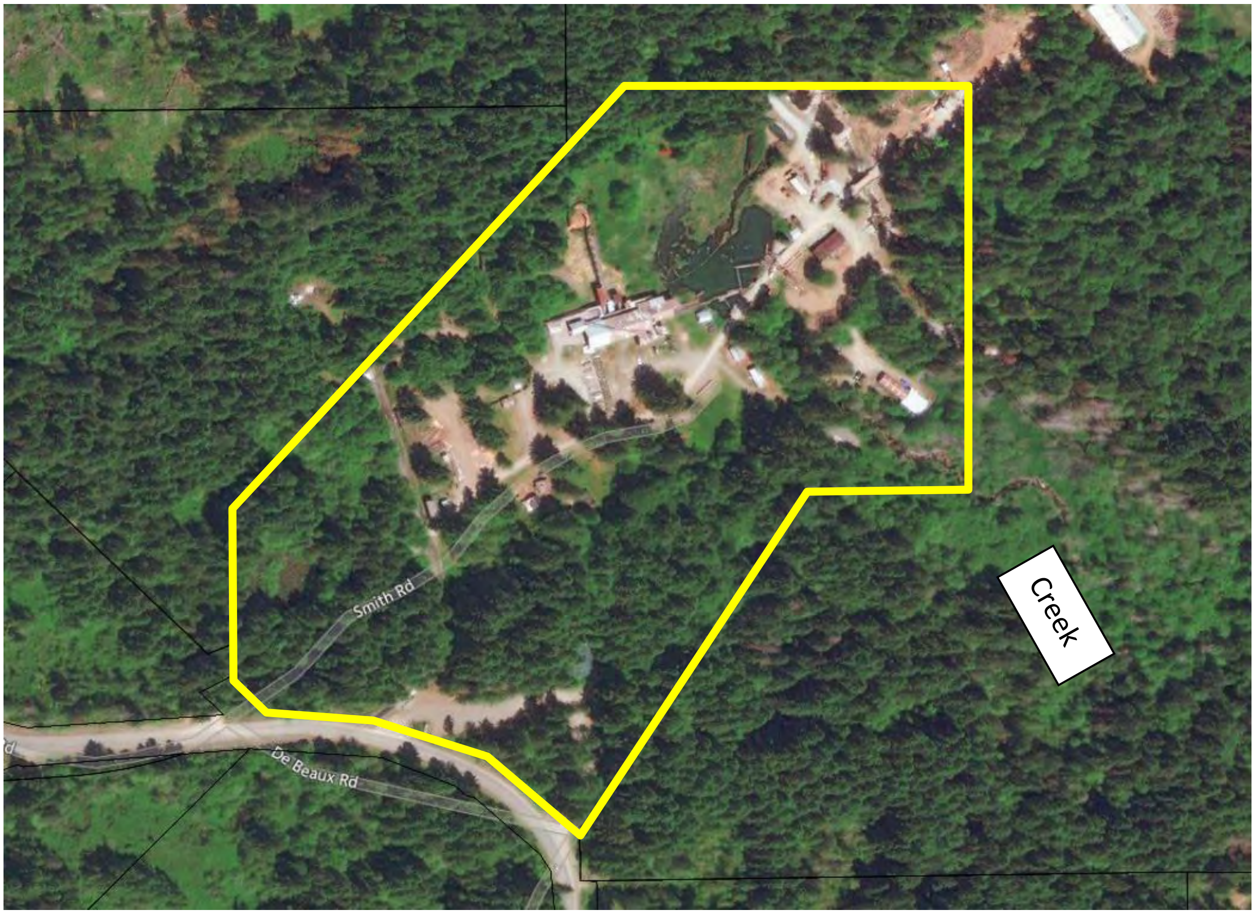


Figure 1. Aerial photo of the McLean Mill National Historic Site and property boundary (outlined in yellow) (base photo reference: Integrated Cadastral Information Society, ICI Society Map Viewer 2.0).

SCOPE OF WORK

The scope of work completed for this project included the following:

- Review select previous environmental reports and related documents;
- Correspond with interested parties as required including the Client and other government agencies (e.g. MOE); and
- Prepare a letter response to support answering the concerns and questions raised from Mr. John Adams (member of the public) about potential contamination from the McLean Mill site as conveyed by the MOE (Ms. Katelyn Dick) in an e-mail dated February 20, 2016.

The previous environmental reports reviewed by Envirochem included the following two reports:

- McLean Mill, National Historic Site, Port Alberni, B.C., Contamination Assessment, prepared for City of Port Alberni by Envirochem Special Projects Inc., and dated October 1994.
- Soil Remediation Summary, McLean Mill National Historic Site, Port Alberni, B.C., prepared for City of Port Alberni by Envirochem Special Projects Inc., and dated July 1995.

It should be noted, Envirochem was not retained to provide answers to the concerns and questions in their entirety, only is as much we were able to answer based on review of the aforementioned reports and information obtained through correspondence with others (and from an environmental perspective only).

RESPONSES TO QUESTIONS AND CONCERNS RAISED

Based on an e-mail received by Envirochem from the MOE on February 20, 2017 (see attached), it is understood that the member of the public, Mr. John Adams (an owner of an approximately 54.3 ha property located >250 m to the south-east of the mill site), raised several concerns to the MOE after reviewing the previous reports for the site. After reviewing the aforementioned reports, and through additional correspondence with the client and others, Envirochem's observations and opinions on some of the concerns raised are as follows:

1) ***Mr. Adams is concerned about the fact that the dipping tank is still in the ground, he says that the PCP levels were above standard for a park at the time of remediation. He also adds that it is not roped off and kids play in it.***

   Response: With respect to the available data reviewed, and other information indicated by others, the concentrations of pentachlorophenol (PCP) in soil do not appear to suggest any significant risk to human health or the environment through direct soil ingestion or direct soil contact based on comparison to current soil quality guidelines and standards that may be applicable. The benchmark federal Canadian Council of Ministers of the Environment (CCME) soil quality criterion for residential/parkland land use for PCP referred to at the time (0.5 mg/kg) was an interim criterion (established in 1991) and used as a screening tool only. The CCME soil quality guideline value established in 1997 and currently in use today for residential/parkland land use is 7.6 mg/kg (human health guideline/groundwater check value) (see attachment for additional information), and all PCP concentrations in soil identified based on historical sampling are within this benchmark (with the highest sample concentration identified being 3.49 mg/kg of PCP). And the benchmark is intended as a guideline value only.

In addition, a screening level evaluation of the CCME soil ingestion guideline of 93 mg/kg or soil contact guideline of 11 mg/kg for residential/parkland use for PCP are both significantly higher than past PCP concentrations identified onsite. Provincially, the standard for intake of contaminated soil is 100 mg/kg and for toxicity to soil invertebrates and plants is 20 mg/kg for urban park (PL) and residential land (RL) use.

Furthermore, although the site is designated a national historic site, it is our understanding that the site is not designated specifically for parkland use. That is, national historic sites are located within a variety of settings and the McLean Mill site is located within a historical industrial land use setting.

One limitation in the evaluation of the soil quality as it relates to potential PCP impacts is that the potential impact to groundwater resources is not readily able to be evaluated based on historical soil quality results with respect to current day guidelines and standards (i.e. the pH of soil was not regularly measured during contaminated site investigations in 1994/1995 although current guidelines and standards evaluate potential impacts to groundwater based on the pH of soil). However, the measured concentrations of PCP identified were relatively shallow (0.1m depth or less) and above the assumed depth of the water table, and limited surface water and groundwater sampling conducted at the time (1994) did not detect concentrations of chlorophenol in surface water or groundwater. In addition, relatively recent surface water quality samples obtained by others in the general area of the mill site (on behalf of Westcoast Aquatic, Port Alberni, BC) at a pond close to “Chitty Bridge”, a location just below “Chitty Bridge”, and at “John’s Bridge” as part of a water quality monitoring program (not directly related to the mill activities) did not appear to indicate the presence of chlorophenols but did appear to identify potential poor water quality based on other parameters including total suspended solids (TSS), fecal coliform, nitrogen, dissolved oxygen, aluminum, phosphorous, and conductivity. Based on this and other information, <u>there does not appear to be a suggestion that potential poor water quality observed near the mill is a result of the former PCP use at the site</u>.

2) Mr. Adams is concerned about the oil tank still in the ground.

<u>Response:</u> The underground storage tanks (USTs) (in the area of oil and gas shed) appear may have been left in place so as to not impact the ‘oil & gas shed’ structure (understood to be considered a heritage building). The USTs were reported to be essentially empty at the time of investigation, and soil quality sampling in the areas of these tanks did not suggest soil quality impacts at a depth that would be associated with these tanks [based on testing of concentrations of oil and grease, total extractable hydrocarbons (TEH), and volatile organic compounds (VOCs)].

3) ***Mr. Adams says that lumber stacking areas were also higher than park standards for PCP at time of remediation.***

   Response: See response to concern #1.

4) ***Mr. Adams wonders what happened to the lumber when the treated mill was torn down? Was it burned on site?***

   Response: In general, it is our understanding that the mill buildings and key structures were restored, not torn down or demolished. Envirochem is not aware of the specifics regarding any material disposal that otherwise may have occurred during the time of restoration activities.

5) ***What happened to the two cells from the grease rack? Mr. Adams believes the new channel for the creek may have been dug through them.***

   Response: Envirochem is not aware of what happened to soil from the former bioremediation cell.

6) ***The reports say the soil would need to go to a special waste dump, but Mr. Adams says it stayed on site.***

   Response: Envirochem is not aware of what eventually happened to the soils identified and characterized as special waste (under the former Special Waste Regulation) (generally surficial, shallow soils impacted by mineral oil and grease – i.e. surficial soil staining).

7) ***Mr. Adams wonders if the arsenic tank was removed?***

   Response: Envirochem is not clear on what the "arsenic tank" refers to.

Please note, Envirochem only provided responses to aspects of the questions which are considered related to the environmental issues and that we believed we were qualified and/or knowledgeable enough to answer. The responses provided were not meant to address all aspects of the forwarded questions. If you have questions regarding our responses, it is recommended to contact Envirochem for further clarification.

CLOSURE

We trust this letter is satisfactory for your purposes. We have answered the questions forwarded to us to the best of our ability and have provided relevant opinions where deemed appropriate. If you request further clarification on any of our responses, please do not hesitate to contact us.

Sincerely,
ENVIROCHEM SERVICES INC.

Eric Choi, P.Eng.
Senior Environmental Engineer
Senior Manager and Partner

Attachments:

Attachment A	E-mail dated February 20, 2016, from MOE (Ms. Katelyn Dick) to Envirochem
Attachment B	Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Pentachlorophenol (1997), Canadian Council of Ministers of the Environment
Attachment C	Limitations

ATTACHMENT A

Eric Choi

From: Dick, Katelyn ENV:EX <Katelyn.Dick@gov.bc.ca>
Sent: Monday, February 20, 2017 3:36 PM
To: Eric Choi
Subject: McLean Mill Port Alberni

Hi Eric,

I was given your email address from Timothy Pley. I work for the BC Ministry of Environment in compliance and I was assigned to respond to a complaint from a local citizen, Mr. John Adams about the mill. Mr. Adams was concerned that the mill was not correctly remediated and that there is still contamination which is affecting the health of local people and animals. The Ministry of Environment cannot speak to health issues, but we can address the environmental aspects. The site was remediated before our contaminated sites department existed so I don't have much of anything on record. I am not an expert in site remediation as I work in compliance, so I am hoping you are able to answer some questions about the remediation so we can determine if the site is up to standards for a park.

The complainant Mr. Adams has read over the 1994 and 1995 Envirochem reports and has several concerns. I'm not sure if you'll be able to address all of them, but I thought I would send them your way.

1) Mr. Adams is concerned about the fact that the dipping tank is still in the ground, he says that the PCP levels were above standard for a park at the time of remediation. He also adds that it is not roped off and kids play in it.
2) Mr. Adams is concerned about the oil tank still in the ground.
3) Mr. Adams says that lumber stacking areas were also higher than park standards for PCP at time of remediation.
4) Mr. Adams wonders what happened to the lumber when the treated mill was torn down? Was it burned on site?
5) What happened to the two cells from the grease rack? Mr. Adams believes the new channel for the creek may have been dug through them.
6) The reports say the soil would need to go to a special waste dump, but Mr. Adams says it stayed on site.
7) Mr. Adams wonders if the arsenic tank was removed?

Thanks,

Katelyn Dick
B.Sc. Applied Biology
Environmental Protection Co-op

Regional Operations Branch
Environmental Protection Division | Ministry of Environment
200, 10470 152nd Street |Surrey, BC | V3R 0Y3
Phone: 604 582 5234

ATTACHMENT B

Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

PENTACHLOROPHENOL 1997

This fact sheet provides Canadian soil quality guidelines for pentachlorophenol (PCP) for the protection of environmental and human health (Table 1). A supporting scientific document is also available (CCME 1997).

Background Information

Pentachlorophenol (C_6HCl_5O; CAS 87-86-5) and its salt, sodium pentachlorophenate ($C_6Cl_5O^-Na^+$; CAS 113-52-2), are the most common forms of pentachlorophenol used in Canada. Synonyms for PCP include chlorophen, pentachlorol, penta, pentachlorofenol, and 2,3,4,5,6-PCP. It has a molecular weight of 266.35, a specific gravity of 1.987 (at 25°C), a log K_{ow} of 5.05 (at pH of 5.1), vapour pressure of 2.0×10^{-6} kPa (at 20°C), and a pH-dependant water solubility ranging from 14.0 to 15 000 $mg \cdot L^{-1}$ (CCME 1997). PCP is an anthropogenic chemical that is ubiquitous in the Canadian environment as a result of extensive historical use in the wood preservation and wood protection industries. The only current uses of the chemical are restricted to heavy-duty wood preservation and ground line remedial treatment of utility poles; both uses are subject to re-evaluation under the Pest Control Products Regulations.

PCP has been detected in a wide range of environmental media sampled from across Canada. In particular, PCP has been found in association with wood preservation and protection facilities, sewage effluents, and in soils, waters, and sediments contiguous to these sources. PCP has also been detected in groundwater, surface waters, indoor and ambient air, housedust, and food (CCME 1997).

The majority of samples (98th percentile of determinations) from old urban parklands and rural parklands in Ontario

Table 1. Soil quality guidelines for pentachlorophenol ($mg \cdot kg^{-1}$).

	Land use			
	Agricultural	**Residential/ parkland**	**Commercial**	**Industrial**
Guideline	**7.6**[a]	**7.6**[a]	**7.6**[a]	**7.6**[a]
SQG_{HH}	7.6	7.6	7.6	7.6
Limiting pathway for SQG_{HH}	Groundwater check (drinking water)	Groundwater check (drinking water)	Groundwater check (drinking water)	Groundwater check (drinking water)
Provisional SQG_{HH}	NC[b]	NC[b]	NC[b]	NC[b]
Limiting pathway for provisional SQG_{HH}	ND	ND	ND	ND
SQG_E	11	11	28	28
Limiting pathway for SQG_E	Soil contact	Soil contact	Soil contact	Soil contact
Provisional SQG_E	NC[c]	NC[c]	NC[c]	NC[c]
Limiting pathway for provisional SQG_E	ND	ND	ND	ND
Interim soil quality criterion (CCME 1991)	0.05	0.5	5	5

Notes: NC = not calculated; ND = not determined; SQG_E = soil quality guideline for environmental health; SQG_{HH} = soil quality guideline for human health.

[a]Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated de novo guideline for this land use, derived in accordance with the soil protocol (CCME 1996a). The corresponding interim soil quality criterion (CCME 1991) is superseded by the soil quality guideline.

[b]Because data are sufficient and adequate to calculate an SQG_{HH} for this land use, a provisional SQG_{HH} is not calculated.

[c]Because data are sufficient and adequate to calculate an SQG_E for this land use, a provisional SQG_E is not calculated.

The guidelines in this fact sheet are for general guidance only. Site-specific conditions should be considered in the application of these values. The values may be applied differently in various jurisdictions. The reader should consult the appropriate jurisdiction before application of the values.

not impacted by a local source of pollution contained PCP concentrations below the detection limit of 14 ng·g^{-1}, with a maximum value of 21.5 ng·g^{-1} determined in rural parklands (OMEE 1993). At Canadian wood treatment sites, PCP concentrations in soil ranged from 0.049 to 16 000 mg·kg^{-1} (CCME 1997).

Impurities in technical grade PCP, which may include tetrachlorophenol, trichlorophenols, hexachlorobenzene, polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzo-furans (PCDFs), and chlorinated phenoxyphenols, are contributors to the compound's toxicity. Chronic toxicity studies indicate that technical grade PCP can be up to 10 times more potent than purified PCP due to the presence of these impurities (CCME 1997).

Environmental Fate and Behaviour in Soil

Laboratory studies indicate that the major physical and chemical processes that determine the transport and distribution of PCP and its derivatives in soil, water, and air are volatilization, adsorption, and leaching. At low concentrations, persistence in soil is generally low (<10 d), but may be modified by a number of factors (Bellin and O'Connor 1990).

Volatilization of PCP can occur from treated materials at a significant rate. A 30–80% evaporative loss of applied PCP was observed from treated wood within 1 year of application (Morgan and Purslow 1973).

Adsorption of PCP to soil is influenced by soil pH and organic carbon content (Choi and Aomine 1974). In general, adsorption was found to increase as soil pH decreased. As adsorption increases, PCP is less bioavailable and the rate of biodegradation tends to be reduced (van Gestel and Ma 1988).

Leaching of PCP tends to increase with high PCP input, high soil moisture, alkaline soil conditions, and low organic matter content in the soil (Kaufman 1976). Over a range of environmentally significant temperatures and pH, the solubility of PCP was found to vary from 5 to 8000 mg·L^{-1}.

Biodegradation is an important process particularly under aerobic conditions. Biodegradation processes reported include reduction, dechlorination, methylation, demethylation, acetylation, and hydroxylation. Products include lower chlorinated phenols, methyl ethers, and pentachloroanisole. The rate of biodegradation in soil is affected by temperature, pH, moisture, adsorption, and cation exchange capacity. Microbial species known to biodegrade PCP include *Pseudomonas*, *Flavobacterium*, and *Arthrobacter*. Several species of fungi are also known to be capable of PCP degradation (CCME 1997).

Behaviour and Effects in Biota

Soil Microbial Processes

Very few data are available on the effects of PCP on soil microbial processes including nitrification, ammonification, and respiration. Respiration has been shown to be unaffected by an application of 2 mg·kg^{-1} and inhibited by 10–20% by an application of 20 mg PCP·kg^{-1} (Zelles et al. 1985). In a comparison of the effects of PCP on nitrification, ammonification, and respiration in soils, a study has shown that nitrification is the most sensitive process (NOEC between ≥10 and <100 mg·kg^{-1} ww), respiration less sensitive (NOEC between ≥100 and <1000 mg·kg^{-1} ww), and ammonification the least sensitive of the three processes (NOEC ≥ 1000 mg·kg^{-1} ww) (Vonk et al. 1986).

Terrestrial Plants

PCP is metabolized rapidly in plants, so that while PCP products may be detected in plants, little intact PCP is found in plant tissues. Corn plants *(Zea mays)* exposed to soil spiked with 1.25 mg·kg^{-1} dry soil for 14 d accumulated 6.30 mg ^{14}C-PCP·kg^{-1}. Of the accumulated PCP, 16% was parent PCP, 40% unknown, and 44% PCP conjugates (Lu et al. 1978).

Scheunert et al. (1986) tested the uptake of 1 mg·kg^{-1} applied ^{14}C-PCP in carrots during one growing season. The authors determined that 57.6% was recovered in soil, 42% was lost to the atmosphere, and only very low amounts were leached to groundwater (0.1%) or taken up by carrots (0.1%). The weight of evidence from uptake, metabolism, and elimination studies suggests that bioaccumulation from PCP in soil would not be a major occurrence in plants.

The lowest soil PCP concentrations at which phytotoxic effects have been observed are 3.2 mg·kg^{-1}, resulting in 25% reduction in lettuce growth and 4.8 mg·kg^{-1} resulting in a 50% growth reduction (Vonk et al. 1986). The next most sensitive measurements were a 23% reduction in seedling emergence for lettuce at 11 mg·kg^{-1} (CCME 1997) and a 50% reduction in turnip growth at 11.32 mg·kg^{-1} (Gunter and Pestemer 1990).

Terrestrial Invertebrates

Van Gestel and Ma (1988) reported soil BCFs of 8.0 and 3.4 for the earthworms *Lumbricus rubellus* and *Eisenia foetida andrei*, respectively. A change in organic matter content of soil did not influence the BCF. In a study by Haque and Ebing (1988), whole body BCFs of the earthworm *Allolobophora caliginosa* exposed to 2.2 and 11.2 mg Na-PCP·kg^{-1} for 14 d were 37 and 50, respectively. In the first of two food chain studies by Gruttke et al. (1986), springtails *(Folsomia candida)* accumulated up to 370 mg·kg^{-1} fresh weight (fw) after a 10-d diet of baker's yeast containing 870 mg ^{14}C-Na-PCP·kg^{-1} dw. Carabid beetles *(Nebria brevicollis)* showed a body burden of approximately 4.5 mg PCP·kg^{-1} fw in the steady state (days 4–12) after feeding on contaminated springtails. After 4 d of feeding on uncontaminated springtails, the body burden had dropped to 0.4 mg·kg^{-1} fw. Similar results of low bioaccumulation tendency were reported in a PCP-contaminated soil system consisting of poplar leaves, isopods *(Oniscus asellus)* as a primary consumer, and staphylinid beetle *(Ocypus olens)* predators (Gruttke et al. 1986).

The lowest soil PCP concentration at which toxic effects have been observed in soil invertebrates is 10 mg·kg^{-1} resulting in an LC_{50} for the earthworm *E. foetida andrei*, after 28 d of exposure (van de Meent et al. 1991).

Human and Experimental Animal Health Effects

The majority of PCP exposure to humans is through contaminated food (accounting for 92–97% of estimate total daily exposure) and to a lesser extent from contaminated indoor air and house dust. The average total daily intake of PCP was estimated to range from 0.039 μg·kg^{-1} bw per day in adults to 0.16 μg·kg^{-1} bw per day in breast-fed infants (CCME 1997). Aboriginal peoples who rely on a traditional diet of fish and fish products may receive approximately twice as much dietary PCP as the average adult Canadian.

PCP is readily absorbed via the lungs, gastrointestinal tract, and skin in both humans and experimental animals. Chronic and subchronic PCP exposure of workers in high-risk, multiple-exposure environments has been extensively studied. Although various symptoms, including impairments in liver and kidney functions, have been reported in association with occupational exposure, no clear correlation between exposure and chronic/subchronic effects could be made (CCME 1997).

Experimental animal studies have shown that PCP is embryolethal and embryotoxic. In a single generation reproduction study, purified PCP (Dowicide EC-7) was given to rats at doses of 3 and 30 mg·kg^{-1} bw per day in the diet. The highest dose, administered to females prior to mating, during mating and gestation, and throughout lactation, caused a reduction in mean adult body weight and a significant decrease in neonatal survival and growth among litters of treated females (Schwetz et al. 1978). Ingestion of 3 mg·kg^{-1} bw per day had no effect on reproduction, neonatal growth, survival, or development. The same authors also studied the chronic toxicity of PCP in rats and reported mild signs of toxicity at 30 mg·kg^{-1} bw per day (decreased body weight [females], impaired liver function [both sexes] and impaired kidney function [females]). Ingestion of 3 mg·kg^{-1} bw per day or less by females and 10 mg·kg^{-1} bw per day or less by males was not associated with significant toxic effects (Schwetz et al. 1978).

Recent National Toxicology Program investigations have shown that long-term oral exposure to 100 and 200 ppm (18 and 37 mg·kg^{-1} bw per day) technical PCP and Dowicide EC-7 in mice resulted in significantly increased incidence of hemangiosarcomas (blood vessel tumours), pheochromocytoma (adrenal gland tumours), and hepatocellular adenomas and carcinomas (liver tumours) (U.S. Department of Health and Human Services 1989). PCP may be genotoxic, but the evidence is equivocal.

PCP is therefore classified in Group III, possibly carcinogenic to humans, according to the classification scheme of the Bureau of Chemical Hazards of Health Canada (Health Canada 1994). Substances classified as "possibly carcinogenic to humans" are generally assessed by Health Canada in a manner similar to threshold toxicants. Based on the NOEL of 3 mg·kg^{-1} bw per day reported in both a subchronic reproductive study and a limited chronic study (Schwetz et al. 1978), and using an uncertainty factor of 1000 (10 each for intra- and interspecies variation, and 10 for limited evidence of carcinogenicity, reproductive and teratogenic effects, and limitations of chronic studies), a provisional TDI of 3 μg·kg^{-1} bw per day was established (CCME 1997).

Guideline Derivation

Canadian soil quality guidelines are derived for different land uses following the process outlined in CCME (1996a) using different receptors and exposure scenarios for each land use (Table 1). Detailed derivations for PCP soil quality guidelines are provided in CCME (1997).

Soil Quality Guidelines for Environmental Health

The environmental soil quality guidelines (SQG_Es) are based on soil contact using data from toxicity studies on plants and invertebrates. In the case of agricultural land, soil and food ingestion toxicity data for mammalian and avian species are included. To provide a broader scope of protection, a nutrient and energy cycling check is calculated. For industrial land use, an off-site migration check is also calculated (Table 2).

For all land uses, the preliminary soil contact value (also called threshold effects concentration [TEC] or effects concentration low [ECL], depending on the land use) is compared to the nutrient and energy cycling check. If the nutrient and energy cycling check is lower, the geometric mean of the preliminary soil contact value and the nutrient and energy cycling check is calculated as the soil quality guideline for soil contact. If the nutrient and energy cycling check is greater than the preliminary soil contact value, the preliminary soil contact value becomes the soil quality guideline for soil contact.

For agricultural land use, the lower of the soil quality guideline for soil contact and the soil and food ingestion guideline is recommended as the SQG_E.

For residential/parkland and commercial land uses, the soil quality guideline for soil contact is recommended as the SQG_E.

For industrial land use, the lower of the soil quality guideline for soil contact and the off-site migration check is recommended as the SQG_E.

In the case of PCP, there are insufficient data to calculate the nutrient and energy cycling check or the soil and food ingestion check. Therefore, the soil contact guidelines are recommended as the SQG_Es for all land uses (Table 2).

The results of the groundwater check for the protection of aquatic life are reported over a range of pH; the adsorption of PCP to soil as well its solubility in soil pore water and groundwater will vary significantly with pH. Although the groundwater check value is not applied in the determination of environmental soil quality guidelines, its application should be evaluated on a site-specific basis (Table 2).

Soil Quality Guidelines for Human Health

The PCP soil concentration, based on direct exposure from soil ingestion, has been approved by the Standards and Guidelines Rulings Committee of the Bureau of Chemical Hazards of Health Canada as a preliminary human health soil quality guideline. However, the CCME recommends the application of various check mechanisms, when relevant, in order to provide a broader scope of protection. For PCP, the lowest of the soil ingestion guideline, the inhalation of indoor air check, the off-site migration check, and groundwater for drinking water check is recommended as the SQG_{HH}. Therefore, for PCP, the SQG_{HH} is the groundwater check for drinking water for all land uses (Table 2).

Soil Quality Guidelines for PCP

The soil quality guidelines for PCP are the lower of the SQG_{HH} and SQG_E for each land use. For all land uses, the soil quality guideline is the soil concentration calculated for the SQG_{HH}, which is based on the protection of groundwater for drinking water (Table 1).

Because there are sufficient data to calculate an SQG_{HH} and an SQG_E for each land use, the soil quality guideline represents a fully integrated de novo guideline for each land use, derived according to the soil protocol (CCME 1996a). The interim soil quality criteria (CCME 1991) for PCP are superseded by the soil quality guidelines.

CCME (1996b) provides guidance on potential modifications to the final recommended soil quality guidelines when setting site-specific objectives.

References

Bellin, C.A., and G.A. O'Connor. 1990. Plant uptake of pentachlorophenol from sludge-amended soils. J. Environ. Qual. 19(3):598–602.

CCME (Canadian Council of Ministers of the Environment). 1991. Interim Canadian environmental quality criteria for contaminated sites. CCME, Winnipeg.

———. 1996a. A protocol for the derivation of environmental and human health soil quality guidelines. CCME, Winnipeg. [A summary of the protocol appears in Canadian environmental quality guidelines, Chapter 7, Canadian Council of Ministers of the Environment, 1999, Winnipeg.]

———. 1996b. Guidance manual for developing site-specific soil quality remediation objectives for contaminated sites in Canada. CCME, Winnipeg. [Reprinted in Canadian environmental quality guidelines, Chapter 7, Canadian Council of Ministers of the Environment, 1999, Winnipeg.]

———. 1997. Canadian soil quality guidelines for pentachlorophenol: Environmental and human health. CCME, Winnipeg.

Choi, J., and S. Aomine. 1974. Adsorption of pentachlorophenol by soils. Soil Sci. Plant Nutr. 20(2):135–144

Gruttke, H., W. Kratz, V. Papenhauen, G. Weigmann, A. Haque, and I. Schuphan. 1986. Transfer of ^{14}C-Na-PCP in model-food chains (in German). Verh. Ges. Oekol. 14:451–455.

Gunter, P., and W. Pestemer. 1990. Risk assessment for selected xenobiotics by bioassay methods with higher plants. Environ. Manage. 14:381–388.

Haque, A., and W. Ebing. 1988. Uptake and accumulation of pentachlorophenol and sodium pentachlorophenol by earthworms from water and soil. Sci. Total Environ. 68:113–125.

Health Canada. 1994. Human health risk assessment for priority substances. Priority Substances List Assessment Report. Ottawa.

Kaufman, D.D. 1976. Phenols. In: Chemistry, degradation and mode of action, vol. 2, P.C. Kearney and D.D. Kaufman, eds. Marcel Dekker Inc., New York.

Lu, P.Y., R.L. Metcalf, and L.K. Cole. 1978. The environmental fate of ^{14}C-pentachlorophenol in laboratory model aquatic ecosystems. In: Pentachlorophenol: Chemistry, pharmacology and environmental toxicology, K.R. Rao, ed. Plenum Press, New York.

Table 2. Soil quality guidelines and check values for pentachlorophenol ($mg \cdot kg^{-1}$).

		Land use		
	Agricultural	Residential/ parkland	Commercial	Industrial
Guideline	7.6[a]	7.6[a]	7.6[a]	7.6[a]
Human health guidelines/check values				
SQG_{HH}	7.6[b]	7.6[b]	7.6[b]	7.6[b]
Soil ingestion guideline	93	93	340	7500
Inhalation of indoor air check	66 000	66 000	240 000	280 000
Off-site migration check	—	—	—	1 300
Groundwater check (drinking water) pH 7.0	7.6	7.6	7.6	7.6
Produce, meat, and milk check	NC[c]	NC[c]	—	—
Provisional SQG_{HH}	NC[d]	NC[d]	NC[d]	NC[d]
Limiting pathway for provisional SQG_{HH}	ND	ND	ND	ND
Environmental health guidelines/check values				
SQG_E	11[e]	11[e]	28[e]	28[e]
Soil contact guideline	11	11	28	28
Soil and food ingestion guideline	NC[f]	—	—	—
Nutrient and energy cycling check	NC[f]	NC[f]	NC[f]	NC[f]
Off-site migration check	—	—	—	160
Groundwater check (aquatic life) pH 4.5	7.4[g]	7.4[g]	7.4[g]	7.4[g]
pH 5.0	4.0	4.0	4.0	4.0
pH 5.5	1.7	1.7	1.7	1.7
pH 6.0	0.58	0.58	0.58	0.58
pH 6.5	0.19	0.19	0.19	0.19
pH 7.0	0.063	0.063	0.063	0.063
pH 7.5	0.022	0.022	0.022	0.022
pH 8.0	0.009	0.009	0.009	0.009
Provisional SQG_{HH}	NC[h]	NC[h]	NC[h]	NC[h]
Limiting pathway for provisional SQG_{HH}	ND	ND	ND	ND
Interim soil quality criterion (CCME 1991)	0.05	0.5	5	5

Notes: NC = not calculated; ND = not determined; SQG_E = soil quality guideline for environmental health; SQG_{HH} = soil quality guideline for human health. The dash indicates guideline/check value that is not part of the exposure scenario for this land use and therefore is not calculated.

[a]Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated de novo guideline for this land use, derived in accordance with the soil protocol (CCME 1996a). The corresponding interim soil quality criterion (CCME 1991) is superseded by the soil quality guideline.

[b]The SQG_{HH} is the lowest of the human health guidelines and check values.

[c]Calculated for nonpolar organic compounds. Because PCP is a polar organic compound in its dissociated form, the check is not calculated.

[d]Because data are sufficient and adequate to calculate an SQG_{HH} for this land use, a provisional SQG_{HH} is not calculated.

[e]The SQG_E is based on the soil contact guideline value.

[f]Data are insufficient/inadequate to calculate this value.

[g]The groundwater check (aquatic life) value has not been applied in the determination of the soil quality guideline. The applicability of the groundwater check (aquatic life) values should be determined on a site-specific basis.

[h]Because data are sufficient and adequate to calculate an SQG_E for this land use, a provisional SQG_E is not calculated.

Morgan, J.W.W., and D.F. Purslow. 1973. Volatile losses of wood preservatives. In: Proc. 23rd Annual Convention of the British Wood Preservers Association.

OMEE (Ontario Ministry of Environment and Energy). 1993. Ontario typical range of chemical parameters in soil, vegetation, moss bags and snow. Version 1.0a. PIBS 2792. Standards Development Branch, Phytotoxicology Section, Toronto.

Scheunert, I., Zhang Qiao, and F. Korte. 1986. Comparative studies of the fate of atrazine-^{14}C and pentachlorophenol-^{14}C in various laboratory and outdoor soil–plant systems. J. Environ. Sci. Health 21(6):457–485.

Schwetz, B.A., I.F. Quast, P.A. Keeler, C.G. Humiston, and R.J. Kociba. 1978. Results of two-year toxicity and reproduction studies on pentachlorophenol in rats. In: Pentachlorophenol: Chemistry, pharmacology, and environmental toxicology, K.R. Rao, ed. Plenum Press, New York.

U.S. Department of Health and Human Services. 1989. NTP technical report on the toxicology and carcinogenesis studies of two pentachlorophenol technical-grade mixtures in B6C3F-1 mice (feed studies). Public Health Services, National Institutes of Health, National Toxicology Program, Research Triangle Park, NC.

van de Meent, J.A., Janus R.D.F.M. Taalman, and R.M.C. Theelan 1991. Integrated criteria document chlorophenols-Effects. Appendix to Report No. 710401013. RIVM, Bilthoven, Netherlands.

van Gestel, C.A.M., and W. Ma. 1988. Toxicity and bioaccumulation of chlorophenols in earthworms in relation to bioavailability in soil. Ecotoxicol. Environ. Saf. 15:289–297.

Vonk, J.W., D.M.M. Adema, and D. Barug. 1986. Comparison of the effects of several chemicals on microorganisms, higher plants and earthworms. In: Contaminated soil, J.W. Assink and W.J. van der Brink, eds. Martinus Nijhoff Publishers, Dordrecht, Netherlands.

Zelles, L., I. Scheunert, and F. Korte. 1985. Side effects of some pesticides on non-target soil microorganisms. J. Environ. Sci. Health. B20(5):457–488.

This fact sheet was originally published in the working document entitled "Recommended Canadian Soil Quality Guidelines" (Canadian Council of Ministers of the Environment, March 1997, Winnipeg). A revised and edited version is presented here.

Reference listing:

Canadian Council of Ministers of the Environment. 1999. Canadian soil quality guidelines for the protection of environmental and human health: Pentachlorophenol (1997). In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

For further scientific information, contact:

Environment Canada
Guidelines and Standards Division
351 St. Joseph Blvd.
Hull, QC K1A 0H3
Phone: (819) 953-1550
Facsimile: (819) 953-0461
E-mail: ceqg-rcqe@ec.gc.ca
Internet: http://www.ec.gc.ca

For additional copies, contact:

CCME Documents
c/o Manitoba Statutory Publications
200 Vaughan St.
Winnipeg, MB R3C 1T5
Phone: (204) 945-4664
Facsimile: (204) 945-7172
E-mail: spccme@chc.gov.mb.ca

Excerpt from Publication No. 1299; ISBN 1-896997-34-1

Aussi disponible en français.

ATTACHMENT C

LIMITATIONS

This letter was prepared for the exclusive use of the City of Port Alberni (the Client). Any third party recipient of this letter or user of any content contained herein uses this letter and its contents at its sole risk, and by acceptance or use releases Envirochem Services Inc. (Envirochem), its affiliates, officers, employees and subcontractors from any liability for direct, indirect, incidental, consequential or special loss or damage or other liability of any nature arising from its use of the letter or reliance upon any of its content.

In preparing this letter for the Client, Envirochem reviewed data and information, including site investigations, provided by the Client and third parties as well as limited information in Envirochem files. Envirochem has assumed this information to be accurate, complete, reliable, timely, non-infringing and fit for the intended purpose. Envirochem accepts no responsibility for any deficiency, misstatements or inaccuracy contained in this letter as a result of omissions, misstatements or fraudulent acts of persons interviewed.

In addition, all environmental site investigations have an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk.

Achieving the opinions stated in this letter has required us to arrive at conclusions based upon the best information presently known to us. Professional judgment was exercised in reviewing and analyzing the information obtained and in the formulation of the opinions.

Please note, regulatory statutes and the interpretation of regulatory statutes are subject to change over time. This letter is not meant to represent a legal opinion regarding environmental compliance with current applicable laws.

Envirochem expressly disclaims any and all warranties in connection with this letter. This disclaimer of warranty includes, without limitation, any warranty that this letter has uncovered all potential environmental liabilities associated with the Property. Envirochem believes this letter to be accurate; however, Envirochem disclaims any warranty of the completeness or accuracy of information supplied to Envirochem that was relied upon in the preparation of this letter.

APPENDIX E.

3.2.17 Sediment and Water Sampling Results-McLean Mill. 2018. TerraWest Environmental Inc. (TerraWest)

Mailing
PO Box 58
Cowichan Bay, BC
V0R 1N0

Regional
3148-F Barons Road
Nanaimo, BC
V9T 4B5

D.R. Clough Consulting
6966 Leland Road, Lantzville, B.C.
C.C., V0R 2H0

October 30, 2018

Attn: David R. Clough, R.P.Bio.

Re: *SEDIMENT AND WATER SAMPLING RESULTS* – Mclean Mill

TerraWest Environmental Inc. (TerraWest) was retained by D.R. Clough Consulting (the 'Client') to complete sediment and surface water sampling at 5633 Smith Road, Port Alberni, BC, herein referred to as the 'Subject Property' and/or the 'Site'. Historical industrial activities were previously identified on the Site including a lumber mill, Currently the Site is a historical park. TerraWest was supplied with an identified investigation area which, encompassed the mill's pond, and designated sample locations supplied from D.R. Clough Consulting, see Figure 1 and Figure 2.

1.0 FIELD ACTIVITIES

Sediment samples were obtained at three designated sampling locations by extending a hand auger into the benthos of the mill's pond and collecting approximately the top 20 cm to 40 cm of sediment. Captured water was carefully drained from the hand auger prior to sampling. Sediment was extracted from the hand auger and placed into laboratory-supplied 120 mL soil jars, along with 40 mL vials using designated soil plugs containing methanol preservative. The equipment was rinsed in the pond water at the sample location in attempt to minimize potential cross-contamination between other sample locations.

Surface water samples were collected at three designated sampling locations utilizing laboratory-supplied bottles that were filled to capacity by plunging the bottle directly into the water with the opening of the bottle downwards first, then tipping upwards within the water column allowing air bubbles to escape.

Photographs of the sediment and surface water sampling locations are attached to this letter.

Sediment samples were analyzed by Exova for potential contaminants of concern (PCOCs) including benzene, toluene, ethylbenzene, total xylenes, methyl tertiary butyl ether, styrene (BTEXSM), light extractable petroleum hydrocarbons (LEPH), heavy extractable petroleum hydrocarbons (HEPH), volatile petroleum hydrocarbons (VPH), polycyclic aromatic hydrocarbons (PAH), metals, polychlorinated phenols, dioxins and furans.

Surface water samples were analyzed by Exova for PCOCs including BTEXSM, EPH, VPH, LEPH/HEPH, PAHs and metals.

2.0 STANDARDS

Laboratory analytical results were compared to the BC Ministry of Environment and Climate Change *Contaminated Sites Regulation* (CSR) Schedule 3.4 Generic Numerical Sediment Criteria for freshwater sensitive sediment and Schedule 3.2 Generic Numerical Water Standards for freshwater aquatic life, irrigation, livestock, and drinking water use, herein referred to as the 'applicable standards'.

3.0 RESULTS

A summary of analytical results is presented in the Tables 1 through 8, attached.

3.1 Sediment Analytical Results

Laboratory analytical results indicated the sediment sample(s) reported concentrations exceeding the lowest applicable standards:

Sample ID	Parameter	Concentration	CSR Schedule 3.4 Freshwater Sediment	
			Sensitive Sediment*	Typical Sediment*
SS18-01	Acenaphthylene	0.22 ug/g	0.08 ug/g	0.15 ug/g
	Naphthalene	0.63 ug/g	0.24 ug/g	0.47 ug/g
	Phenanthrene	0.44 ug/g	0.32 ug/g	0.62 ug/g
	Arsenic	19 ug/g	11 ug/g	20 ug/g
	Chromium (Total)	90 ug/g	56 ug/g	110 ug/g
	Mercury	0.81 ug/g	0.3 ug/g	0.58 ug/g
	Zinc	280 ug/g	200 ug/g	380 ug/g
	Total Equivalency, polychlorinated dioxins and furans (PDCC and PCDF)	0.13840 ug/kg	0.13 ug/kg	0.26 ug/kg

SS18-02	Arsenic	12 ug/g	11 ug/g	20 ug/g
	Chromium (Total)	90 ug/g	56 ug/g	110 ug/g
	Mercury	0.34 ug/g	0.3 ug/g	0.58 ug/g
SS18-03	Chromium (Total)	96 ug/g	56 ug/g	110 ug/g
	Mercury	0.33 ug/g	0.3 ug/g	0.58 ug/g

* As per the BC CSR definitions. Sensitive Sediment standards apply; Typical Sediment standards are shown for comparative purposes only.

All other analyzed parameters were below the applicable standards.

3.2 SURFACE WATER ANALYTICAL RESULTS

Laboratory analytical results indicated the following surface water sample(s) reported concentrations exceeding the lowest applicable standards:

Sample ID	Parameter	Concentration	CSR Schedule 3.2			
			FW AQ[1]	IR[2]	LS[3]	DW[4]
SW18-01	Cobalt	1.7 ug/L	40 ug/L	50 ug/L	1,000 ug/L	1 ug/L
SW18-02/ SW18-02A*	Cobalt	1.9 ug/L	40 ug/L	50 ug/L	1,000 ug/L	1 ug/L
	Cobalt	2.0 ug/L	40 ug/L	50 ug/L	1,000 ug/L	1 ug/L
SW18-03	Cobalt	1.7 ug/L	40 ug/L	50 ug/L	1,000 ug/L	1 ug/L

Notes:

* Represents duplicate sample

1 – Freshwater Aquatic Life 2 – Irrigation 3 – Livestock 4 – Drinking Water

All other analyzed parameters were below the applicable standards.

3.3 RELATIVE PERCENT DIFFERENCE ON DUPLICATE SAMPLES

A relative percent difference (RPD) value for surface water samples of less than 20% is generally considered an indicator of acceptable sampling and analytical precision, as per the British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples. The BC Field Sampling Manual also specifies that RPD values between 20% and 50% may indicate an issue with sampling or analytical precision. It should be noted that as per the BC Field Sampling Manual, the values must be greater than five times the method detection limit to be included in the RPD calculation.

The RPD between the surface water sample SS18-02 and duplicate sample SS18-02A exceeded the 20% and 50% guidelines for aluminum at 151% and titanium at 165%

All precautions were taken in the field to ensure integrity of samples was maintained and the potential for cross-contamination between samples was minimized. As reported in the laboratory analytical reports, all samples met Exova quality assurance and quality control standards. The exact reason why the RPD values exceeded the guideline is not known.

4.0 CONCLUSIONS & RECOMMENDATIONS

Laboratory analytical results indicated exceedances of applicable standards in both sediment and surface water samples obtained from the mill pond. Based on the findings of this sampling program, TerraWest recommends further delineation works be conducted to determine if sediment and surface water impacts extend beyond the initial sample locations. Additionally, TerraWest recommends an assessment of the wider mill property and historical uses to attempt to identify the source of the contaminants currently identified in the pond, in addition to full review of all historic reports provided by DR Clough Consulting on October 23, 2018.

5.0 LIMITATIONS & CLOSURE

TerraWest Environmental Inc. has prepared this report for the exclusive use of its Client, D.R. Clough Consulting, and may be relied upon by the Client for their private business purposes. Any other third party use of this report, or reliance placed on it, or decisions taken based on it, is the responsibility of such parties. TerraWest accepts no responsibility for any damages suffered by any third party, or any claims made by any third party as a result of decisions made or actions taken, based on this report. This report does not constitute any expression of legal opinion, and D.R. Clough Consulting is specifically advised to seek professional legal opinions with respect to applicable regulatory statutes in this matter.

Investigations described by this report were initiated on the Subject Property at the request of the Client. TerraWest's investigations were conducted in accordance with generally accepted practices of such environmental investigations. No other warranties are made, either expressed or implied.

The findings of this report are partially based on information provided to TerraWest by the Client and other individuals or organizations. While TerraWest believes that information was provided in good faith and has attempted to verify such information where possible, TerraWest does not accept any responsibility for any inaccuracies, deficiencies or omissions contained in this report, based on the use of such information.

These report findings are partially based on TerraWest's observations of Site environmental conditions, limited to the dates and specific locations of investigation. TerraWest offers no warranty, either expressed or implied, as to the presence or potential presence of any chemical substances or contamination on the Subject Property covered by this report. This report constitutes neither an endorsement nor a condemnation of the Subject Property.

A signed paper copy of this report constitutes the official and complete deliverable document of record in this matter. The complete report includes the main report text, Attachments and Appendices, as identified in the Table of Contents. Should this report be distributed by means of digital transmission, or copied in paper hardcopy form, TerraWest accepts no liability for the completeness, accuracy or digital compatibility of the files provided.

We trust this meets your requirements, and if there are any questions regarding the above please do not hesitate to contact the undersigned below.

Prepared by:

COLLEGE OF APPLIED BIOLOGY
Derek Nickel
30-Oct-2018
R.P. Bio
3004
CAB

Derek Nickel, B.Sc., R.P.Bio.
Project Biologist

Reviewed by:

BRITISH COLUMBIA INSTITUTE OF AGROLOGISTS
3066
Suzanne Durnin
2018-10-30
P.Ag.

Suzanne Durnin, *P.Ag.*
QA/QC Manager

Enclosures:
Site Inspection Photographs
Figure 1. Site Location
Figure 2. Site Plan with Sample Locations
Table 1. Summary of Sediment Analytical Results – Petroleum Hydrocarbons
Table 2. Summary of Sediment Analytical Results – Metals
Table 3. Summary of Sediment Analytical Results – Phenols
Table 4. Summary of Sediment Analytical Results – Dioxins and Furans
Table 5. Summary of Surface Water Analytical Results - Petroleum Hydrocarbons
Table 6. Summary of Surface Water Analytical Results - Metals
Table 7. Summary of Surface Water Analytical Results – Routine Parameters
Table 8. Relative Percent Difference of Field Duplicate Samples
Laboratory Analytical Report

Photo 1. Looking west towards SS18-01 (bottom left corner) and mill pond.

Photo 2. Looking northeast towards mill pond outlet.

Photo 3. Looking north towards SS18-02 in mill pond.

Photo 4. Looking at sediment sample from SS18-02.

Photo 5. Looking east towards SS18-03 in mill pond.

Photo 6. Looking east from SS18-03 over mill pond.

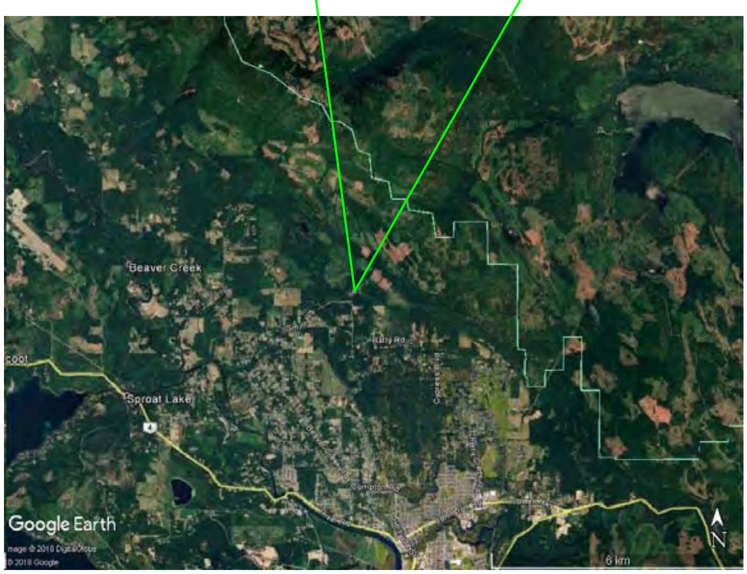


FIGURE 1. SITE LOCATION

CLIENT: D.R. CLOUGH CONSULTING

LOCATION: 5633 SMITH ROAD, PORT ALBERNI, BC

PROJECT: DCMM18-01

DATE: OCTOBER 2018

CREATED BY: DNICKEL

LEGEND

— — — SITE BOUNDARY

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 8 1/2"X11" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH

FIGURE 2. SITE PLAN WITH SAMPLE LOCATIONS

CLIENT: D.R. CLOUGH CONSULTING
LOCATION: 5633 SMITH ROAD, PORT ALBERNI, BC
PROJECT: DCMM18-01
DATE: OCTOBER 2018
CREATED BY: DNICKEL

LEGEND

- SITE BOUNDARY
- SEDIMENT SAMPLE LOCATION
- SURFACE WATER SAMPLE LOCATION
- SAMPLE EXCEEDS LOWEST APPLICABLE STANDARDS

THIS FIGURE IS SUBJECT TO THE SAME LIMITATIONS OUTLINED IN THE REPORT BODY.
THIS FIGURE IS FOR INTERPRETATION ONLY AND IS INTENDED TO BE VIEWED IN COLOUR ON 11"x17" SIZED PAPER.
THE BOUNDARIES AND SCALE DEPICTED ARE APPROXIMATE.
SOURCE: GOOGLE EARTH

Table 1. Summary of Sediment Analytical Results – Petroleum Hydrocarbons

Sample ID		SS18-01	SS18-02	SS18-03	CSR Schedule 3.4[2]	
Matrix		Sediment	Sediment	Sediment	Freshwater Sediment	
Depth (m below surface grade)		0.0-0.4	0.0-0.4	0.0-0.4		
Sample Date		26-Sep-18	26-Sep-18	26-Sep-18	Sensitive Sediment[3]	Typical Sediment[3]
Comments		Pond	Pond	Pond		
PARAMETERS	Units	Analytical Results[1]				
Volatile Hydrocarbons						
Benzene	ug/g	<0.02	<0.02	<0.02	n.s.	n.s.
Toluene	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.
Ethylbenzene	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.
Total Xylenes (m,p,o)	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.
Styrene	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.
Methyl t-Butyl Ether	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.
Volatile Petroleum Hydrocarbons						
VHs_{6-10}	ug/g	<50	<50	<50	n.s.	n.s.
Extractable Petroleum Hydrocarbons						
$LEPH_{10-19}$	ug/g	49	25	<20	n.s.	n.s.
$HEPH_{19-32}$	ug/g	1380	348	156	n.s.	n.s.
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	ug/g	<0.03	<0.03	<0.03	0.055	0.11
Acenaphthylene	ug/g	**<u>0.22</u>**	<0.03	<0.03	0.08	0.15
Anthracene	ug/g	<0.03	<0.03	<0.03	0.15	0.29
Benzo(a)anthracene	ug/g	<0.03	0.08	0.06	0.24	0.46
Benzo(a)pyrene	ug/g	<0.03	<0.03	<0.03	0.48	0.94
Benzo(b+j)fluoranthene	ug/g	<0.06	<0.06	<0.06	n.s.	n.s.
Benzo(g,h,i)perylene	ug/g	<0.03	<0.03	<0.03	n.s.	n.s.
Benzo(k)fluoranthene	ug/g	<0.03	<0.03	<0.03	n.s.	n.s.
Chrysene	ug/g	<0.03	<0.03	<0.03	0.53	1.0
Dibenz(a,h)anthracene	ug/g	<0.03	<0.03	<0.03	0.084	0.16
Fluoranthene	ug/g	0.3	0.07	0.07	1.5	2.8
Fluorene	ug/g	<0.03	<0.03	<0.03	0.089	0.17
Indeno(1,2,3-c,d)pyrene	ug/g	<0.03	<0.03	<0.03	n.s.	n.s.
2-Methylnaphthalene	ug/g	<0.03	<0.03	<0.03	0.12	0.24
Naphthalene	ug/g	**<u>0.63</u>**	<0.03	<0.03	0.24	0.47
Phenanthrene	ug/g	**<u>0.44</u>**	0.10	0.06	0.32	0.62
Pyrene	ug/g	0.28	<0.03	<0.03	0.54	1.1
Total PAH	ug/g	2.11	0.55	0.49	10.0	20.0

Notes:

1 - Data excerpted from Exova analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.4 Generic Numerical Sediment Standards, site-specific pathways as noted above

3 - As per the BC CSR definitions

n.s. = No applicable standard

< = Less than the laboratory method detection limit

Total PAH is the results for following 13 individual PAHs (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene and pyrene)

Bold, <u>underlined</u>, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 2. Summary of Sediment Analytical Results – Metals

Sample ID		SS18-01	SS18-02	SS18-03	CSR Schedule 3.4[2]	
Matrix		Sediment	Sediment	Sediment	Freshwater Sediment	
Depth (m below surface grade)		0.0-0.4	0.0-0.4	0.0-0.4		
Sample Date		26-Sep-18	26-Sep-18	26-Sep-18	Sensitive Sediment[3]	Typical Sediment[3]
Comments		Pond	Pond	Pond		
PARAMETERS	Units	**Analytical Results[1]**				
Metals						
Aluminum	ug/g	25000	27000	27000	n.s.	n.s.
Antimony	ug/g	5.1	5.6	5.7	n.s.	n.s.
Arsenic	ug/g	**<u>19</u>**	**<u>12</u>**	11	11.0	20.0
Barium	ug/g	110	130	160	n.s.	n.s.
Beryllium	ug/g	0.40	0.44	0.47	n.s.	n.s.
Cadmium	ug/g	0.55	0.3	0.3	2.2	4.2
Calcium	ug/g	7300	11000	9700	n.s.	n.s.
Chromium (Total)	ug/g	**<u>90</u>**	**<u>90</u>**	**<u>96</u>**	56.0	110.0
Cobalt	ug/g	24	27	29	n.s.	n.s.
Copper	ug/g	94	99	96	120.0	240.0
Iron	ug/g	44000	42000	44000	n.s.	n.s.
Lead	ug/g	15	8.4	4	57.0	110.0
Lithium	ug/g	13	14	16	n.s.	n.s.
Magnesium	ug/g	6900	8000	8300	n.s.	n.s.
Manganese	ug/g	420	660	460	n.s.	n.s.
Mercury	ug/g	**<u>0.81</u>**	**<u>0.34</u>**	**<u>0.33</u>**	0.3	0.58
Molybdenum	ug/g	0.4	<0.10	<0.10	n.s.	n.s.
Nickel	ug/g	42	42	45	n.s.	n.s.
Phosphorus	ug/g	1400	580	510	n.s.	n.s.
Potassium	ug/g	680	760	760	n.s.	n.s.
Selenium	ug/g	2	0.6	1	n.s.	n.s.
Silicon	ug/g	570	430	390	n.s.	n.s.
Silver	ug/g	1.5	0.81	0.5	n.s.	n.s.
Sodium	ug/g	140	170	150	n.s.	n.s.
Strontium	ug/g	19	23	25	n.s.	n.s.
Thallium	ug/g	<0.5	<0.5	<0.5	n.s.	n.s.
Tin	ug/g	2	1	0.8	n.s.	n.s.
Titanium	ug/g	1000	1300	1100	n.s.	n.s.
Vanadium	ug/g	150	150	160	n.s.	n.s.
Zinc	ug/g	**<u>280</u>**	130	97	200.0	380.0
Zirconium	ug/g	5.8	6.2	5.5	n.s.	n.s.

Notes:

1 - Data excerpted from Exova analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.4 Generic Numerical Sediment Standards, site-specific pathways as noted above

3 - As per the BC CSR definitions

n.s. = No applicable standard

< = Less than the laboratory method detection limit

Bold, <u>underlined</u>, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 3. Summary of Sediment Analytical Results – Phenols

Sample ID		SS18-01	SS18-02	SS18-03	CSR Schedule 3.4[2]	
Matrix		Sediment	Sediment	Sediment	Freshwater Sediment	
Depth (m below surface grade)		0.0-0.4	0.0-0.4	0.0-0.4		
Sample Date		26-Sep-18	26-Sep-18	26-Sep-18	Sensitive Sediment[3]	Typical Sediment[3]
Comments		Pond	Pond	Pond		
PARAMETERS	Units	**Analytical Results[1]**				
Chlorinated Phenols						
Monochlorophenols	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.
Dichlorophenols	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.
Trichlorophenols	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.
Tetrachlorophenols	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.
Pentachlorophenol	ug/g	<0.02	<0.02	<0.02	0.4	0.8
Total Chlorophenols	ug/g	<0.05	<0.05	<0.05	n.s.	n.s.

Notes:

1 - Data excerpted from Exova analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.4 Generic Numerical Sediment Standards, site-specific pathways as noted above

3 - As per the BC CSR definitions

n.s. = No applicable standard

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 4. Summary of Sediment Analytical Results – Dioxins and Furans

Sample ID		SS18-01	SS18-02	SS18-03	CSR Schedule 3.4	
Matrix		Sediment	Sediment	Sediment	Freshwater Sediment	
Depth (m below surface grade)		0.0-0.4	0.0-0.4	0.0-0.4		
Sample Date		26-Sep-18	26-Sep-18	26-Sep-18	Sensitive Sediment[3]	Typical Sediment[3]
Comments		Pond	Pond	Pond		
PARAMETERS	Units	**Analytical Results[1]**				
Dioxins						
2,3,7,8-TCDD	ng/kg	2.1	n.d.	n.d.	n.s.	n.s.
Total TCDD	ng/kg	30	2.9	2.1	n.s.	n.s.
1,2,3,7,8-PeCDD	ng/kg	32	2.6	n.d.	n.s.	n.s.
Total PeCDD	ng/kg	140	2.9	n.d.	n.s.	n.s.
1,2,3,4,7,8-HxCDD	ng/kg	76	n.d.	n.d.	n.s.	n.s.
1,2,3,6,7,8-HxCDD	ng/kg	210	5.4	n.d.	n.s.	n.s.
1,2,3,7,8,9-HxCDD	ng/kg	81	2.7	1.3	n.s.	n.s.
Total HxCDD	ng/kg	1100	45	28	n.s.	n.s.
1,2,3,4,6,7,8-HpCDD	ng/kg	3800	140	41	n.s.	n.s.
Total HpCDD	ng/kg	7200	350	89	n.s.	n.s.
OCDD	ng/kg	11000	1300	320	n.s.	n.s.
Toxic Equivalency*	ng/kg	112	5.5	1.2	n.s.	n.s.
	ug/kg (ppb)	0.1120	0.0055	0.001	n.s.	n.s.
Furans						
2,3,7,8-TCDF	ng/kg	4.2	n.d.	n.d.	n.s.	n.s.
Total TCDF	ng/kg	88	17	8.2	n.s.	n.s.
1,2,3,7,8-PeCDF	ng/kg	7.2	0.72	n.d.	n.s.	n.s.
2,3,4,7,8-PeCDF	ng/kg	9.7	1.2	n.d.	n.s.	n.s.
Total PeCDF	ng/kg	280	19	25	n.s.	n.s.
1,2,3,4,7,8-HxCDF	ng/kg	31	1.1	n.d.	n.s.	n.s.
1,2,3,6,7,8-HxCDF	ng/kg	30	1.9	0.94	n.s.	n.s.
1,2,3,7,8,9-HxCDF	ng/kg	14	n.d.	n.d.	n.s.	n.s.
2,3,4,6,7,8-HxCDF	ng/kg	54	2.6	0.78	n.s.	n.s.
Total HxCDF	ng/kg	870	32	14	n.s.	n.s.
1,2,3,4,6,7,8-HpCDF	ng/kg	830	27	6.1	n.s.	n.s.
1,2,3,4,7,8,9-HpCDF	ng/kg	95	2.4	0.8	n.s.	n.s.
Total HpCDF	ng/kg	3600	110	23	n.s.	n.s.
OCDF	ng/kg	2000	91	18	n.s.	n.s.
Toxic Equivalency*	ng/kg	26	1.3	0.47	n.s.	n.s.
	ug/kg (ppb)	0.026	0.001	0.0005	n.s.	n.s.
Total Equivalency, polychlorinated dioxins and furans (PDCC and PCDF)*	ug/kg (ppb)	**<u>0.13840</u>**	0.00678	0.00170	0.13**	0.26**

Notes:

1 - Data excerpted from Exova analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.4 Generic Numerical Sediment Standards, site-specific pathways as noted above

n.d. = Less than the laboratory method detection limit

n.s. = No applicable standard

*Calculated based on World Health Organization Toxic Equivalency System (WHO-TEQs)

** = Standard has been converted to ug/kg to correspond with laboratory results

Bold, <u>underlined</u>, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 5. Summary of Surface Water Analytical Results - Petroleum Hydrocarbons

Sample ID		SS18-01	SS18-02	SS18-03	CSR Schedule 3.2[2]			
Matrix		Surface Water	Surface Water	Surface Water	Freshwater Aquatic Life	Irrigation	Livestock	Drinking Water
Sample Date		26-Sep-18	26-Sep-18	26-Sep-18				
Comments		Pond	Pond	Pond				
PARAMETERS	Units	**Analytical Results[1]**						
Mono-Aromatic Hydrocarbons								
Benzene	ug/L	<0.5	<0.5	<0.5	400	n.s.	n.s.	5
Ethylbenzene	ug/L	<0.5	<0.5	<0.5	2,000	n.s.	n.s.	140
Methyl t-Butyl Ether	ug/L	<0.5	<0.5	<0.5	34,000	n.s.	11,000	95
Styrene	ug/L	<0.5	<0.5	<0.5	720	n.s.	n.s.	800
Toluene	ug/L	<0.5	<0.5	<0.5	5	n.s.	n.s.	60
Total Xylenes (m,p,o)	ug/L	<0.5	<0.5	<0.5	300	n.s.	n.s.	90
Volatile Petroleum Hydrocarbons								
VPHw(VHw$_{6\text{-}10 \text{ minus BTEX}}$)	ug/L	<50	<50	<50	1,500	n.s.	n.s.	n.s.
VHw6-10	ug/L	<50	<50	<50	15,000	15,000	15,000	15,000
Extractable Hydrocarbons								
EPH$_{w10\text{-}19}$	ug/L	<200	<200	<200	5,000	5,000	5,000	5,000
LEPHw	ug/L	<200	<200	<200	500	n.s.	n.s.	n.s.
EPH$_{w19\text{-}32}$	ug/L	<200	<200	<200	n.s.	n.s.	n.s.	n.s.
HEPHw	ug/L	<200	<200	<200	n.s.	n.s.	n.s.	n.s.
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	ug/L	<0.1	<0.1	<0.1	60	n.s.	n.s.	250
Acenaphthylene	ug/L	<0.1	<0.1	<0.1	n.s.	n.s.	n.s.	n.s.
Acridine	ug/L	<0.05	<0.05	<0.05	0.5	n.s.	n.s.	n.s.
Anthracene	ug/L	<0.1	<0.1	<0.1	1	n.s.	n.s.	1,000
Benzo(a)anthracene	ug/L	<0.01	<0.01	<0.01	1	n.s.	n.s.	0.07
Benzo(a)pyrene	ug/L	<0.01	<0.01	<0.01	0.1	n.s.	n.s.	0.01
Benzo(b+j)fluoranthene	ug/L	<0.02	<0.02	<0.02	n.s.	n.s.	n.s.	n.s.
Benzo(g,h,i)perylene	ug/L	<0.1	<0.1	<0.1	n.s.	n.s.	n.s.	n.s.
Benzo(k)fluoranthene	ug/L	<0.02	<0.02	<0.02	n.s.	n.s.	n.s.	n.s.
Chrysene	ug/L	<0.1	<0.1	<0.1	1	n.s.	n.s.	7
Dibenz(a,h)anthracene	ug/L	<0.01	<0.01	<0.01	n.s.	n.s.	n.s.	0.01
Fluoranthene	ug/L	<0.1	<0.1	<0.1	2	n.s.	n.s.	150
Fluorene	ug/L	<0.1	<0.1	<0.1	120	n.s.	n.s.	150
Indeno(1,2,3-c,d)pyrene	ug/L	<0.1	<0.1	<0.1	n.s.	n.s.	n.s.	n.s.
Naphthalene	ug/L	<0.1	<0.1	<0.1	10	n.s.	n.s.	80
Phenanthrene	ug/L	<0.1	<0.1	<0.1	3	n.s.	n.s.	n.s.
Pyrene	ug/L	<0.02	<0.02	<0.02	0.2	n.s.	n.s.	100
Quinoline	ug/L	<0.01	<0.01	<0.01	34	n.s.	n.s.	0.05

Notes:

1 - Data excerpted from Exova analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.2 Generic Numerical Water Standards, site-specific pathways as noted above

n.s. = No applicable standard

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 6. Summary of Surface Water Analytical Results - Metals

Sample ID		**SS18-01**	**SS18-02**	**SS18-02A**	**SS18-03**	**CSR Schedule 3.2[2]**			
Matrix		Surface Water	Surface Water	Surface Water	Surface Water				
Sample Date		26-Sep-18	26-Sep-18	26-Sep-18	26-Sep-18	Freshwater Aquatic Life	Irrigation	Livestock	Drinking Water
Comments		Pond	Pond	Pond	Pond				
PARAMETERS	Units	**Analytical Results[1]**							
Hardness as $CaCO_3$	mg/L	110	116	118	109	n.s.	n.s.	n.s.	n.s.
Total Metals									
Aluminum	ug/L	27	32	230	28	n.s.	5,000	5,000	9,500
Antimony	ug/L	0.19	0.20	0.22	0.19	90	n.s.	n.s.	6
Arsenic	ug/L	0.8	0.8	1.0	0.8	50	100	25	10
Barium	ug/L	34	37	38	34	10,000	n.s.	n.s.	1,000
Beryllium	ug/L	<0.05	<0.05	<0.05	<0.05	1.5	100	100	8
Bismuth	ug/L	<0.1	<0.1	<0.1	<0.1	n.s.	n.s.	n.s.	n.s.
Boron	ug/L	44	45	47	40	12,000	500 to 6,000[3]	5,000	5,000
Cadmium	ug/L	<0.01	<0.01	<0.01	<0.01	0.5 to 4[H]	5	80	5
Chromium	ug/L	<0.05	<0.05	0.46	<0.05	10 (CrIV)/90 (CrIII)	8 (CrIV)/5 (CrIII)	50 (CrIV)/50 (CrIII)	50 (CrIV)/6,000 (CrIII)
Cobalt	ug/L	**<u>1.7</u>**	**<u>1.9</u>**	**<u>2.0</u>**	**<u>1.7</u>**	40	50	1,000	1
Copper	ug/L	0.6	0.6	1.2	0.7	20 to 90[H]	200	300	1,500
Iron	ug/L	2000	2200	2500	2300	n.s.	5,000	n.s.	6,500
Lead	ug/L	0.03	0.02	0.07	0.03	40 to 160[H]	200	100	10
Lithium	ug/L	<0.5	<0.5	<0.5	<0.5	n.s.	2,500	5,000	8
Manganese	ug/L	2700	3100	3100	2700	n.s.	200	n.s.	1,500
Molybdenum	ug/L	0.03	0.02	0.04	0.02	10,000	10 to 30[4]	50	250
Nickel	ug/L	0.8	0.8	1.1	0.7	250 to 1,500[H]	200	1,000	80
Selenium	ug/L	<0.2	<0.2	<0.2	<0.2	20	20[5] or 50[6]	30	10
Silver	ug/L	<0.01	<0.01	<0.01	<0.01	0.5 to 15[H]	n.s.	n.s.	20
Strontium	ug/L	66	70	71	64	n.s.	n.s.	n.s.	2,500
Tellurium	ug/L	<0.05	<0.05	<0.05	<0.05	n.s.	n.s.	n.s.	n.s.
Thallium	ug/L	<0.01	<0.01	<0.01	<0.01	3	n.s.	n.s.	n.s.
Thorium	ug/L	<0.05	<0.05	<0.05	<0.05	n.s.	n.s.	n.s.	n.s.
Tin	ug/L	<0.1	<0.1	<0.1	<0.1	n.s.	n.s.	n.s.	2,500
Titanium	ug/L	1.9	1.7	18	1.7	1,000	n.s.	n.s.	n.s.
Uranium	ug/L	<0.01	<0.01	<0.01	<0.01	85	10	200	20
Vanadium	ug/L	0.17	0.12	1.0	0.1	n.s.	100	100	20
Zinc	ug/L	5.0	5.1	5.4	5.1	75 to 2,400[H]	1,000 to 5,000[H]	2,000	3,000
Zirconium	ug/L	<0.1	<0.1	0.1	<0.1	n.s.	n.s.	n.s.	n.s.

Notes:

1 - Data excerpted from Exova analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.2 Generic Numerical Water Standards, site-specific pathways as noted above

3 - The standard for boron is crop specific with the lowest of the range noted above

4 - The standard for molybdenum varies with site-specific factors. The lowest of the range is noted above.

5 - The standard for selenium is for continuous applications on crops

6 - The standard for selenium is for intermittent application on crops

n.s. = No applicable standard

H = Standard is hardness dependant and is specific to each sample with the range noted above

\- = Parameter not analyzed

< = Less than the laboratory method detection limit

Bold, <u>underlined</u>, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 7. Summary of Surface Water Analytical Results – Routine Parameters

Sample ID		SS18-01	SS18-02	SS18-02A	SS18-03	CSR Schedule 3.2[2]			
Matrix		Surface Water	Surface Water	Surface Water	Surface Water				
Sample Date		43369	43369	43369	43,369.00	Freshwater Aquatic Life	Irrigation	Livestock	Drinking Water
Comments		Pond	Pond	Pond	Pond				
PARAMETERS	Units	**Analytical Results[1]**							
Routine Parameters									
Calcium	mg/L	37	39	40	36	n.s.	n.s.	1,000	n.s.
Magnesium	mg/L	4.3	4.5	4.6	4.3	n.s.	n.s.	n.s.	n.s.
Potassium	mg/L	1.0	1.1	1.1	1	n.s.	n.s.	n.s.	n.s.
Silicon	mg/L	5.6	6.0	6.2	5.6	n.s.	n.s.	n.s.	n.s.
Sodium	mg/L	2.1	2.2	2.1	2	n.s.	n.s.	n.s.	200
Sulphur	mg/L	1.80	1.90	1.9	1.7	n.s.	n.s.	n.s.	n.s.
Hardness as $CaCO_3$	mg/L	110	116	118	109	n.s.	n.s.	n.s.	n.s.

Notes:

1 - Data excerpted from Exova analytical reports; units as indicated

2 - BC Contaminated Sites Regulation (CSR) Schedule 3.2 Generic Numerical Water Standards, site-specific pathways as noted above

n.s. = No applicable standard

* = Standard has been converted to mg/L to correspond with laboratory results

< = Less than the laboratory method detection limit

Bold, underlined, and shaded grey indicates concentration exceeds lowest of the applicable standards

Table 8. Relative Percent Difference of Field Duplicate Samples

Sample ID	**SS18-02**	**SS18-02A**	**Relative Percent Difference (RPD)** [1]
Matrix	Surface Water	Surface Water	
Sample Date	26-Sep-18	26-Sep-18	
PARAMETERS	**Analytical Results**		
Hardness as $CaCO_3$	116	118	1.71
Aluminum	32	230	151.15
Antimony	0.2	0.22	9.52
Arsenic	0.8	1	22.22
Barium	37	38	2.67
Beryllium	<0.05	<0.05	*
Bismuth	<0.1	<0.1	*
Boron	45	47	4.35
Cadmium	<0.01	<0.01	*
Chromium	<0.05	0.46	*
Cobalt	1.9	2.0	5.13
Copper	0.6	1.2	*
Iron	2200	2500	12.77
Lead	0.02	0.07	*
Lithium	<0.5	<0.5	*
Manganese	3100	3100	0.00
Molybdenum	0.02	0.04	*
Nickel	0.8	1.1	*
Selenium	<0.2	<0.2	*
Silver	<0.01	<0.01	*
Strontium	70	71	1.42
Tellurium	<0.05	<0.05	*
Thallium	<0.01	<0.01	*
Thorium	<0.05	<0.05	*
Tin	<0.1	<0.1	*
Titanium	1.7	18	165.48
Uranium	<0.01	<0.01	*
Vanadium	0.12	1	*
Zinc	5.1	5.4	5.71
Zirconium	<0.1	0.1	*

Notes:

1 - RPD values below 20% are generally considered acceptable sampling and analytical precision as per the BC Field Sampling Manual

* RPD not calculated as both values did not exceed 5 times the laboratory method detection limit, or the parameter did not have a method detection limit listed

Bold, underlined, and shaded indicates concentration exceeds lowest of the applicable standards

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Report Transmission Cover Page

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Contact	Company	Address			
Accounts Payable	**TerraWest Environmental Inc.**	206, 2800 Bryn Maur Road			
		Victoria, BC V9B 3T4			
		Phone:	(866) 500-1553	Fax:	(250) 389-1554
		Email:	ap@terrawest.ca		

Delivery	Format	Deliverables
Email - Single Report	PDF	Invoice

Contact	Company	Address			
Derek Nickel	**TerraWest Environmental Inc.**	3148 F Barons Road			
		Nanaimo, BC V9T 4B5			
		Phone:	(866) 500-1553	Fax:	
		Email:	dnickel@terrawest.ca		

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Single Report	PDF	COA
Email - Single Report	Standard Crosstab	Test Report

Contact	Company	Address			
Erich Bell	**TerraWest Environmental Inc.**	3148 Unit G Barons Road			
		Nanaimo, BC V9T 4B5			
		Phone:	(866) 500-1553	Fax:	
		Email:	ebell@terrawest.ca		

Delivery	Format	Deliverables
Email - Multiple Reports By Lot	PDF	COC / Test Report
Email - Multiple Reports By Lot	PDF	COR
Email - Multiple Reports By Lot	Standard Crosstab	Test Report
Email - Single Report	PDF	COC / COA

Notes To Clients:

- Sep 28, 2018 - Reduction of analytical volume was necessary for metals analysis to bring results within the analytical range for samples. Detection limits are adjusted accordingly.
- Oct 22, 2018 - Dioxin and furan analysis was performed by a subcontract laboratory. See attached 7 page report PR182812.

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Analytical Report

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

		Reference Number	1300986-1	1300986-2	1300986-3	
		Sample Date	Sep 26, 2018	Sep 26, 2018	Sep 26, 2018	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	SS18-01	SS18-02	SS18-03	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Metals Strong Acid Digestion						
Prep			Dried, sieve -325	Dried, sieve -325	Dried, sieve -325	
Aluminum	Strong Acid Extractable	µg/g	25000	27000	27000	0.5
Antimony	Strong Acid Extractable	µg/g	5.1	5.6	5.7	1.5
Arsenic	Strong Acid Extractable	µg/g	19	12	11	0.35
Barium	Strong Acid Extractable	µg/g	110	130	160	0.2
Beryllium	Strong Acid Extractable	µg/g	0.40	0.44	0.47	0.01
Cadmium	Strong Acid Extractable	µg/g	0.55	0.3	0.3	0.05
Calcium	Strong Acid Extractable	µg/g	7300	11000	9700	0.5
Chromium	Strong Acid Extractable	µg/g	90	90	96	0.1
Cobalt	Strong Acid Extractable	µg/g	24	27	29	0.1
Copper	Strong Acid Extractable	µg/g	94	99	96	0.1
Iron	Strong Acid Extractable	µg/g	44000	42000	44000	0.02
Lead	Strong Acid Extractable	µg/g	15	8.4	4	0.5
Lithium	Strong Acid Extractable	µg/g	13	14	16	0.15
Magnesium	Strong Acid Extractable	µg/g	6900	8000	8300	1
Manganese	Strong Acid Extractable	µg/g	420	660	460	0.05
Mercury	Strong Acid Extractable	µg/g	0.81	0.34	0.33	0.003
Molybdenum	Strong Acid Extractable	µg/g	0.4	<0.10	<0.10	0.1
Nickel	Strong Acid Extractable	µg/g	42	42	45	0.25
Phosphorus	Strong Acid Extractable	µg/g	1400	580	510	0.5
Potassium	Strong Acid Extractable	µg/g	680	760	760	2
Selenium	Strong Acid Extractable	µg/g	2	0.6	1	0.5
Silicon	Strong Acid Extractable	µg/g	570	430	390	0.25
Silver	Strong Acid Extractable	µg/g	1.5	0.81	0.5	0.4
Sodium	Strong Acid Extractable	µg/g	140	170	150	5
Strontium	Strong Acid Extractable	µg/g	19	23	25	0.05
Thallium	Strong Acid Extractable	µg/g	<0.5	<0.5	<0.5	0.5
Tin	Strong Acid Extractable	µg/g	2	1	0.8	0.5
Titanium	Strong Acid Extractable	µg/g	1000	1300	1100	0.1
Vanadium	Strong Acid Extractable	µg/g	150	150	160	0.2
Zinc	Strong Acid Extractable	µg/g	280	130	97	0.05
Zirconium	Strong Acid Extractable	µg/g	5.8	6.2	5.5	0.1
Prep	Sieve 230 mesh		Done	Done	Done	
Soil Acidity						
pH	1:2 Soil:Water	pH	5.1	5.7	6.0	0.5
Mono-Aromatic Hydrocarbons - Soil						
Benzene	Dry Weight	µg/g	<0.02	<0.02	<0.02	0.02
Toluene	Dry Weight	µg/g	<0.05	<0.05	<0.05	0.05
Ethylbenzene	Dry Weight	µg/g	<0.05	<0.05	<0.05	0.05

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Analytical Report

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

		Reference Number	1300986-1	1300986-2	1300986-3	
		Sample Date	Sep 26, 2018	Sep 26, 2018	Sep 26, 2018	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	SS18-01	SS18-02	SS18-03	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Soil - Continued						
Total Xylenes (m,p,o)	Dry Weight	µg/g	<0.05	<0.05	<0.05	0.05
Styrene	Dry Weight	µg/g	<0.05	<0.05	<0.05	0.05
Methyl t-Butyl Ether	Dry Weight	µg/g	<0.05	<0.05	<0.05	0.05
Toluene-d8	Surrogate	%	100.68	114.82	101.10	80-120
Dibromofluoromethane	Surrogate	%	107.56	102.86	110.44	80-120
4-Bromofluorobenzene	Surrogate	%	105.84	109.52	101.70	80-120
Methanol Field Preservation			Yes	Yes	Yes	
Volatile Petroleum Hydrocarbons - Soil						
VHs6-10	Dry Weight	µg/g	<50	<50	<50	50
VPHs (VHs6-10 minus BTEX)	Dry Weight	µg/g	<50	<50	<50	50
Field Preservation						
Methanol Field Preservation			Yes	Yes	Yes	
Extractable Petroleum Hydrocarbons - Soil						
EPHs10-19	Dry Weight	µg/g	51	25	<20	20
EPHs19-32	Dry Weight	µg/g	1380	348	156	20
LEPHs	Dry Weight	µg/g	49	25	<20	20
HEPHs	Dry Weight	µg/g	1380	348	156	20
2-Methylnonane	Surrogate	%	86	96	88	60-140
Soil % Moisture						
Moisture	Soil % Moisture	%	85.2	80.50	78.6	0.1
Polycyclic Aromatic Hydrocarbons - Soil						
2-Methylnaphthalene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Acenaphthene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Acenaphthylene	Dry Weight	µg/g	0.22	<0.03	<0.03	0.03
Anthracene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Benzo(a)anthracene	Dry Weight	µg/g	<0.03	0.08	0.06	0.03
Benzo(a)pyrene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Benzo(b+j)fluoranthene	Dry Weight	µg/g	<0.06	<0.06	<0.06	0.06
Benzo(g,h,i)perylene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Benzo(k)fluoranthene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Chrysene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Dibenzo(a,h)anthracene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Fluoranthene	Dry Weight	µg/g	0.30	0.07	0.07	0.03
Fluorene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Indeno(1,2,3-c,d)pyrene	Dry Weight	µg/g	<0.03	<0.03	<0.03	0.03
Naphthalene	Dry Weight	µg/g	0.63	<0.03	<0.03	0.03
Phenanthrene	Dry Weight	µg/g	0.44	0.10	0.06	0.03
Pyrene	Dry Weight	µg/g	0.28	<0.03	<0.03	0.03

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

		Reference Number	1300986-1	1300986-2	1300986-3	
		Sample Date	Sep 26, 2018	Sep 26, 2018	Sep 26, 2018	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	SS18-01	SS18-02	SS18-03	
		Matrix	Soil	Soil	Soil	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
PAH - Soil - Surrogate Recovery						
2-Fluorobiphenyl	PAH - Surrogate	%	113.89	106.80	99.34	50-130
Naphthalene-d8	PAH - Surrogate	%	95.81	94.76	94.17	50-130
p-Terphenyl-d14	PAH - Surrogate	%	99.26	107.12	109.66	60-130
Quinoline-d7	PAH - Surrogate	%	84.98	89.76	94.41	50-130
Chlorinated Phenols - Soil						
Monochlorophenols	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Dichlorophenols	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Trichlorophenols	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Tetrachlorophenols	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Pentachlorophenol	Dry Weight	mg/kg	<0.02	<0.02	<0.02	0.02
Total Chlorophenols	Dry Weight	mg/kg	<0.05	<0.05	<0.05	0.05
Chlorinated Phenols - Soil - Surrogate Recovery						
2,4,6-Tribromophenol	PCP - Surrogate	%	44	49	48	50-140

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

		Reference Number	1300986-4	1300986-5	1300986-6	
		Sample Date	Sep 26, 2018	Sep 26, 2018	Sep 26, 2018	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	SW18-01	SW18-02	SW18-02A	
		Matrix	Water	Water	Water	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Routine Water						
Hardness	Total	mg CaCO3/L	110	116	118	1
Trace Metals Total						
Aluminum	Total	µg/L	27	32	230	1
Antimony	Total	µg/L	0.19	0.20	0.22	0.02
Arsenic	Total	µg/L	0.8	0.8	1.0	0.1
Barium	Total	µg/L	34	37	38	0.1
Beryllium	Total	µg/L	<0.05	<0.05	<0.05	0.05
Bismuth	Total	µg/L	<0.1	<0.1	<0.1	0.1
Boron	Total	µg/L	44	45	47	2
Cadmium	Total	µg/L	<0.01	<0.01	<0.01	0.01
Chromium	Total	µg/L	<0.05	<0.05	0.46	0.05
Cobalt	Total	µg/L	1.7	1.9	2.0	0.02
Copper	Total	µg/L	0.6	0.6	1.2	0.2
Iron	Total	µg/L	2000	2200	2500	2
Lead	Total	µg/L	0.03	0.02	0.07	0.01
Lithium	Total	µg/L	<0.5	<0.5	<0.5	0.5
Manganese	Total	µg/L	2700	3100	3100	1
Molybdenum	Total	µg/L	0.03	0.02	0.04	0.02
Nickel	Total	µg/L	0.8	0.8	1.1	0.2
Selenium	Total	µg/L	<0.2	<0.2	<0.2	0.2
Silver	Total	µg/L	<0.01	<0.01	<0.01	0.01
Strontium	Total	µg/L	66	70	71	0.1
Tellurium	Total	µg/L	<0.05	<0.05	<0.05	0.05
Thallium	Total	µg/L	<0.01	<0.01	<0.01	0.01
Thorium	Total	µg/L	<0.05	<0.05	<0.05	0.05
Tin	Total	µg/L	<0.1	<0.1	<0.1	0.1
Titanium	Total	µg/L	1.9	1.7	18	0.1
Uranium	Total	µg/L	<0.01	<0.01	<0.01	0.01
Vanadium	Total	µg/L	0.17	0.12	1.0	0.05
Zinc	Total	µg/L	5.0	5.1	5.4	0.5
Zirconium	Total	µg/L	<0.1	<0.1	0.1	0.1
Calcium	Total	µg/L	37000	39000	40000	10
Magnesium	Total	µg/L	4300	4500	4600	20
Potassium	Total	µg/L	1000	1100	1100	40
Silicon	Total	µg/L	5600	6000	6200	5
Sodium	Total	µg/L	2100	2200	2100	100
Sulfur	Total	µg/L	1800	1900	1900	20

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

		Reference Number	1300986-4	1300986-5	1300986-7	
		Sample Date	Sep 26, 2018	Sep 26, 2018	Sep 26, 2018	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	SW18-01	SW18-02	SW18-03	
		Matrix	Water	Water	Water	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Mono-Aromatic Hydrocarbons - Water						
Benzene		µg/L	<0.5	<0.5	<0.5	0.5
Ethylbenzene		µg/L	<0.5	<0.5	<0.5	0.5
Methyl t-Butyl Ether		µg/L	<0.5	<0.5	<0.5	0.5
Styrene		µg/L	<0.5	<0.5	<0.5	0.5
Toluene		µg/L	<0.5	<0.5	<0.5	0.5
Total Xylenes (m,p,o)		µg/L	<0.5	<0.5	<0.5	0.5
Dibromofluoromethane	Surrogate	%	97.24	105.90	92.86	80-120
Toluene-d8	Surrogate	%	109.50	116.52	111.00	80-120
4-Bromofluorobenzene	Surrogate	%	112.04	116.90	106.02	80-120
Volatile Petroleum Hydrocarbons - Water						
VPHw (VHw6-10 minus BTEX)		µg/L	<50	<50	<50	50
VHw6-10		µg/L	<50	<50	<50	50
Extractable Petroleum Hydrocarbons - Water						
2-Methylnonane	Surrogate	%	130	110	120	60-140
EPHw10-19		µg/L	<200	<200	<200	200
EPHw19-32		µg/L	<200	<200	<200	200
LEPHw		µg/L	<200	<200	<200	200
HEPHw		µg/L	<200	<200	<200	200
Polycyclic Aromatic Hydrocarbons - Water						
Acenaphthene		µg/L	<0.1	<0.1	<0.1	0.1
Acenaphthylene		µg/L	<0.1	<0.1	<0.1	0.1
Acridine		µg/L	<0.05	<0.05	<0.05	0.05
Anthracene		µg/L	<0.1	<0.1	<0.1	0.1
Benzo(a)anthracene		µg/L	<0.01	<0.01	<0.01	0.01
Benzo(a)pyrene		µg/L	<0.01	<0.01	<0.01	0.01
Benzo(b+j)fluoranthene		µg/L	<0.02	<0.02	<0.02	0.02
Benzo(g,h,i)perylene		µg/L	<0.1	<0.1	<0.1	0.1
Benzo(k)fluoranthene		µg/L	<0.02	<0.02	<0.02	0.02
Chrysene		µg/L	<0.1	<0.1	<0.1	0.1
Dibenzo(a,h)anthracene		µg/L	<0.01	<0.01	<0.01	0.01
Fluoranthene		µg/L	<0.1	<0.1	<0.1	0.1
Fluorene		µg/L	<0.1	<0.1	<0.1	0.1
Indeno(1,2,3-c,d)pyrene		µg/L	<0.1	<0.1	<0.1	0.1
Naphthalene		µg/L	<0.1	<0.1	<0.1	0.1
Phenanthrene		µg/L	<0.1	<0.1	<0.1	0.1
Pyrene		µg/L	<0.02	<0.02	<0.02	0.02
Quinoline		µg/L	<0.01	<0.01	<0.01	0.01

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Analytical Report

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

		Reference Number	1300986-4	1300986-5	1300986-7	
		Sample Date	Sep 26, 2018	Sep 26, 2018	Sep 26, 2018	
		Sample Time	NA	NA	NA	
		Sample Location				
		Sample Description	SW18-01	SW18-02	SW18-03	
		Matrix	Water	Water	Water	
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
PAH - Water - Surrogate Recovery						
2-Fluorobiphenyl	PAH - Surrogate	%	74.55	66.43	60.85	50-130
p-Terphenyl-d14	PAH - Surrogate	%	92.81	67.35	65.99	60-130
Naphthalene-d8	PAH - Surrogate	%	90.45	88.80	84.46	50-130
Quinoline-d7	PAH - Surrogate	%	88.54	69.80	66.71	50-130

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

		Reference Number	1300986-7			
		Sample Date	Sep 26, 2018			
		Sample Time	NA			
		Sample Location				
		Sample Description	SW18-03			
		Matrix	Water			
Analyte		**Units**	**Results**	**Results**	**Results**	Nominal Detection Limit
Routine Water						
Hardness	Total	mg CaCO3/L	109			1
Trace Metals Total						
Aluminum	Total	µg/L	28			1
Antimony	Total	µg/L	0.19			0.02
Arsenic	Total	µg/L	0.8			0.1
Barium	Total	µg/L	34			0.1
Beryllium	Total	µg/L	<0.05			0.05
Bismuth	Total	µg/L	<0.1			0.1
Boron	Total	µg/L	40			2
Cadmium	Total	µg/L	<0.01			0.01
Chromium	Total	µg/L	<0.05			0.05
Cobalt	Total	µg/L	1.7			0.02
Copper	Total	µg/L	0.7			0.2
Iron	Total	µg/L	2300			2
Lead	Total	µg/L	0.03			0.01
Lithium	Total	µg/L	<0.5			0.5
Manganese	Total	µg/L	2700			1
Molybdenum	Total	µg/L	0.02			0.02
Nickel	Total	µg/L	0.7			0.2
Selenium	Total	µg/L	<0.2			0.2
Silver	Total	µg/L	<0.01			0.01
Strontium	Total	µg/L	64			0.1
Tellurium	Total	µg/L	<0.05			0.05
Thallium	Total	µg/L	<0.01			0.01
Thorium	Total	µg/L	<0.05			0.05
Tin	Total	µg/L	<0.1			0.1
Titanium	Total	µg/L	1.7			0.1
Uranium	Total	µg/L	<0.01			0.01
Vanadium	Total	µg/L	0.10			0.05
Zinc	Total	µg/L	5.1			0.5
Zirconium	Total	µg/L	<0.1			0.1
Calcium	Total	µg/L	36000			10
Magnesium	Total	µg/L	4300			20
Potassium	Total	µg/L	1000			40
Silicon	Total	µg/L	5600			5
Sodium	Total	µg/L	2000			100
Sulfur	Total	µg/L	1700			20

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Analytical Report

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Approved by:

Mathieu Simoneau
Operations Manager

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Exova

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Chlorinated Phenols - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
2-Chlorophenol	ng/mL	0	-0.08	0.08	yes
3-Chlorophenol	ng/mL	0	-0.08	0.08	yes
4-Chlorophenol	ng/mL	0	-0.08	0.08	yes
4-Chloro-3-methylphenol	ng/mL	0	-0.08	0.08	yes
2,6-Dichlorophenol	ng/mL	0	-0.08	0.08	yes
2,3-Dichlorophenol	ng/mL	0	-0.08	0.08	yes
2,4 & 2,5-Dichlorophenol	ng/mL	0	-0.08	0.08	yes
3,4-Dichlorophenol	ng/mL	0	-0.08	0.08	yes
3,5-Dichlorophenol	ng/mL	0	-0.08	0.08	yes
2,3,4-Trichlorophenol	ng/mL	0	-0.08	0.08	yes
2,3,5-Trichlorophenol	ng/mL	0	-0.08	0.08	yes
2,3,6-Trichlorophenol	ng/mL	0	-0.08	0.08	yes
2,4,5-Trichlorophenol	ng/mL	0	-0.08	0.08	yes
2,4,6-Trichlorophenol	ng	0	-0.08	0.08	yes
3,4,5-Trichlorophenol	ng/mL	0	-0.08	0.08	yes
2,3,4,5-Tetrachlorophenol	ng/mL	0	-0.08	0.08	yes
2,3,4,6-Tetrachlorophenol	ng/mL	0	-0.08	0.08	yes
2,3,5,6-Tetrachlorophenol	ng/mL	0	-0.08	0.08	yes
Monochlorophenols	ng/mL	0	-0.08	0.08	yes
Dichlorophenols	ng/mL	0	-0.08	0.08	yes
Trichlorophenols	ng/mL	0	-0.08	0.08	yes
Tetrachlorophenols	ng/mL	0	-0.08	0.08	yes
Pentachlorophenol	ng/mL	0	-0.08	0.08	yes

Date Acquired: September 28, 2018

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
2-Chlorophenol	ng/mL	95.70	80	120	yes
3-Chlorophenol	ng/mL	85.27	80	120	yes
4-Chlorophenol	ng/mL	96.03	80	120	yes
4-Chloro-3-methylphenol	ng/mL	85.60	80	120	yes
2,6-Dichlorophenol	ng/mL	95.10	80	120	yes
2,3-Dichlorophenol	ng/mL	92.77	80	120	yes
2,4 & 2,5-Dichlorophenol	ng/mL	94.73	80	120	yes
3,4-Dichlorophenol	ng/mL	80.31	80	120	yes
3,5-Dichlorophenol	ng/mL	93.09	80	120	yes
2,3,4-Trichlorophenol	ng/mL	86.20	80	120	yes
2,3,5-Trichlorophenol	ng/mL	95.30	80	120	yes
2,3,6-Trichlorophenol	ng/mL	99.50	80	120	yes
2,4,5-Trichlorophenol	ng/mL	82.90	80	120	yes
2,4,6-Trichlorophenol	ng	95.10	80	120	yes
3,4,5-Trichlorophenol	ng/mL	82.60	80	120	yes
2,3,4,5-Tetrachlorophenol	ng/mL	90.20	80	120	yes
2,3,4,6-Tetrachlorophenol	ng/mL	95.90	80	120	yes
2,3,5,6-Tetrachlorophenol	ng/mL	93.30	80	120	yes
Pentachlorophenol	ng/mL	95.40	80	120	yes

Date Acquired: September 28, 2018

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Chlorinated Phenols - Soil - Continued

Chlorinated Phenols - Soil - Surrogate Recovery

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
2,4,6-Tribromophenol	%	107.844	50	140		yes
Date Acquired:	September 28, 2018					

Extractable Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
EPHs10-19	µg/mL	0	-20	20		yes
EPHs19-32	µg/mL	2.90397	-20	20		yes
Date Acquired:	September 26, 2018					
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
EPHs10-19	µg/mL	102.04	85	115		yes
EPHs19-32	µg/mL	100.64	85	115		yes
Date Acquired:	September 26, 2018					
Certified Reference Material	**Units**	**Measured**	**Target**	**Lower Limit**	**Upper Limit**	**Passed QC**
EPHs10-19	µg/g	2470	2576	1803	3348	yes
EPHs19-32	µg/g	3470	3743	2620	4866	yes
Date Acquired:	September 26, 2018					
Replicates	**Units**	**Replicate 1**	**Replicate 2**	**% RSD Criteria**	**Absolute Criteria**	**Passed QC**
EPHs10-19	µg/g	<20	<20	40	100	yes
EPHs19-32	µg/g	<20	<20	40	100	yes
Date Acquired:	September 26, 2018					

Extractable Petroleum Hydrocarbons - Water

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
EPHw10-19	µg/mL	0.86	-5.010	5.010		yes
EPHw19-32	µg/mL	0	-5.010	5.010		yes
Date Acquired:	September 28, 2018					
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
C20	µg/mL	93.82	85	115		yes
Date Acquired:	September 28, 2018					
EPHw10-19	µg/mL	103.84	70	130		yes
EPHw19-32	µg/mL	102.17	70	130		yes
Date Acquired:	September 28, 2018					

Metals Strong Acid Digestion

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Aluminum	mg/L	0	-0.010	0.010		yes
Antimony	mg/L	0.000863457	-0.030	0.030		yes
Arsenic	mg/L	0.00665642	-0.007	0.007		yes
Barium	mg/L	0.000228096	-0.004	0.004		yes

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Metals Strong Acid Digestion - Continued

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Beryllium	mg/L	0.000144222	-0.000	0.000	yes
Cadmium	mg/L	6.98787e-005	-0.001	0.001	yes
Calcium	mg/L	0	-0.010	0.010	yes
Chromium	mg/L	0.000679504	-0.002	0.002	yes
Cobalt	mg/L	-0.000378373	-0.002	0.002	yes
Copper	mg/L	-0.00142536	-0.002	0.002	yes
Iron	mg/L	0	-0.004	0.004	yes
Lead	mg/L	0.00276329	-0.010	0.010	yes
Lithium	mg/L	0.00234696	-0.003	0.003	yes
Magnesium	mg/L	0.0191327	-0.020	0.020	yes
Manganese	mg/L	0	-0.001	0.001	yes
Mercury	µg/L	-0.019	-0.030	0.030	yes
Molybdenum	mg/L	-0.00054053	-0.002	0.002	yes
Nickel	mg/L	-0.000928137	-0.005	0.005	yes
Phosphorus	mg/L	0	-0.010	0.010	yes
Potassium	mg/L	0	-0.039	0.039	yes
Selenium	mg/L	0.00829735	-0.010	0.010	yes
Silver	mg/L	0	-0.008	0.008	yes
Sodium	mg/L	0.0692587	-0.099	0.099	yes
Strontium	mg/L	-8.3387e-005	-0.000	0.000	yes
Thallium	mg/L	-0.00512229	-0.010	0.010	yes
Tin	mg/L	-0.00180173	-0.010	0.010	yes
Titanium	mg/L	5.34582e-005	-0.002	0.002	yes
Vanadium	mg/L	0.000430753	-0.004	0.004	yes
Zinc	mg/L	0	-0.001	0.001	yes
Zirconium	mg/L	0.000365435	-0.002	0.002	yes

Date Acquired: October 01, 2018

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	93.88	90	110	yes
Antimony	mg/L	94.78	90	110	yes
Arsenic	mg/L	96.64	90	110	yes
Barium	mg/L	98.26	90	110	yes
Beryllium	mg/L	98.55	90	110	yes
Cadmium	mg/L	97.13	90	110	yes
Calcium	mg/L	98.10	90	110	yes
Chromium	mg/L	97.96	90	110	yes
Cobalt	mg/L	103.95	90	110	yes
Copper	mg/L	97.93	90	110	yes
Iron	mg/L	98.10	90	110	yes
Lead	mg/L	99.74	90	110	yes
Lithium	mg/L	94.19	90	110	yes
Magnesium	mg/L	96.23	90	110	yes
Manganese	mg/L	101.74	90	110	yes
Molybdenum	mg/L	95.80	90	110	yes
Nickel	mg/L	101.06	90	110	yes

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Metals Strong Acid Digestion - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Phosphorus	mg/L	97.00	90	110	yes
Potassium	mg/L	93.70	90	110	yes
Selenium	mg/L	96.52	90	110	yes
Silicon	mg/L	94.48	90	110	yes
Silver	mg/L	98.67	90	110	yes
Sodium	mg/L	96.47	90	110	yes
Thallium	mg/L	95.90	90	110	yes
Tin	mg/L	97.53	90	110	yes
Titanium	mg/L	97.43	90	110	yes
Vanadium	mg/L	97.92	90	110	yes
Zinc	mg/L	97.53	90	110	yes
Zirconium	mg/L	95.27	90	110	yes
Date Acquired:	October 01, 2018				
Aluminum	mg/L	91.22	90	110	yes
Antimony	mg/L	104.45	90	110	yes
Arsenic	mg/L	95.17	90	110	yes
Barium	mg/L	97.55	90	110	yes
Beryllium	mg/L	97.49	90	110	yes
Cadmium	mg/L	97.93	90	110	yes
Calcium	mg/L	97.42	90	110	yes
Chromium	mg/L	98.27	90	110	yes
Cobalt	mg/L	104.16	90	110	yes
Copper	mg/L	107.42	90	110	yes
Iron	mg/L	102.97	90	110	yes
Lead	mg/L	107.40	90	110	yes
Lithium	mg/L	94.71	90	110	yes
Magnesium	mg/L	95.75	90	110	yes
Manganese	mg/L	101.48	90	110	yes
Mercury	µg/L	102.83	90	110	yes
Molybdenum	mg/L	97.51	90	110	yes
Nickel	mg/L	102.26	90	110	yes
Phosphorus	mg/L	92.86	90	110	yes
Potassium	mg/L	91.32	90	110	yes
Selenium	mg/L	95.70	90	110	yes
Silicon	mg/L	96.00	90	110	yes
Silver	mg/L	96.25	90	110	yes
Sodium	mg/L	101.17	90	110	yes
Strontium	mg/L	96.84	90	110	yes
Thallium	mg/L	94.59	90	110	yes
Tin	mg/L	96.66	90	110	yes
Titanium	mg/L	96.02	90	110	yes
Vanadium	mg/L	97.61	90	110	yes
Zinc	mg/L	95.31	90	110	yes
Zirconium	mg/L	92.00	90	110	yes
Date Acquired:	October 01, 2018				

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Metals Strong Acid Digestion - Continued

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aluminum	µg/g	25000	24000	30	2.500	yes
Antimony	µg/g	5.1	5.9	30	3.000	yes
Arsenic	µg/g	19	19	30	1.750	yes
Barium	µg/g	110	110	30	1.000	yes
Beryllium	µg/g	0.40	0.39	30	0.050	yes
Cadmium	µg/g	0.55	0.53	30	0.250	yes
Calcium	µg/g	7300	7300	30	2.500	yes
Chromium	µg/g	90	88	30	0.500	yes
Cobalt	µg/g	24	24	30	0.500	yes
Copper	µg/g	94	93	30	0.500	yes
Iron	µg/g	44000	42000	30	0.100	yes
Lead	µg/g	15	16	30	2.500	yes
Lithium	µg/g	13	13	30	0.750	yes
Magnesium	µg/g	6900	6800	30	5.000	yes
Manganese	µg/g	420	410	30	2.500	yes
Mercury	µg/g	0.81	0.76	30	0.500	yes
Molybdenum	µg/g	0.4	0.4	30	0.500	yes
Nickel	µg/g	42	42	30	1.250	yes
Phosphorus	µg/g	1400	1400	30	2.500	yes
Potassium	µg/g	680	680	30	10.000	yes
Selenium	µg/g	2	1	30	2.500	yes
Silver	µg/g	1.5	2.6	30	2.000	yes
Sodium	µg/g	140	140	30	25.000	yes
Strontium	µg/g	19	19	30	0.250	yes
Thallium	µg/g	<0.5	<0.5	30	2.500	yes
Tin	µg/g	2	2	30	2.500	yes
Vanadium	µg/g	150	140	30	1.000	yes
Zinc	µg/g	280	280	30	0.250	yes
Zirconium	µg/g	5.8	5.9	30	0.500	yes

Date Acquired: October 01, 2018

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/g	11000	9373.000	15511.000	yes
Antimony	µg/g	<1	0.040	2.080	yes
Arsenic	µg/g	4.6	2.940	5.520	yes
Barium	µg/g	160	139.210	174.790	yes
Beryllium	µg/g	0.55	0.405	0.603	yes
Cadmium	µg/g	0.2	0.101	0.341	yes
Calcium	µg/g	15000	12998.000	18122.000	yes
Chromium	µg/g	27	11.360	37.040	yes
Cobalt	µg/g	8.3	4.970	8.870	yes
Copper	µg/g	16	12.330	17.430	yes
Iron	µg/g	15000	12770.000	20366.000	yes
Lead	µg/g	9.4	5.500	11.320	yes
Lithium	µg/g	12	8.700	16.500	yes
Magnesium	µg/g	3000	2480.000	3500.000	yes

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Metals Strong Acid Digestion - Continued

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Manganese	µg/g	390	266.500	425.500	yes
Mercury	µg/g	0.020	0.012	0.034	yes
Molybdenum	µg/g	0.57	0.252	0.828	yes
Nickel	µg/g	23	16.430	23.720	yes
Phosphorus	µg/g	620	489.000	693.000	yes
Potassium	µg/g	1600	1078.000	2056.000	yes
Silicon	µg/g	460	73.000	1255.000	yes
Sodium	µg/g	130	78.800	189.200	yes
Strontium	µg/g	73	59.580	83.220	yes
Tin	µg/g	0.5	0.104	0.938	yes
Titanium	µg/g	99	74.800	125.200	yes
Vanadium	µg/g	34	25.800	48.600	yes
Zinc	µg/g	62	46.370	66.830	yes
Zirconium	µg/g	4.9	4.196	5.324	yes
Date Acquired:	October 01, 2018				

Metals Total

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	0.00137947	-0.010	0.010	yes
Magnesium	mg/L	0.0148862	-0.020	0.020	yes
Potassium	mg/L	0	-0.040	0.040	yes
Silicon	mg/L	0.00329579	-0.005	0.005	yes
Sodium	mg/L	0.00675433	-0.099	0.099	yes
Date Acquired:	September 27, 2018				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Calcium	mg/L	100.74	90	110	yes
Magnesium	mg/L	99.51	90	110	yes
Potassium	mg/L	98.15	90	110	yes
Silicon	mg/L	95.23	90	110	yes
Sodium	mg/L	99.94	90	110	yes
Date Acquired:	September 27, 2018				
Calcium	mg/L	105.10	90	110	yes
Magnesium	mg/L	95.42	90	110	yes
Potassium	mg/L	97.51	90	110	yes
Silicon	mg/L	92.70	90	110	yes
Sodium	mg/L	94.60	90	110	yes
Date Acquired:	September 27, 2018				

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Calcium	mg/L	40	37	20	0.050	yes
Magnesium	mg/L	4.6	4.3	20	0.050	yes
Potassium	mg/L	1.1	1.0	20	0.100	yes
Silicon	mg/L	6.2	5.9	20	0.100	yes
Sodium	mg/L	2.1	2.0	20	0.100	yes
Date Acquired:	September 27, 2018					

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Mono-Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Benzene	ng	0	-0.02	0.02	yes
Toluene	ng	0	-0.05	0.05	yes
Ethylbenzene	ng	0	-0.05	0.05	yes
o-Xylene	ng	0	-0.05	0.05	yes
m,p-Xylene	ng	0	-0.05	0.05	yes
Total Xylenes (m,p,o)	ng	0	-0.05	0.05	yes
Styrene	ng	0	-0.05	0.05	yes
Methyl t-Butyl Ether	ng	0	-0.05	0.05	yes
Toluene-d8	%	99.54	80.000	110.000	yes
Dibromofluoromethane	%	103.04	79.990	120.010	yes
4-Bromofluorobenzene	%	104.84	85.000	115.000	yes

Date Acquired: September 27, 2018

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Benzene	ng	115.40	80	120	yes
Toluene	ng	106.00	80	120	yes
Ethylbenzene	ng	119.20	80	120	yes
o-Xylene	ng	111.60	80	120	yes
m,p-Xylene	ng	111.00	80	120	yes
Total Xylenes (m,p,o)	ng	111.33	80	120	yes
Styrene	ng	112.80	80	120	yes
Methyl t-Butyl Ether	ng	115.00	80	120	yes
Toluene-d8	%	99.50	80	120	yes
Dibromofluoromethane	%	101.74	80	120	yes
4-Bromofluorobenzene	%	98.48	80	120	yes

Date Acquired: September 27, 2018

Benzene	ng	115.00	75	125	yes
Toluene	ng	101.00	75	125	yes
Ethylbenzene	ng	120.00	75	125	yes
o-Xylene	ng	109.00	75	125	yes
m,p-Xylene	ng	95.50	75	125	yes
Total Xylenes (m,p,o)	ng	100.00	75	125	yes
Styrene	ng	114.00	75	125	yes
Methyl t-Butyl Ether	ng	115.00	75	125	yes
Toluene-d8	%	98.80	85	115	yes
Dibromofluoromethane	%	96.52	85	115	yes
4-Bromofluorobenzene	%	99.24	85	115	yes

Date Acquired: September 27, 2018

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Benzene	µg/g	<0.02	<0.02	20	0.10	yes
Toluene	µg/g	<0.05	<0.05	20	0.10	yes
Ethylbenzene	µg/g	<0.05	<0.05	20	0.10	yes
o-Xylene	µg/g	<0.05	<0.05	20	0.10	yes
m,p-Xylene	µg/g	<0.05	<0.05	20	0.10	yes
Total Xylenes (m,p,o)	µg/g	<0.05	<0.05	20	0.10	yes

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Exova

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Mono-Aromatic Hydrocarbons - Soil - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Styrene	µg/g	<0.05	<0.05	20	0.10	yes
Methyl t-Butyl Ether	µg/g	<0.05	<0.05	20	0.10	yes

Date Acquired: September 27, 2018

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Benzene	µg/g	116	80	120	yes
Toluene	µg/g	116	80	120	yes
Ethylbenzene	µg/g	108	80	120	yes
o-Xylene	µg/g	102	81	121	yes
m,p-Xylene	µg/g	104	80	120	yes
Total Xylenes (m,p,o)	µg/g	103	80	120	yes
Styrene	µg/g	119	80	120	yes
Methyl t-Butyl Ether	µg/g	114	80	120	yes

Date Acquired: September 27, 2018

Mono-Aromatic Hydrocarbons - Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Benzene	ng	0	-0.5	0.5	yes
Ethylbenzene	ng	0	-0.5	0.5	yes
Methyl t-Butyl Ether	ng	0	-0.5	0.5	yes
m,p-Xylene	ng	0	-0.5	0.5	yes
o-Xylene	ng	0	-0.5	0.5	yes
Styrene	ng	0	-0.5	0.5	yes
Toluene	ng	0	-0.5	0.5	yes
Total Xylenes (m,p,o)	ng	0	-0.5	0.5	yes
Dibromofluoromethane	%	107.34	74.990	115.010	yes
Toluene-d8	%	102.1	80.000	110.000	yes
4-Bromofluorobenzene	%	108.34	85.000	115.000	yes

Date Acquired: September 27, 2018

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Benzene	ng	114.89	80	120	yes
Ethylbenzene	ng	118.60	80	120	yes
Methyl t-Butyl Ether	ng	114.54	80	120	yes
m,p-Xylene	ng	110.75	80	120	yes
o-Xylene	ng	111.03	80	120	yes
Styrene	ng	112.24	80	120	yes
Toluene	ng	105.62	80	120	yes
Total Xylenes (m,p,o)	ng	110.84	80	120	yes
Dibromofluoromethane	%	101.74	80	120	yes
Toluene-d8	%	99.50	80	120	yes
4-Bromofluorobenzene	%	98.48	80	120	yes

Date Acquired: September 27, 2018

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Benzene	µg/L	<0.5	<0.5	20	2.5	yes

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Mono-Aromatic Hydrocarbons - Water - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Ethylbenzene	µg/L	<0.5	<0.5	20	2.5	yes
Methyl t-Butyl Ether	µg/L	<0.5	<0.5	20	2.5	yes
m,p-Xylene	µg/L	<0.5	<0.5	20	2.5	yes
o-Xylene	µg/L	<0.5	<0.5	20	2.5	yes
Styrene	µg/L	<0.5	<0.5	20	2.5	yes
Toluene	µg/L	<0.5	<0.5	20	2.5	yes
Total Xylenes (m,p,o)	µg/L	<0.5	<0.5	20	2.5	yes
Date Acquired:	September 27, 2018					

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Benzene	µg/L	116	80	120	yes
Ethylbenzene	µg/L	108	80	120	yes
Methyl t-Butyl Ether	µg/L	113	80	120	yes
m,p-Xylene	µg/L	103	80	120	yes
o-Xylene	µg/L	101	80	120	yes
Styrene	µg/L	118	80	120	yes
Toluene	µg/L	115	80	120	yes
Total Xylenes (m,p,o)	µg/L	102	80	120	yes
Date Acquired:	September 27, 2018				

PAH - Soil - Surrogate Recovery

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
2-Fluorobiphenyl	%	98.57	80	120	yes
Naphthalene-d8	%	97.96	80	120	yes
p-Terphenyl-d14	%	101.25	80	120	yes
Date Acquired:	September 26, 2018				

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
2-Fluorobiphenyl	%	63.52	70.04	20	0.150	yes
Naphthalene-d8	%	90.28	94.37	20	0.150	yes
p-Terphenyl-d14	%	71.22	71.29	20	0.150	yes
Date Acquired:	September 26, 2018					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
2-Fluorobiphenyl	%	99.60	50.100	129.900	yes
Naphthalene-d8	%	99.63	50.100	129.900	yes
p-Terphenyl-d14	%	97.50	59.990	130.010	yes
Date Acquired:	September 26, 2018				

PAH - Water - Surrogate Recovery

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
2-Fluorobiphenyl	%	113.36	80	120	yes
p-Terphenyl-d14	%	98.91	80	120	yes
Naphthalene-d8	%	95.95	80	120	yes
Date Acquired:	September 29, 2018				

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

PAH - Water - Surrogate Recovery - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
2-Fluorobiphenyl	%	82.23	74.94	20	0.150	yes
p-Terphenyl-d14	%	105.32	106.36	20	0.250	yes
Naphthalene-d8	%	89.71	88.20	20	0.250	yes
Date Acquired:	September 29, 2018					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
2-Fluorobiphenyl	%	82.23	50.100	129.900	yes
p-Terphenyl-d14	%	105.32	59.990	130.010	yes
Naphthalene-d8	%	89.71	50.100	129.900	yes
Date Acquired:	September 29, 2018				

Polycyclic Aromatic Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
2-Methylnaphthalene	ng/mL	0	-0.030	0.030	yes
Acenaphthene	ng/mL	0	-0.030	0.030	yes
Acenaphthylene	ng/mL	0	-0.030	0.030	yes
Anthracene	ng/mL	0	-0.030	0.030	yes
Benzo(a)anthracene	ng/mL	0	-0.030	0.030	yes
Benzo(a)pyrene	ng/mL	0	-0.030	0.030	yes
Benzo(b)fluoranthene	ng/mL	0	-0.030	0.030	yes
Benzo(g,h,i)perylene	ng/mL	0	-0.030	0.030	yes
Benzo(k)fluoranthene	ng/mL	0	-0.030	0.030	yes
Chrysene	ng/mL	0	-0.030	0.030	yes
Dibenzo(a,h)anthracene	ng/mL	0	-0.030	0.030	yes
Fluoranthene	ng/mL	0	-0.030	0.030	yes
Fluorene	ng/mL	0	-0.030	0.030	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	0	-0.030	0.030	yes
Naphthalene	ng/mL	0	-0.030	0.030	yes
Phenanthrene	ng/mL	0	-0.030	0.030	yes
Pyrene	ng/mL	0	-0.030	0.030	yes
Date Acquired:	September 26, 2018				

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
2-Methylnaphthalene	ng/mL	98.93	80	120	yes
Acenaphthene	ng/mL	99.59	80	120	yes
Acenaphthylene	ng/mL	97.22	80	120	yes
Anthracene	ng/mL	99.20	80	120	yes
Benzo(a)anthracene	ng/mL	98.13	80	120	yes
Benzo(a)pyrene	ng/mL	100.20	80	120	yes
Benzo(b)fluoranthene	ng/mL	98.89	80	120	yes
Benzo(g,h,i)perylene	ng/mL	97.05	80	120	yes
Benzo(j)fluoranthene	ng/mL	107.11	80	120	yes
Benzo(k)fluoranthene	ng/mL	97.29	80	120	yes
Dibenzo(a,h)anthracene	ng/mL	101.35	80	120	yes
Fluoranthene	ng/mL	97.75	80	120	yes

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Exova

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Polycyclic Aromatic Hydrocarbons - Soil - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Fluorene	ng/mL	97.80	80	120	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	97.94	80	120	yes
Naphthalene	ng/mL	98.80	80	120	yes
Phenanthrene	ng/mL	100.23	80	120	yes
Pyrene	ng/mL	99.07	80	120	yes

Date Acquired: September 26, 2018

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
2-Methylnaphthalene	µg/g	<0.03	<0.03	20	0.150	yes
Acenaphthene	µg/g	<0.03	<0.03	20	0.150	yes
Acenaphthylene	µg/g	<0.03	<0.03	20	0.150	yes
Anthracene	µg/g	<0.03	<0.03	20	0.150	yes
Benzo(a)anthracene	µg/g	<0.03	<0.03	20	0.150	yes
Benzo(a)pyrene	µg/g	<0.03	<0.03	20	0.150	yes
Benzo(b)fluoranthene	µg/g	<0.03	<0.03	20	0.150	yes
Benzo(g,h,i)perylene	µg/g	<0.03	<0.03	20	0.150	yes
Benzo(k)fluoranthene	µg/g	<0.03	<0.03	20	0.150	yes
Chrysene	µg/g	<0.03	<0.03	20	0.150	yes
Dibenzo(a,h)anthracene	µg/g	<0.03	<0.03	20	0.150	yes
Fluoranthene	µg/g	<0.03	<0.03	20	0.150	yes
Fluorene	µg/g	<0.03	<0.03	20	0.150	yes
Indeno(1,2,3-c,d)pyrene	µg/g	<0.03	<0.03	20	0.150	yes
Naphthalene	µg/g	<0.03	<0.03	20	0.150	yes
Phenanthrene	µg/g	<0.03	<0.03	20	0.150	yes
Pyrene	µg/g	<0.03	<0.03	20	0.150	yes

Date Acquired: September 26, 2018

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
2-Methylnaphthalene	µg/g	95.85	50.010	129.990	yes
Acenaphthene	µg/g	95.53	50.010	129.990	yes
Acenaphthylene	µg/g	89.70	50.010	129.990	yes
Anthracene	µg/g	88.19	59.990	130.010	yes
Benzo(a)anthracene	µg/g	90.62	59.990	130.010	yes
Benzo(a)pyrene	µg/g	89.42	59.990	130.010	yes
Benzo(b)fluoranthene	µg/g	83.13	59.990	130.010	yes
Benzo(g,h,i)perylene	µg/g	87.88	59.990	130.010	yes
Benzo(k)fluoranthene	µg/g	88.57	59.990	130.010	yes
Chrysene	µg/g	100.22	59.990	130.010	yes
Dibenzo(a,h)anthracene	µg/g	88.79	59.990	130.010	yes
Fluoranthene	µg/g	90.51	59.990	130.010	yes
Fluorene	µg/g	91.91	50.010	129.990	yes
Indeno(1,2,3-c,d)pyrene	µg/g	85.23	59.990	130.010	yes
Naphthalene	µg/g	98.43	50.010	129.990	yes
Phenanthrene	µg/g	94.37	59.990	130.010	yes
Pyrene	µg/g	91.50	59.990	130.010	yes

Date Acquired: September 26, 2018

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Exova

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Polycyclic Aromatic Hydrocarbons - Soil - Continued

Polycyclic Aromatic Hydrocarbons - Water

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Acenaphthene	ng/mL	0	-0.099	0.099	yes
Acenaphthylene	ng/mL	0	-0.099	0.099	yes
Acridine	ng/mL	0	-0.050	0.050	yes
Anthracene	ng/mL	0	-0.099	0.099	yes
Benzo(a)anthracene	ng/mL	0	-0.009	0.009	yes
Benzo(a)pyrene	ng/mL	0	-0.009	0.009	yes
Benzo(b)fluoranthene	ng/mL	0	-0.009	0.009	yes
Benzo(g,h,i)perylene	ng/mL	0	-0.099	0.099	yes
Benzo(k)fluoranthene	ng/mL	0	-0.020	0.020	yes
Chrysene	ng/mL	0	-0.099	0.099	yes
Dibenzo(a,h)anthracene	ng/mL	0	-0.009	0.009	yes
Fluoranthene	ng/mL	0	-0.099	0.099	yes
Fluorene	ng/mL	0	-0.099	0.099	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	0	-0.099	0.099	yes
Naphthalene	ng/mL	0	-0.099	0.099	yes
Phenanthrene	ng/mL	0	-0.099	0.099	yes
Pyrene	ng/mL	0	-0.020	0.020	yes
Quinoline	ng/mL	0	-0.099	0.099	yes

Date Acquired: September 29, 2018

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Acenaphthene	ng/mL	103.40	80	120	yes
Acenaphthylene	ng/mL	116.79	80	120	yes
Acridine	ng/mL	97.27	80	120	yes
Anthracene	ng/mL	112.12	80	120	yes
Benzo(a)anthracene	ng/mL	106.98	80	120	yes
Benzo(a)pyrene	ng/mL	103.28	80	120	yes
Benzo(b)fluoranthene	ng/mL	103.76	80	120	yes
Benzo(g,h,i)perylene	ng/mL	94.00	80	120	yes
Benzo(j)fluoranthene	ng/mL	91.47	80	120	yes
Benzo(k)fluoranthene	ng/mL	112.80	80	120	yes
Chrysene	ng/mL	100.61	80	120	yes
Dibenzo(a,h)anthracene	ng/mL	99.58	80	120	yes
Fluoranthene	ng/mL	102.74	80	120	yes
Fluorene	ng/mL	104.11	80	120	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	97.24	80	120	yes
Naphthalene	ng/mL	103.89	80	120	yes
Phenanthrene	ng/mL	106.21	80	120	yes
Pyrene	ng/mL	110.08	80	120	yes
Quinoline	ng/mL	96.15	80	120	yes

Date Acquired: September 29, 2018

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Polycyclic Aromatic Hydrocarbons - Water - Continued

Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Acenaphthene	µg/L	<0.1	<0.1	20	0.500	yes
Acenaphthylene	µg/L	<0.1	<0.1	20	0.500	yes
Acridine	µg/L	0.11	0.11	20	0.250	yes
Anthracene	µg/L	<0.1	<0.1	20	0.500	yes
Benzo(a)anthracene	µg/L	0.10	0.10	20	0.050	yes
Benzo(a)pyrene	µg/L	0.10	0.10	20	0.050	yes
Benzo(b)fluoranthene	µg/L	0.10	0.11	20	0.050	yes
Benzo(g,h,i)perylene	µg/L	0.1	0.1	20	0.500	yes
Benzo(k)fluoranthene	µg/L	0.10	0.10	20	0.100	yes
Chrysene	µg/L	0.1	0.1	20	0.500	yes
Dibenzo(a,h)anthracene	µg/L	0.10	0.11	20	0.050	yes
Fluoranthene	µg/L	0.1	0.1	20	0.500	yes
Fluorene	µg/L	0.1	0.1	20	0.500	yes
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	0.1	20	0.500	yes
Naphthalene	µg/L	<0.1	<0.1	20	0.500	yes
Phenanthrene	µg/L	<0.1	<0.1	20	0.500	yes
Pyrene	µg/L	0.11	0.11	20	0.100	yes
Quinoline	µg/L	0.11	0.11	20	1.700	yes

Date Acquired: September 29, 2018

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Acenaphthene	µg/L	92.8	50.010	129.990	yes
Acenaphthylene	µg/L	94.3	50.010	129.990	yes
Acridine	µg/L	108.39	59.990	130.010	yes
Anthracene	µg/L	97.7	59.990	130.010	yes
Benzo(a)anthracene	µg/L	100.80	59.990	130.010	yes
Benzo(a)pyrene	µg/L	98.79	59.990	130.010	yes
Benzo(b)fluoranthene	µg/L	103.03	59.990	130.010	yes
Benzo(g,h,i)perylene	µg/L	102.0	59.990	130.010	yes
Benzo(k)fluoranthene	µg/L	98.19	59.990	130.010	yes
Chrysene	µg/L	103.8	59.990	130.010	yes
Dibenzo(a,h)anthracene	µg/L	103.54	59.990	130.010	yes
Fluoranthene	µg/L	109.7	59.990	130.010	yes
Fluorene	µg/L	103.7	50.010	129.990	yes
Indeno(1,2,3-c,d)pyrene	µg/L	103.0	59.990	130.010	yes
Naphthalene	µg/L	99.8	50.010	129.990	yes
Phenanthrene	µg/L	99.8	59.990	130.010	yes
Pyrene	µg/L	111.13	59.990	130.010	yes
Quinoline	µg/L	108.60	50.010	129.990	yes

Date Acquired: September 29, 2018

Routine Water

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Hardness	mg CaCO3/L	118	110	20	1.000	yes

Date Acquired: September 27, 2018

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Routine Water - Continued

Soil Acidity

Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
pH	pH	5.5	5.5	0		yes
Date Acquired:	October 03, 2018					

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
pH	pH	4.0	3.9	4.1	yes
Date Acquired:	October 03, 2018				
pH	pH	7.9	7.9	8.1	yes
Date Acquired:	October 03, 2018				
pH	pH	7.3	7.0	7.6	yes
Date Acquired:	October 03, 2018				

Trace Metals Total

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	0	-0.990	0.990	yes
Antimony	µg/L	-0.00100894	-0.020	0.020	yes
Arsenic	µg/L	0.000575845	-0.099	0.099	yes
Barium	µg/L	-0.0436569	-0.099	0.099	yes
Beryllium	µg/L	0.00659792	-0.050	0.050	yes
Bismuth	µg/L	-0.000768981	-0.099	0.099	yes
Boron	µg/L	-0.690529	-2.001	2.001	yes
Cadmium	µg/L	-0.00173009	-0.010	0.010	yes
Chromium	µg/L	-0.0288322	-0.050	0.050	yes
Cobalt	µg/L	-0.00231552	-0.020	0.020	yes
Copper	µg/L	0.00720172	-0.501	0.501	yes
Iron	µg/L	-1.48444	-2.001	2.001	yes
Lead	µg/L	0	-0.010	0.010	yes
Lithium	µg/L	4.3646e-005	-0.501	0.501	yes
Manganese	µg/L	0.0462714	-0.990	0.990	yes
Molybdenum	µg/L	-0.00228605	-0.020	0.020	yes
Nickel	µg/L	0.0152424	-0.201	0.201	yes
Selenium	µg/L	0.011161	-0.201	0.201	yes
Silver	µg/L	-0.00057429	-0.010	0.010	yes
Strontium	µg/L	-0.0290046	-0.099	0.099	yes
Tellurium	µg/L	-0.0227524	-0.050	0.050	yes
Thallium	µg/L	-0.000527096	-0.010	0.010	yes
Thorium	µg/L	-0.000175946	-0.050	0.050	yes
Tin	µg/L	0.0223038	-0.099	0.099	yes
Titanium	µg/L	-0.0811536	-0.099	0.099	yes
Uranium	µg/L	-0.000385229	-0.099	0.099	yes
Vanadium	µg/L	-0.0430993	-0.050	0.050	yes
Zinc	µg/L	0	-0.501	0.501	yes
Zirconium	µg/L	0.00685125	-0.099	0.099	yes
Date Acquired:	September 27, 2018				

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Trace Metals Total - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Aluminum	µg/L	112.76	80	120	yes
Antimony	µg/L	93.09	90	110	yes
Arsenic	µg/L	95.46	90	110	yes
Barium	µg/L	96.66	90	110	yes
Beryllium	µg/L	93.49	90	110	yes
Boron	µg/L	100.69	70	130	yes
Cadmium	µg/L	93.67	90	110	yes
Chromium	µg/L	94.10	90	110	yes
Cobalt	µg/L	97.74	90	110	yes
Copper	µg/L	96.38	90	110	yes
Lead	µg/L	92.69	90	110	yes
Lithium	µg/L	95.66	90	110	yes
Molybdenum	µg/L	97.38	90	110	yes
Nickel	µg/L	98.28	90	110	yes
Selenium	µg/L	96.43	90	110	yes
Silver	µg/L	98.08	90	110	yes
Strontium	µg/L	97.99	90	110	yes
Thallium	µg/L	99.30	90	110	yes
Thorium	µg/L	93.34	90	110	yes
Tin	µg/L	94.96	90	110	yes
Titanium	µg/L	105.07	90	110	yes
Uranium	µg/L	90.40	90	110	yes
Vanadium	µg/L	93.54	90	110	yes
Zinc	µg/L	101.19	90	110	yes
Date Acquired:	September 27, 2018				
Aluminum	µg/L	92.86	80	120	yes
Antimony	µg/L	95.29	90	110	yes
Arsenic	µg/L	92.92	90	110	yes
Barium	µg/L	96.54	90	110	yes
Beryllium	µg/L	95.77	90	110	yes
Boron	µg/L	93.56	80	120	yes
Cadmium	µg/L	95.94	90	110	yes
Chromium	µg/L	94.87	90	110	yes
Cobalt	µg/L	95.61	90	110	yes
Copper	µg/L	91.52	90	110	yes
Lead	µg/L	93.23	90	110	yes
Lithium	µg/L	94.87	90	110	yes
Molybdenum	µg/L	96.87	90	110	yes
Nickel	µg/L	96.06	90	110	yes
Selenium	µg/L	96.05	90	110	yes
Silver	µg/L	98.17	90	110	yes
Strontium	µg/L	96.26	90	110	yes
Thallium	µg/L	96.28	90	110	yes
Thorium	µg/L	93.98	90	110	yes
Tin	µg/L	93.28	90	110	yes

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Trace Metals Total - Continued

Calibration Check	Units	% Recovery	Lower Limit	Upper Limit		Passed QC
Titanium	µg/L	92.42	90	110		yes
Uranium	µg/L	90.14	90	110		yes
Vanadium	µg/L	92.73	90	110		yes
Zinc	µg/L	93.37	90	110		yes
Date Acquired:	September 27, 2018					

Volatile Petroleum Hydrocarbons - Soil

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
VHs6-10	ng	0	-50	50		yes
VPHs (VHs6-10 minus	ng	0	-50	50		yes
Date Acquired:	September 27, 2018					
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
VHs6-10	ng	81.89	80	120		yes
Date Acquired:	September 27, 2018					
VHs6-10	ng	88.11	75	125		yes
VPHs (VHs6-10 minus	ng	3.82	75	125		yes
Date Acquired:	September 27, 2018					
VHs6-10	ng	116.67	50	150		yes
Date Acquired:	September 27, 2018					
Replicates	**Units**	**Replicate 1**	**Replicate 2**	**% RSD Criteria**	**Absolute Criteria**	**Passed QC**
VHs6-10	µg/g	<50	<50	20	10	yes
VPHs (VHs6-10 minus	µg/g	<50	<50	20	10	yes
VHs6-oXylene	µg/g	<50	<50	20	10	yes
VHsoXylene-10	µg/g	<50	<50	20	10	yes
Date Acquired:	September 27, 2018					
Matrix Spike	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
VHs6-10	µg/g	95	80	120		yes
Date Acquired:	September 27, 2018					

Volatile Petroleum Hydrocarbons - Water

Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
VPHw (VHw6-10 minus	ng	0	-50	50		yes
VHw6-10	ng	0	-50	50		yes
Date Acquired:	September 27, 2018					
Calibration Check	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
VHw6-10	ng	98.07	80	120		yes
Date Acquired:	September 27, 2018					
Replicates	**Units**	**Replicate 1**	**Replicate 2**	**% RSD Criteria**	**Absolute Criteria**	**Passed QC**
VPHw (VHw6-10 minus	µg/L	<50	<50	20	100	yes
VHw6-10	µg/L	<50	<50	20	100	yes
Date Acquired:	September 27, 2018					
Matrix Spike	**Units**	**% Recovery**	**Lower Limit**	**Upper Limit**		**Passed QC**
VHw6-10	µg/L	96	80	120		yes

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Quality Control

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Volatile Petroleum Hydrocarbons - Water - Continued

Matrix Spike	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Date Acquired:	September 27, 2018				

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Methodology and Notes

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
BTEX-VPH - Soil (Surrey)	BCELM	* Volatile Hydrocarbons in Solids by GC/FID, VH Solids	Sep 27, 2018	Exova Surrey
BTEX-VPH - Water (MS) (Surrey)	B.C.M.O.E	* Volatile Hydrocarbons in Waters by GC/FID (April, 2007), CSR	Sep 27, 2018	Exova Surrey
BTEX-VPH - Water (MS) (Surrey)	BCELM	* Volatile Hydrocarbons in Water by GC/FID, VH Water	Sep 27, 2018	Exova Surrey
EPH - Soil	B.C.M.O.E	* EPH in Solids by GC/FID (Dec. 31, 2000), EPH in Solids	Sep 27, 2018	Exova Surrey
EPH - Soil	BCELM	* Extractable Petroleum Hydrocarbons (EPH) in Solids by GC/FID, EPH Solids	Sep 27, 2018	Exova Surrey
EPH - Water (Surrey)	BCELM	Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Waters (LEPH & HEPH)., LEPH/HEPH Calculation	Sep 28, 2018	Exova Surrey
EPH - Water (Surrey)	BCELM	* Extractable Petroleum Hydrocarbons (EPH) in Water by GC/FID, EPH Water	Sep 28, 2018	Exova Surrey
Metals (Strong Acid Leachable) in soils (Surrey)	B.C.M.O.E	* Strong Acid Leachable Metals (SALM) in Soil, V 1.0, SALM	Oct 1, 2018	Exova Surrey
Metals (Strong Acid Leachable) in soils (Surrey)	US EPA	* Mercury in Solid and Semi-Solid Wastes (Cold Vapour), 7471B	Oct 1, 2018	Exova Surrey
PAH - Soil (Surrey)	BCELM	* Polycyclic Aromatic Hydrocarbons in Solids by GC/MS - PBM, PAH Solids	Sep 27, 2018	Exova Surrey
PAH - Soil (Surrey)	US EPA	* Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270	Sep 27, 2018	Exova Surrey
PAH - Water (Surrey)	BCELM	* Polycyclic Aromatic Hydrocarbons in Water by GC/MS - PBM, PAH Water	Sep 29, 2018	Exova Surrey
PAH - Water (Surrey)	BCELM	* Polycyclic Aromatic Hydrocarbons in Water by GC/MS - PBM, PAH Water	Oct 1, 2018	Exova Surrey
PCP - Soil	US EPA	* Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270	Sep 28, 2018	Exova Calgary
pH and EC - 1:2 (Surrey)	Carter	* Soil pH (1:2 Water), 16.2	Oct 1, 2018	Exova Surrey
Trace Metals (Total) in Water (Surrey)	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	Sep 27, 2018	Exova Surrey

** Reference Method Modified*

References

B.C.M.O.E	B.C. Ministry of Environment
BCELM	B.C. Environmental Laboratory Manual
Carter	Soil Sampling and Methods of Analysis.
US EPA	US Environmental Protection Agency Test Methods

Comments:

- Sep 28, 2018 - Reduction of analytical volume was necessary for metals analysis to bring results within the analytical range for samples. Detection

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Methodology and Notes

Bill To:	TerraWest Environmental Inc.	Project ID:	2018447.01	Lot ID:	**1300986**
	206, 2800 Bryn Maur Road	Project Name:	DCMM18-01	Control Number:	
	Victoria, BC, Canada	Project Location:	Port Alberni	Date Received:	Sep 27, 2018
	V9B 3T4	LSD:		Date Reported:	Oct 22, 2018
Attn:	Accounts Payable	P.O.:		Report Number:	2327037
Sampled By:	Derek Nickel	Proj. Acct. code:			
Company:	TerraWest				

limits are adjusted accordingly.

- Oct 22, 2018 - Dioxin and furan analysis was performed by a subcontract laboratory. See attached 7 page report PR182812.

SAMPLE RECEIPT FORM / CHEMICAL ANALYSIS FORM

FILE #: PR182812

CLIENT: Exova
#104, 19575 55A Avenue
Surrey, BC
V3S 8P8

Phone: (604) 514-3322
Fax: (604) 514-3323
Email: Surrey@exova.com

RECEIVED BY: M. Cavaliere
CONDITION: Okay, 16.8°C

DATE/TIME: September 27, 2018 (11:30 a.m.)

# of Containers	Sample Type	Sample (Client Codes)	Lab Codes	Test Requested
		PO#: POC113407		
1	Soil	1300986-1	PR182812	PCDD/F
1	Soil	1300986-2	PR182813	PCDD/F
1	Soil	1300986-3	PR182814	PCDD/F

STORAGE: Stored at <-10ºC.

ANALYTES: HRGC/HRMS analysis for polychlorinated dibenzo(p)dioxins and dibenzofurans (PCDD/F).

SPECIAL INSTRUCTIONS: none

METHODOLOGY

Reference Method: PCDD/F: SOP LAB01; EPA Method 1613b

Data summarized in Data Report Attached

Report sent to: Client Services Date: October 22, 2018

Comments: Results relate only to items tested.

Digitally signed by Patrick Pond
DN: cn=Patrick Pond, o=Pacific Rim Laboratories Inc., ou=CTO, email=Pat@pacificrimlabs.com, c=CA
Date: 2018.10.22 15:12:50 -07'00'

Patrick Pond, C. Chem, CTO

DATA REPORT

Client:	Exova Surrey	**Contact:**	Client Services
Client ID:	1390086-1	**Date Extracted:**	04-Oct-18
PRL ID:	PR182812	**Date Analysed:**	18-Oct-18

DIOXINS			Surrogate	I-TEQs		WHO-TEQs (2005)	
	Conc.	DL	Recoveries	(ND=0)	(ND=DL)	(ND=0)	(ND=DL)
Congeners	ng/kg	ng/kg	%	ng/kg	ng/kg	ng/kg	ng/kg
2,3,7,8-TCDD	2.1	0.2	84	2.1	2.1	2.1	2.1
Total TCDD	30	0.2					
1,2,3,7,8-PeCDD	32	0.3	74	16	16	32	32
Total PeCDD	140	0.3					
1,2,3,4,7,8-HxCDD	76	0.5	86	7.6	7.6	7.6	7.6
1,2,3,6,7,8-HxCDD	210	0.5	84	21	21	21	21
1,2,3,7,8,9-HxCDD	81	0.5	-	8.1	8.1	8.1	8.1
Total HxCDD	1100	0.5					
1,2,3,4,6,7,8-HpCDD	3800	0.7	98	38	38	38	38
Total HpCDD	7200	0.7					
OCDD	11000	1	108	11	11	3.3	3.3
		Total Dioxin TEQ		**104**	**104**	**112**	**112**

FURANS			Surrogate	I-TEQs		WHO-TEQs (2005)	
		DL	Recoveries	(ND=0)	(ND=DL)	(ND=0)	(ND=DL)
Congeners	ng/kg	ng/kg	%	ng/kg	ng/kg	ng/kg	ng/kg
2,3,7,8-TCDF	4.2	0.2	64	0.42	0.42	0.42	0.42
Total TCDF	88	0.2					
1,2,3,7,8-PeCDF	7.2	0.3	68	0.36	0.36	0.216	0.216
2,3,4,7,8-PeCDF	9.7	0.3	78	4.85	4.85	2.91	2.91
Total PeCDF	280	0.3					
1,2,3,4,7,8-HxCDF	31	0.5	76	3.1	3.1	3.1	3.1
1,2,3,6,7,8-HxCDF	30	0.5	80	3	3	3	3
1,2,3,7,8,9-HxCDF	14	0.5	74	1.4	1.4	1.4	1.4
2,3,4,6,7,8-HxCDF	54	0.5	92	5.4	5.4	5.4	5.4
Total HxCDF	870	0.5					
1,2,3,4,6,7,8-HpCDF	830	0.7	98	8.3	8.3	8.3	8.3
1,2,3,4,7,8,9-HpCDF	95	0.7	78	0.95	0.95	0.95	0.95
Total HpCDF	3600	0.7					
OCDF	2000	1	-	2	2	0.6	0.6
		Total Furan TEQ		**30**	**30**	**26**	**26**

	I-TEQs (ND=0)	I-TEQs (ND=DL)	WHO-TEQs (ND=0)	WHO-TEQs (ND=DL)
Total PCDD/PCDF Toxic Equivalent	**133.58**	**133.58**	**138.40**	**138.40**

ND - none detected

DATA REPORT

Client:	Exova Surrey	**Contact:**	Client Services
Client ID:	1390086-2	**Date Extracted:**	04-Oct-18
PRL ID:	PR182813	**Date Analysed:**	18-Oct-18

DIOXINS			**Surrogate**	**I-TEQs**		**WHO-TEQs (2005)**	
	Conc.	**DL**	**Recoveries**	**(ND=0)**	**(ND=DL)**	**(ND=0)**	**(ND=DL)**
Congeners	**ng/kg**	**ng/kg**	**%**	**ng/kg**	**ng/kg**	**ng/kg**	**ng/kg**
2,3,7,8-TCDD	ND	0.2	68	ND	0.2	ND	0.2
Total TCDD	2.9	0.2					
1,2,3,7,8-PeCDD	2.6	0.3	68	1.3	1.3	2.6	2.6
Total PeCDD	2.9	0.3					
1,2,3,4,7,8-HxCDD	ND	0.5	78	ND	0.05	ND	0.05
1,2,3,6,7,8-HxCDD	5.4	0.5	84	0.54	0.54	0.54	0.54
1,2,3,7,8,9-HxCDD	2.7	0.5	-	0.27	0.27	0.27	0.27
Total HxCDD	45	0.5					
1,2,3,4,6,7,8-HpCDD	140	0.7	78	1.4	1.4	1.4	1.4
Total HpCDD	350	0.7					
OCDD	1300	1	92	1.3	1.3	0.39	0.39
		Total Dioxin TEQ		**4.8**	**5.1**	**5.2**	**5.5**

FURANS			**Surrogate**	**I-TEQs**		**WHO-TEQs (2005)**	
		DL	**Recoveries**	**(ND=0)**	**(ND=DL)**	**(ND=0)**	**(ND=DL)**
Congeners	**ng/kg**	**ng/kg**	**%**	**ng/kg**	**ng/kg**	**ng/kg**	**ng/kg**
2,3,7,8-TCDF	ND	0.2	54	ND	0.02	ND	0.02
Total TCDF	17	0.2					
1,2,3,7,8-PeCDF	0.72	0.3	58	0.04	0.04	0.02	0.02
2,3,4,7,8-PeCDF	1.2	0.3	76	0.60	0.60	0.36	0.36
Total PeCDF	19	0.3					
1,2,3,4,7,8-HxCDF	1.1	0.5	72	0.11	0.11	0.11	0.11
1,2,3,6,7,8-HxCDF	1.9	0.5	76	0.19	0.19	0.19	0.19
1,2,3,7,8,9-HxCDF	ND	0.5	72	ND	0.05	ND	0.05
2,3,4,6,7,8-HxCDF	2.6	0.5	90	0.26	0.26	0.26	0.26
Total HxCDF	32	0.5					
1,2,3,4,6,7,8-HpCDF	27	0.7	86	0.27	0.27	0.27	0.27
1,2,3,4,7,8,9-HpCDF	2.4	0.7	78	0.02	0.02	0.02	0.02
Total HpCDF	110	0.7					
OCDF	91	1	-	0.09	0.09	0.03	0.03
		Total Furan TEQ		**1.6**	**1.7**	**1.3**	**1.3**

Total PCDD/PCDF Toxic Equivalent	**6.39**	**6.71**	**6.46**	**6.78**

ND - none detected

DATA REPORT

Client:	Exova Surrey	**Contact:**	Client Services
Client ID:	1390086-3	**Date Extracted:**	04-Oct-18
PRL ID:	PR182814	**Date Analysed:**	18-Oct-18
			###

DIOXINS Congeners	Conc. ng/kg	DL ng/kg	Surrogate Recoveries %	I-TEQs (ND=0) ng/kg	I-TEQs (ND=DL) ng/kg	WHO-TEQs (2005) (ND=0) ng/kg	WHO-TEQs (2005) (ND=DL) ng/kg
2,3,7,8-TCDD	ND	0.2	52	ND	0.2	ND	0.2
Total TCDD	2.1	0.2					
1,2,3,7,8-PeCDD	ND	0.3	58	ND	0.15	ND	0.3
Total PeCDD	ND	0.3					
1,2,3,4,7,8-HxCDD	ND	0.5	64	ND	0.05	ND	0.05
1,2,3,6,7,8-HxCDD	ND	0.5	68	ND	0.05	ND	0.05
1,2,3,7,8,9-HxCDD	1.3	0.5	-	0.13	0.13	0.13	0.13
Total HxCDD	28	0.5					
1,2,3,4,6,7,8-HpCDD	41	0.7	68	0.41	0.41	0.41	0.41
Total HpCDD	89	0.7					
OCDD	320	1	76	0.32	0.32	0.10	0.10
		Total Dioxin TEQ		**0.86**	**1.3**	**0.64**	**1.2**

FURANS Congeners	ng/kg	DL ng/kg	Surrogate Recoveries %	I-TEQs (ND=0) ng/kg	I-TEQs (ND=DL) ng/kg	WHO-TEQs (2005) (ND=0) ng/kg	WHO-TEQs (2005) (ND=DL) ng/kg
2,3,7,8-TCDF	ND	0.2	48	ND	0.02	ND	0.02
Total TCDF	8.2	0.2					
1,2,3,7,8-PeCDF	ND	0.3	52	ND	0.015	ND	0.009
2,3,4,7,8-PeCDF	ND	0.3	56	ND	0.15	ND	0.09
Total PeCDF	25	0.3					
1,2,3,4,7,8-HxCDF	ND	0.5	56	ND	0.05	ND	0.05
1,2,3,6,7,8-HxCDF	0.94	0.5	62	0.094	0.094	0.094	0.094
1,2,3,7,8,9-HxCDF	ND	0.5	64	ND	0.05	ND	0.05
2,3,4,6,7,8-HxCDF	0.78	0.5	74	0.078	0.078	0.078	0.078
Total HxCDF	14	0.5					
1,2,3,4,6,7,8-HpCDF	6.1	0.7	70	0.06	0.06	0.06	0.06
1,2,3,4,7,8,9-HpCDF	0.8	0.7	60	0.01	0.01	0.01	0.01
Total HpCDF	23	0.7					
OCDF	18	1	-	0.02	0.02	0.01	0.01
		Total Furan TEQ		**0.26**	**0.54**	**0.25**	**0.47**

Total PCDD/PCDF Toxic Equivalent	I-TEQ (ND=0)	I-TEQ (ND=DL)	WHO-TEQ (ND=0)	WHO-TEQ (ND=DL)
	1.12	**1.85**	**0.88**	**1.70**

ND - none detected

Tel (604) 532-8711 | Fax (604) 532-8712 | info@pacificrimlabs.com | pacificrimlabs.com
Pacific Rim Laboratories Inc. - #103, 19557 - 55A Ave. Surrey, BC V3S 8P8, Canada

QC REPORT - BLANK

Client:	Exova Surrey	**Contact:**	Client Services
Client ID:	BLANK	**Date Extracted:**	04-Oct-18
PRL ID:	DF180817B	**Date Analysed:**	18-Oct-18

DIOXINS			Surrogate	I-TEQs		WHO-TEQs (2005)	
	Conc.	DL	Recoveries	(ND=0)	(ND=DL)	(ND=0)	(ND=DL)
Congeners	ng/kg	ng/kg	%	ng/kg	ng/kg	ng/kg	ng/kg
2,3,7,8-TCDD	ND	0.2	46	ND	0.2	ND	0.2
Total TCDD	ND	0.2					
1,2,3,7,8-PeCDD	ND	0.3	62	ND	0.15	ND	0.3
Total PeCDD	ND	0.3					
1,2,3,4,7,8-HxCDD	ND	0.5	74	ND	0.05	ND	0.05
1,2,3,6,7,8-HxCDD	ND	0.5	80	ND	0.05	ND	0.05
1,2,3,7,8,9-HxCDD	ND	0.5	-	ND	0.05	ND	0.05
Total HxCDD	ND	0.5					
1,2,3,4,6,7,8-HpCDD	ND	0.7	82	ND	0.007	ND	0.007
Total HpCDD	ND	0.7					
OCDD	ND	1	86	ND	0.001	ND	0.0003
		Total Dioxin TEQ		**0.00**	**0.51**	**0.00**	**0.66**

FURANS			Surrogate	I-TEQs		WHO-TEQs (2005)	
		DL	Recoveries	(ND=0)	(ND=DL)	(ND=0)	(ND=DL)
Congeners	ng/kg	ng/kg	%	ng/kg	ng/kg	ng/kg	ng/kg
2,3,7,8-TCDF	ND	0.2	36	ND	0.02	ND	0.02
Total TCDF	ND	0.2					
1,2,3,7,8-PeCDF	ND	0.3	50	ND	0.015	ND	0.009
2,3,4,7,8-PeCDF	ND	0.3	60	ND	0.15	ND	0.09
Total PeCDF	ND	0.3					
1,2,3,4,7,8-HxCDF	ND	0.5	60	ND	0.05	ND	0.05
1,2,3,6,7,8-HxCDF	ND	0.5	64	ND	0.05	ND	0.05
1,2,3,7,8,9-HxCDF	ND	0.5	74	ND	0.05	ND	0.05
2,3,4,6,7,8-HxCDF	ND	0.5	86	ND	0.05	ND	0.05
Total HxCDF	ND	0.5					
1,2,3,4,6,7,8-HpCDF	ND	0.7	74	ND	0.007	ND	0.007
1,2,3,4,7,8,9-HpCDF	ND	0.7	74	ND	0.007	ND	0.007
Total HpCDF	ND	0.7					
OCDF	ND	1	-	ND	0.001	ND	0.0003
		Total Furan TEQ		**0.00**	**0.40**	**0.00**	**0.33**

	I-TEQ (ND=0)	I-TEQ (ND=DL)	WHO-TEQ (ND=0)	WHO-TEQ (ND=DL)
Total PCDD/PCDF Toxic Equivalent	**0.00**	**0.91**	**0.00**	**0.99**

ND - none detected

Acronyms used in reporting dioxins and furans:

TCDD = Tetrachlorodibenzo-*p*-dioxin
PeCDD = Pentachlorodibenzo-*p*-dioxin
HxCDD = Hexachlorodibenzo-*p*-dioxin
HpCDD = Heptachlorodibenzo-*p*-dioxin
OCDD = Octachlorodibenzo-*p*-dioxin

TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlorodibenzofuran
OCDF = Octachlorodibenzofuran

Acceptable recoveries for surrogates	**EPA 1613**	
	Min (%)	**Max (%)**
$^{13}C_{12}$ -2,3,7,8-TCDD	25	164
$^{13}C_{12}$ -1,2,3,7,8-PeCDD	25	181
$^{13}C_{12}$ -1,2,3,4,7,8-HxCDD	32	141
$^{13}C_{12}$ -1,2,3,6,7,8-HxCDD	28	130
$^{13}C_{12}$ -1,2,3,4,6,7,8-HpCDD	23	140
$^{13}C_{12}$ -OCDD	17	157
$^{13}C_{12}$ -2,3,7,8-TCDF	24	169
$^{13}C_{12}$ -1,2,3,7,8-PeCDF	24	185
$^{13}C_{12}$ -2,3,4,7,8-PeCDF	21	178
$^{13}C_{12}$ -1,2,3,4,7,8-HxCDF	26	152
$^{13}C_{12}$ -1,2,3,6,7,8-HxCDF	26	123
$^{13}C_{12}$ -1,2,3,7,8,9-HxCDF	29	147
$^{13}C_{12}$ -2,3,4,6,7,8-HxCDF	28	136
$^{13}C_{12}$ -1,2,3,4,6,7,8-HpCDF	28	143
$^{13}C_{12}$ -1,2,3,4,7,8,9-HpCDF	26	138

Tel (604) 532-8711 | Fax (604) 532-8712 | info@pacificrimlabs.com | pacificrimlabs.com
Pacific Rim Laboratories Inc. - #103, 19557 - 55A Ave. Surrey, BC V3S 8P8, Canada

Exova
#104, 19575-55 A Ave.
Surrey, BC
Canada, V3S 8P8

T: (604) 514-3322
F: (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

11,30 am, 27Sep18, 14.3°C MC

Exova

External Sublet Request

Lot: 1300986
Number of Samples: 3
Printed Date: Sep 27, 2018
Page 1 of 1

Sublet Requested to:
Attn: Patrick Pond
Pacific Rim Laboratories Inc.
103
19575 - 55A Avenue
Surrey, BC V3S 8P8
Tel: (604) 532-8711
Fax: (604) 532-8712

Exova Contact: Questions can be directed to Exova Surrey Client Services at (604) 514-3322.

Email Results to: Surrey@exova.com

Mail Invoice to: 2395 Speakman Dr., Mississauga, ON L5K 1B3, Canada
E: accpayable.americas@exova.com

Due Date: October 19, 2018

PO#: POC113407

The PO # Must be Recorded on all invoices.

Sample Id	Sample Date	Service	Service Name
1300986 - 1	Sep 26, 2018 PR182812	DFS	Dioxins and furans in soil
1300986 - 2	Sep 26, 2018 PR182813	DFS	Dioxins and furans in soil
1300986 - 3	Sep 26, 2018 PR182814	DFS	Dioxins and furans in soil

****If rush surcharge is required to meet due date, contact Exova prior to processing.**
****Samples received are regular priority unless otherwise indicated on paperwork.**

Special Instructions: ______

Relinquished by: ______ ***Received by:*** ______

Company: ______ ***Company:*** ______

Date: ______ ***Date:*** ______

Exova Testing, calibrating, advising.
www.exova.com

Project Information

Project ID	2018447.01
Project Name	DCMM18-01
Project Location	Port Alberni
Legal Location	
PO/AFE#	
Proj. Acct. Code	
Quote #	

Invoice To:

Company	TerraWest Environmental Inc.
Address	206, 2800 Bryn Maur Road
	Victoria, BC V9B 3T4
Attention	Accounts Payable
Phone	866-500-1553
Cell	
Fax	
E-mail	kmarks@terrawest.ca
Agreement ID	
Copy of Report	

Report To:

Company	TerraWest Environmental Inc.
Address	3148-F Barons Road, Nanaimo, BC
	V9T 4B5
Attention	Derek Nickel
Phone	
Cell	1250216-4313
Fax	
E-mail 1	dnickel@terrawest.ca
E-mail 2	ebell@terrawest.ca
Copy of Invoice	

Report Results		Regulatory Requirement	
E-Mail	x	HCDWQG	
Mail		Ab Tier 1	
Online		SPIGEC	
Fax		BCCSR	x
PDF	x	Other (list below)	
Excel	x		
QA/QC	X		

Sample Custody (please print)

Sampled by: Derek Nickel

Company: TerraWest

I authorize Exova to proceed with the work indicated on this form:

Date: 26-Sep-2018 Initial: DN

This section for Lab use

Date/Time stamp: SEP 27 '18 10:22

RUSH Priority

☐	Emergency (contact lab for turnaround and pricing)
☐	Priority 1-2 working days (100% surcharge)
☐	Urgent 2-3 working days (50% surcharge)

When "ASAP" is requested, turn around will default to a 100% RUSH priority, with pricing and turn around time to match. Please contact the lab prior to submitting RUSH samples. If not all samples require RUSH, please indicate in the special instructions.

Date Required ____________ Signature ____________

Special Instructions/Comments (please include contact information including ph. # if different from above).

Please report as per CSR Schedule 3.4 for Sediment samples

	Site I.D.	Sample description	Depth start	Depth end (in cm m)	Date/Time sampled	Matrix	Sampling method	Number of Containers	CTEH10	BCCSR Metals in Sediment	Dioxins & Furans	PCP2	pH Soil	CTEH10W	W39BC	Hardness water		
1		SS18-01			9/26/2018	Sedim	Grab	7	✓	✓	✓	✓	✓					
2		SS18-02			9/26/2018	Sedim	Grab	7	✓	✓	✓	✓	✓					
3		SS18-03			9/26/2018	Sedim	Grab	7	✓	✓	✓	✓	✓					
4		SW18-01			9/26/2018	Water	Grab	7						✓	✓	✓		
5		SW18-02			9/26/2018	Water	Grab	7						✓	✓	✓		
6		SW18-02A			9/26/2018	Water	Grab	1							✓	✓		
7		SW18-03			9/26/2018	Water	Grab	7						✓	✓	✓		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		

Enter tests above (√ relevant samples below)

Indicate in the space allotted any deficiencies by the corresponding number.

1. Indicate any samples that were not packaged well
2. Indicate any samples not received in Exova supplies
3. Indicate any samples that were not clearly labeled
4. Indicate any samples not received within the required hold time or temp.
5. Indicate any missing or extra samples
6. Indicate any samples that were received broken
7. Indicate any samples where sufficient volume was not received
8. Indicate any samples received in an inappropriate container

Environmental Sample Information Sheet

Note: Proper completion of this form is required in order to proceed with analysis

Please indicate any potentially hazardous samples

Page _1_ of _1_ Control #

Indi

Lot: 1300986 COC

Shipping: COD Y/N

and size of coolers

Temp. received: 10.1

Delivery Method:

Waybill:

Received by:

APPENDIX E.

3.2.18 Groundwater Well Drilling, Fife Drilling, 1997

092F036221 #12

AQUIFER 697
92F 36 #17

Fyfe's WELL DRILLING & PUMP CO. LTD.

WTN 94833

3331 Alberni Hwy., Qualicum, B.C. V9K 1Y5
Telephone: 1 800 780-FYFE Fax: (604) 752-1274

10,367149,5463419

CLIENT / COMPANY: MCLEAN MILL NATIONAL HISTORIC SITE

CONTACT : BARRY MCGINN MCGINN ENGINEERING PHONE: 250-723-2677 FAX 250-723-2621

DL 106

MAILING ADDRESS: MCLEAN MILL NATIONAL HISTORIC SITE OFFICE 5633 SMITH ROAD PORT ALBERNI B.C. V5Y-7L5

Alberni (?)

WELL LOCATION: 5633 SMITH ROAD PORT ALBERNI AT MCLEAN MILL NATIONAL HISTORIC SITE

PROPOSED USE:					
	Residential		Industrial		Municipal
	Irrigation	X	Test Well	X	Community

TYPE OF WORK:				
Well Identification Number:		97-1		
X	New Well	Method:	X	Air Rotary
	Deepened			Cable Tool
	Reconditioned			Auger

WELL DIMENSIONS:		
Diameter of Well:	6	Inches
Total Depth Drilled:	400	Feet
Depth of Completed Well:	400	Feet

CONSTUCTION DETAILS:								
Well Casing:				X	Welded			
0.250	in	6	in dia frm	0	ft. to	105	ft.	
0.350	in	10	in dia frm	0	ft. to	22	ft.	
Drive Shoe:	X	Yes		No	Size:	6	in.	
Surface Seal:					Yes	X	No	
Material used in seal:				Bentonite				
Well Liner:					Yes	X	No	
Type / Size					PVC		in.	

WELL SCREEN INFORMATION:							
	in. dia.		slot frm.		ft. to		ft.
	in. dia.		slot frm.		ft. to		ft.

WELL INFORMATION SUMMARY:					
Final Well Depth:				400	FEET
Total Well Casing Installed:				105	FEET
Estimated Well Yield:				4	USgpm
Static Water Level:				30	FEET
Well Development Information:					
Development method:	X	Air	Bailer		Pump
Development time:				2	HOURS
Water Quality Notes (eg: Taste, Odour, Colour, Sand, etc.)					
WATER IS MOD. TURBID, NO ODOUR.					

STRATUM (FT)		MATERIAL DESCRIPTION	CASING (FT/IN)	
0	22	10 INCH SURFACE SEAL CASING	0	22
0	10	BROWN, STONEY TILL	0	20.4
10	20	GREY, STONEY TILL W/ COBBLES	20.1	40.5
20	35	GREY STONEY TILL	20.1	60.6
35	40	SOFT, BROWN TILL	20.0	80.6
40	60	GREY TILL W/ BOULDERS	20.	100.6
60	100	GREY, STONEY TILL	5	105.6
@	100	BEDROCK		
100	230	GREY SANDSTONE/SHALE		
		INTERBEDS (MEDIUM HARD)		
230	240	FRACTURE: WATER BEARING		
		APPROXIMATELY 4 USGPM		
2~~3~~40	300	GREY SHALE - MODERATELY SOFT		
300	400	GREY SHALE - SOFT TO MEDIUM		
	400	COMPLETED DEPTH		
		BOREHOLE APPEARS STABLE.		
		WELL SUMMARY		
		TOTAL DEPTH DRILLED	400	FEET
		FINAL DEPTH OF WELL	400	FEET
		TOTAL SURFACE CASING INSTALLED	22	FEET
		TOTAL WELL CASING INSTALLED	105	FEET
		10 INCH DRIVE SHOE	1	QTY
		6 INCH DRIVE SHOE	1	QTY
		ESTIMATED WELL YIELD	4	GPM
		STATIC WATER LEVEL (APPROX.)	30	FEET

WELL CONSTRUCTION PERSONNEL:			
Driller:	GLEN FYFE	License Number:	0039-WW-94
Crewman:	JENS HEINEN	Engineer/Tech:	B. McGINN
Start Date:	AUG 18, 1997	**Completion Date:**	AUG 22, 1997
Drillers Signature:	Glen Fyfe		

RESULTS OF ANALYSIS File No. H6976

			97-A2
			97 09 04 03:00
Physical Tests			
Colour	(CU)		<5
Conductivity	(umhos/cm)		1930
Total Dissolved Solids			1380
Hardness	CaCO3		12.6
pH			8.35
Turbidity	(NTU)		404
Dissolved Anions			
Alkalinity-Total		CaCO3	897
Chloride	Cl		143
Fluoride	F		1.86
Sulphate	SO4		1
Nutrients			
Nitrate Nitrogen		N	0.200
Nitrite Nitrogen		N	0.044
Dissolved Metals			
Aluminum	D-Al		2.2
Arsenic	D-As		0.0141
Barium	D-Ba		0.87
Boron	D-B		0.7
Cadmium	D-Cd		<0.0002
Calcium	D-Ca		2.82
Chromium	D-Cr		<0.01
Copper	D-Cu		<0.01
Iron	D-Fe		1.43
Lead	D-Pb		<0.001
Magnesium	D-Mg		1.35
Manganese	D-Mn		0.014
Potassium	D-K		2
Selenium	D-Se		<0.0005
Sodium	D-Na		463
Zinc	D-Zn		0.008

Results are expressed as milligrams per litre except for pH, Conductivity (umhos/cm), Turbidity (NTU), and Colour (CU).
< = Less than the detection limit indicated.

WTN 94833

Fyfe's WELL DRILLING & PUMP CO. LTD.

3331 Alberni Hwy., Qualicum, B.C. V9K 1Y5
Telephone: 1 800 780-FYFE Fax: (604) 752-1274

CLIENT / COMPANY: MCLEAN MILL NATIONAL HISTORIC SITE

CONTACT : BARRY MCGINN MCGINN ENGINEERING PHONE: 250-723-2677 FAX 250-723-2621

MAILING ADDRESS: MCLEAN MILL NATIONAL HISTORIC SITE OFFICE 5633 SMITH ROAD PORT ALBERNI B.C. V5Y-7L5

WELL LOCATION: 5633 SMITH ROAD PORT ALBERNI AT MCLEAN MILL NATIONAL HISTORIC SITE

PROPOSED USE:

	Residential		Industrial		Municipal
	Irrigation	X	Test Well	X	Community

TYPE OF WORK:

Well Identification Number:		97-1		
	New Well	Method:	X	Air Rotary
X	Deepened			Cable Tool
	Reconditioned			Auger

WELL DIMENSIONS:

Diameter of Well:	6	Inches
Total Depth Drilled:	540	Feet
Depth of Completed Well:	540	Feet

CONSTUCTION DETAILS:

Well Casing:				X	Welded		
0.250	in	6	in dia frm	0	ft. to	105	ft.
0.350	in	10	in dia frm	0	ft. to	22	ft.
Drive Shoe:	X	Yes		No	Size:	6	in.
Surface Seal:				X	Yes		No
Material used in seal:				Bentonite			
Well Liner:					Yes	X	No
Type / Size					PVC		in.

WELL SCREEN INFORMATION:

	in. dia.		slot frm.		ft. to		ft.
	in. dia.		slot frm.		ft. to		ft.

WELL INFORMATION SUMMARY:

Final Well Depth:			540	FEET
Total Well Casing Installed:			105	FEET
Estimated Well Yield:			20	USgpm
Static Water Level:			30	FEET
Well Development Information:				
Development method:	X	Air	Bailer	Pump
Development time:			4	HOURS
Water Quality Notes (eg: Taste, Odour, Colour, Sand, etc.)				
WATER TURBID, TASTE IS BRACKISH (IE: SALTY)				

STRATUM (FT)		MATERIAL DESCRIPTION	CASING (FT/IN)	
		EXISTING WELL DEPTH: 400 FT.		
400	450	GREY SHALE - SOFT TO MEDIUM		
450	470	GREY SHALE - MEDIUM		
470	500	GREY SHALE W/ GREENISH		
		INCLUSIONS (CALCITE?)		
500	530	GREY SHALE - V. SOFT		
530	535	FRACTURE: WATER BEARING		
		LIGHT COLOURED IGNEOUS ROCK		
		(GRANO-DIORITE?)		
		YIELD ESTIMATE: 20 USGPM		
535	540	IGNEOUS ROCK - V. HARD		
	540	COMPLETED DEPTH		
		BOREHOLE APPEARS STABLE.		
		WELL SUMMARY		
		TOTAL DEPTH DRILLED	140	FEET
		FINAL DEPTH OF WELL	540	FEET
		TOTAL SURFACE CASING INSTALLED	22	FEET
		TOTAL CASING INSTALLED	105	FEET
		10 ICH DRIVE SHOE	1	QTY
		6 INCH DRIVE SHOE	1	QTY
		ESTIMATED WELL YIELD	20	GPM
		STATIC WATER LEVEL (APPROX.)	30	FEET

WELL CONSTRUCTION PERSONNEL:

Driller:	GLEN FYFE	License Number:	0039-WW-94
Crewman:	JENS HEINEN	Engineer/Tech:	B. McGINN
Start Date:	OCT 16, 1997	**Completion Date:**	OCT 17, 1997
Drillers Signature:	Glen Fyfe		

RESULTS OF ANALYSIS - Water

File No. H9401

		McLean Mill 97-1-B 97 11 20 18:00
Physical Tests		
Colour	(CU)	<5
Conductivity	(umhos/cm)	20500
Total Dissolved Solids		12300
Hardness	CaCO3	2170
pH		7.13
Turbidity	(NTU)	211
Dissolved Anions		
Alkalinity-Total	CaCO3	472
Chloride	Cl	7400
Fluoride	F	0.54
Sulphate	SO4	<1
Nutrients		
Nitrate Nitrogen	N	0.005
Nitrite Nitrogen	N	<0.001
Bacteriological Tests		
Heterotrophic Plate Count[1]		560
Total Metals		
Aluminum	T-Al	8
Arsenic	T-As	0.0629
Barium	T-Ba	144
Boron	T-B	1.0
Cadmium	T-Cd	<0.002
Calcium	T-Ca	678
Chromium	T-Cr	<0.05
Copper	T-Cu	<0.05
Iron	T-Fe	6.6
Lead	T-Pb	<0.01
Magnesium	T-Mg	117
Manganese	T-Mn	0.12
Mercury	T-Hg	0.00012
Potassium	T-K	21
Selenium	T-Se	0.0007
Sodium	T-Na	3190
Zinc	T-Zn	0.03

Remarks regarding the analyses appear at the beginning of this report.
Results are expressed as milligrams per litre except for pH, Colour (CU), Conductivity (umhos/cm) and Turbidity (NTU).
< = Less than the detection limit indicated.
[1]Heterotrophic Plate Count is expressed as Colony Forming Units (CFU)/mL.

BCGS MAP 092F.036.2.2.1 WTN 94833 WELL NO. 12

WATER WELL RECORD

MINISTRY OF WATER, LAND AND AIR PROTECTION — VICTORIA, BRITISH COLUMBIA

Z ___ WELL NO. ___ E ___ N ___

Z X Y NO.

LEGAL DESCRIPTION: LOT ___ SEC. ___ TP. ___ R. ___ D.L. 106 LAND DISTRICT Alberni PLAN ___

DESCRIPTIVE LOCATION 5633 Smith Rd, Port Alberni LICENCE NO. ___ DATE ___

OWNER'S NAME McLean Mill National Historic Site ADDRESS ___

DRILLER'S NAME Fyfe's ADDRESS ___ DATE COMPLETED ___

NAT. TOPO. SHEET NO. ___

DEPTH 540 ELEVATION OF ___ ☐ ESTIMATED ☐ SURVEYED CASING DIAM. ___ LENGTH ___

METHOD OF CONSTRUCTION ___ CASING DIAM ___ LENGTH ___

SCREEN LOCATION ___ SCREEN ☐ SIZE ___ LENGTH ___ TYPE ___

SANITARY SEAL YES ☐ NO ☐ SCREEN ☐ SIZE ___ LENGTH ___ TYPE ___

PERFORATED CASING ☐ LENGTH ___ PERFORATIONS FROM ___ TO ___

GRAVEL PACK ☐ LENGTH ___ DIAM. ___ SIZE GRAVEL, ETC. ___

DISTANCE TO WATER FROM ___ ☐ ESTIMATED ☐ MEASURED WATER LEVEL ELEVATION ___ ARTESIAN PRESSURE ___

DATE OF WATER LEVEL MEASUREMENT ___ WATER USE ___

PRODUCTION TEST SUMMARY

DATE ___
TEST BY ___
BAIL TEST ☐ PUMP TEST ☐ DURATION OF TEST ___
RATE ___ DRAWDOWN ___
WATER LEVEL AT COMPLETION OF TEST ___
AVAILABLE DRAWDOWN ___ SPECIFIC CAPACITY ___
PERMEABILITY ___ STORAGE COEFF. ___
TRANSMISSIVITY ___
ESTIMATED WELL YIELD ___
RECOMMENDED PUMPING RATE ___
RECOMMENDED PUMP SETTING ___

CHEMISTRY

TEST BY ___ DATE ___

TOTAL DISSOLVED SOLIDS ___ mg/l TEMPERATURE ___ °C pH ___ SILICA (SiO_2) ___ mg/l

CONDUCTANCE ___ µmhos/cm AT 25°C TOTAL IRON (Fe) ___ mg/l TOTAL HARDNESS ($CaCO_3$) ___ mg/l

TOTAL ALKALINITY ($CaCO_3$) ___ mg/l PHEN. ALKALINITY ($CaCO_3$) ___ mg/l MANGANESE (Mn) ___ mg/l

COLOUR ___ ODOUR ___ TURBIDITY ___

ANIONS	mg/l	epm
CARBONATE (CO_3)		
BICARBONATE (HCO_3)		
SULPHATE (SO_4)		
CHLORIDE (Cl)		
$NO_2 + NO_3$ (NITROGEN)		
* TKN. (NITROGEN)		
PHOSPHORUS (P)		

CATIONS	mg/l	epm
CALCIUM (Ca)		
MAGNESIUM (Mg)		
SODIUM (Na)		
POTASSIUM (K)		
IRON (DISSOLVED)		

* TKN = TOTAL KJELDAHL NITROGEN CHEMISTRY SITE NO. ___

NO_2 = NITRITE NO_3 = NITRATE

CHEMISTRY FIELD TESTS

TEST BY ___ DATE ___ EQUIPMENT USED ___

LITHOLOGY

FROM	TO	DESCRIPTION

CONTENTS OF FOLDER

☐ DRILL LOG ☐ PUMP TEST DATA ☐ CHEMICAL ANALYSIS

☐ SIEVE ANALYSIS ☐ GEOPHYSICAL LOGS ☐ REPORT

OTHER ___

SOURCES OF INFORMATION ___

NORTH

WEST

EAST

SOUTH

CARD BY________________________________ DATE________________________

ADDITIONAL DATA ADDED BY____

REMARKS

97941

ENV 1995

APPENDIX G.

ASSESSMENT STANDARDS

1.0 ASSESSMENT STANDARDS

Environmental liabilities and the protection of air, soils, surface waters, and groundwater quality in British Columbia are principally governed by BC ENV under authority of the *Environmental Management Act* and its subordinate regulations and amendments. Under ENV jurisdiction, site owners/operators are subject to environmental contamination standards and liabilities, operating protocols, and reporting requirements defined by, though not limited to, the *Contaminated Sites Regulation* (CSR) which defines numerical contamination standards for soils, sediment, groundwater, surface water and vapours, materials management, and reporting requirements.

1.1 SOILS STANDARDS

There are three sets of soil standards applicable for the soil samples collected during this Phase II ESA, separated into numerous land uses and sensitive receptors. The Site-specific information regarding land use is presented in the table below:

Land Use Determination	
Historical land use	Industrial
Current land use	National historic site, parkland, camping, fish hatchery.
Zoning[1]	Park and Public Use District
Distance to nearest surface water bodies[2]	Kitsucksis Creek running through the Subject Property in the northwest portion of the Site.
Has a successful investigation into the drinking water pathway been conducted, as per the CSR Protocol 21 and the pathway eliminated?	Yes – on-Site well drilled in 1997 down to 540 ft, indicated approximately 90 ft of till overlaying bedrock. Natural water quality was deemed poor due based on review of provided analytical groundwater results.
Is there a possibility of livestock ingesting the soil?	Not anticipated within the Subject Property.
Is the groundwater used for livestock watering?	Not anticipated within the Subject Property. Shallow groundwater and surface water use for livestock watering potentially occurs on neighbouring properties.
Is the groundwater used for irrigation?	Not anticipated within the Subject Property. Shallow groundwater and surface water is reportedly used for irrigation on neighbouring properties.

[1] Regional District of Alberni-Clayoquot Consolidated Zoning By-law (2018). Zoning Bylaw No. 1971. Available from https://www.acrd.bc.ca/cms/wpattachments/wpID174atID2700.pdf, and https://www.acrd.bc.ca/dms/documents/Maps/Alberni-Valley/d10.pdf
[2] BC Ministry of Environment (2018). BC Water Resources Atlas. Available from http://maps.gov.bc.ca/ess/sv/wrbc/

Based on the table above, the applicable CSR standards for soil at the Site as follows, herein referred to as the 'applicable standards':

- CSR Schedule 3.1 Part 1 Numerical Soil Standards for Urban park land use:
  - Intake of contaminated soil
  - Toxicity to soil invertebrates and plants
  - Groundwater flow to freshwater surface water
  - Groundwater flow for livestock
  - Groundwater flow for irrigation
- CSR Schedule 3.1 Part 2 Generic Numerical Soil Standards to protect human health for urban park land use; and
- CSR Schedule 3.1 Part 3 Generic Numerical Soil Standards to protect ecological health for urban park land use.

1.2 SEDIMENT STANDARDS

CSR Schedule 3.4 standards are dependent on water type and if it is anticipated whether or not the sediment would be capable of supporting aquatic life. The Site-specific information regarding aquatic life in sediment is presented in the table below:

Sensitive Sediment Determination[3]	
Is the water type above the sediment marine or freshwater?	Freshwater- Kitsucksis Creek
Was aquatic life observed on-Site including phytoplankton, zooplankton, benthos, macrophytes, or fish?	Yes
Is it a habitat used by endangered or threatened species, or species of special concern under the *Species at Risk Act?*	No evidence
Is the water body important to the preservation of fish or wildlife?	Yes
Does the water body reach aquatic habitats important to fish spawning or rearing fish?	Yes
Does the water body reach aquatic environments designed or used for habitat restoration or border habitat compensation areas?	Yes
Is the area and aquatic habitat included in a wildlife management area under the *Wildlife Act?*	No

Based on the table above, the applicable CSR standards for sediment at the Site is the CSR Schedule 3.4 Generic Numerical Sediment Criteria for freshwater sensitive sediment, herein referred to as the 'applicable standards'.

[3] Contaminated Sites Regulation (1996). Definition of Sensitive Sediment. Accessed from: http://www.bclaws.ca/Recon/document/ID/freeside/375_96_01

1.3 Groundwater and Surface water Standards

The CSR Protocol 21 – Water Use Determination outlines there are four defined uses and standards for groundwater: freshwater and/or aquatic life, drinking water, irrigation, and livestock. The CSR Technical Guidance 15 – Concentration Limits for the Protection of Aquatic Receiving Environments is also used to determine standards appropriate for groundwater and surface water application within the Site. The Site-specific information regarding water used determination is presented in the table below:

Water Use Determination	
Distance and type of nearest surface water bodies[4]	Kitsucksus Creek (freshwater) located within the northeast portion of the Site running north to south.
Are the aquatic water use standards applicable to the Site, as per the CSR Protocol 21?	Yes
Has a successful investigation into the drinking water pathway been conducted, as per the CSR Protocol 21 and the pathway eliminated?	Yes – on-Site well drilled in 1997 down to 540 ft, indicated approximately 90 ft of till overlaying bedrock. Natural water quality was deemed poor due based on review of provided analytical groundwater results.
Are the irrigation and livestock pathways applicable, as per the CSR Protocol 21?	Not anticipated within the Subject Property. Shallow groundwater and surface water use for livestock watering and irrigation potentially occurs on neighbouring properties.
Are groundwater investigations within 10 m of the high water mark of an aquatic receiving environment, as per CSR Technical Guidance (TG) 15?	Yes
Is surface water and porewater <10 m from HWM located within a receiving environment other then a maintained watercourse present within the Site, as per TG 15?	Yes

Based on the table above, the applicable CSR standards for groundwater at the Site are the CSR Schedule 3.2 Generic Numerical Water Standards for irrigation and livestock use and the freshwater aquatic use.

[4] BC Ministry of Environment (2018). BC Water Resources Atlas. Available from http://maps.gov.bc.ca/ess/sv/wrbc/

1.4 VAPOUR STANDARDS

The CSR Schedule 3.3 Generic Numerical Vapour Standards identify five possible sets of standards based on land use. The applicable vapour standard for this Site is based on currently understood anticipated land use as residential. Buildings within 30 m of any collected or calculated samples are likely used for urban park and residential purposes. Residential vapour standard is herein referred to as the 'applicable standards'.

Analytical vapour results or calculated soil or groundwater samples are not compared directly to the Schedule 3.3 standards. The appropriate attenuation factors (for indoor and/or outdoor air) are first applied, based on the depth of the sample. These attenuated concentrations are then applied to the Schedule 3.3 applicable standards.

APPENDIX H.

MINISTRY OF ENVIRONMENT SITE REGISTRY

As Of: JAN 06, 2019 BC Online: Site Registry 19/01/07
For: PB84632 TERRAWEST ENVIRONMENTAL INC 14:45:26
Folio: DCMM19-01 Page 1

1 records selected for 0.5 km from latitude 49 deg, 18 min, 39.8 sec
and Longitude 124 deg, 49 min, 36.1 sec

Site Id	Lastupd	Address / City
0001715		5633 SMITH ROAD PORT ALBERNI

Detail Report
SITE LOCATION
Site ID: 1715 Latitude: 49d 18m 38.4s
Victoria File: Longitude: 124d 49m 34.8s
Regional File: 26250-20/1715
Region: NANAIMO, VANCOUVER ISLAND

Site Address: 5633 SMITH ROAD
City: PORT ALBERNI Prov/State: BC
Postal Code:

Registered: OCT 09, 1997 Updated: Detail Removed:

Notations: 6 Participants: 13 Associated Sites: 0
Documents: 3 Susp. Land Use: 5 Parcel Descriptions: 1

Location Description: SMITH ROAD & DEBEAUX ROAD LOCATION DERIVED FROM GPS PROJECT ENVIC RVR #P110121A

Record Status: NOT ASSIGNED
Fee category: UNRANKED

= =
NOTATIONS

Notation Type: SITE INVESTIGATION REPORT SUBMITTED
Notation Class: ADMINISTRATIVE
Initiated: APR 07, 1995 Approved: APR 07, 1995

Ministry Contact: PATTEN, BARRY

Notation Participants Notation Roles
ENVIROCHEM SPECIAL PROJECTS INC (NORTH VANCOUVER) SUBMITTED BY
CITY OF PORT ALBERNI (PORT ALBERNI) REQUESTED BY

Note: METALS CONTAMINATED SOILS SURROUNDING BLACKSMITH SHOP
- -
Notation Type: CASE MANAGEMENT ITEM
Notation Class: ADMINISTRATIVE
Initiated: APR 03, 1995 Approved: APR 03, 1995

Ministry Contact: PATTEN, BARRY

Note: SOIL SUITABLE FOR DISPOSAL AT PORT ALBERNI REGIONAL LANDFILL. (SOILS FROM BLACKSMITH SHOP)

- -
Notation Type: SITE INVESTIGATION REPORT SUBMITTED
Notation Class: ADMINISTRATIVE
Initiated: MAY 10, 1994 Approved: MAY 10, 1994

Ministry Contact: DAVIES, ROBERT J

Notation Participants Notation Roles

CITY OF PORT ALBERNI (PORT ALBERNI) SUBMITTED BY

Note: FUEL OIL SPILL ON SITE
- -
Notation Type: CONCENTRATION CRITERIA APPROACH USED
Notation Class: ADMINISTRATIVE
Initiated: MAY 10, 1994 Approved: MAY 10, 1994

Ministry Contact: DAVIES, ROBERT J
- -
Notation Type: REMEDIATION PLAN REPORT SUBMITTED
Notation Class: ADMINISTRATIVE
Initiated: MAY 10, 1994 Approved: MAY 10, 1994

Ministry Contact: DAVIES, ROBERT J

Notation Participants Notation Roles
CITY OF PORT ALBERNI (PORT ALBERNI) SUBMITTED BY

Note: FUEL OIL SPILL ON SITE
- -
Notation Type: SITE INVESTIGATION REPORT SUBMITTED
Notation Class: ADMINISTRATIVE
Initiated: AUG 27, 1993 Approved: AUG 27, 1993

Ministry Contact: DAVIES, ROBERT J

Notation Participants Notation Roles
MINISTRY OF SMALL BUSINESS, TOURISM, AND CULTURE SUBMITTED BY
(VICTORIA)
CITY OF PORT ALBERNI (PORT ALBERNI) REQUESTED BY

Note: PRELIMINARY
= =
SITE PARTICIPANTS

Participant: ALBERNI-CLAYOQUOT REGIONAL DISTRICT
Role(s): LANDFILL OPERATOR/OWNER
MUNICIPAL/REGIONAL CONTACT
Start Date: APR 03, 1995 End Date:
- -
Participant: CANTEST LIMITED (VANCOUVER)
Role(s): ANALYTICAL LAB
Start Date: FEB 22, 1995 End Date:
- -
Participant: CITY OF PORT ALBERNI (PORT ALBERNI)
Role(s): FORMER PROPERTY OWNER
MUNICIPAL/REGIONAL CONTACT
Start Date: MAY 04, 1992 End Date: APR 09, 1997
Notes: ERIC MCCORMICK
- -

SITE PARTICIPANTS

Participant: DAVIES, ROBERT J
Role(s): MAIN MINISTRY CONTACT
Start Date: AUG 24, 1993 End Date: MAR 31, 2004
- -
Participant: ENVIROCHEM SPECIAL PROJECTS INC (NORTH VANCOUVER)
Role(s): ENVIRONMENTAL CONSULTANT/CONTRACTOR
Start Date: JAN 01, 1994 End Date:
Notes: LINDA EASTCOTT
- -
Participant: ENVIRONMENT CANADA, CANADIAN PARKS SERVICES (VANCOUVER)
Role(s): ENVIRONMENT CANADA CONTACT
Start Date: MAY 04, 1992 End Date:
Notes: BRIAN WELLER
- -
Participant: HBT AGRA LIMITED (VICTORIA)
Role(s): ENVIRONMENTAL CONSULTANT/CONTRACTOR
Start Date: OCT 24, 1993 End Date:
Notes: T. STEMP
- -

Participant: MACMILLAN BLOEDEL LIMITED (TIMBERLANDS AND PROPERTIES DIVISION)
Role(s): PROPERTY OWNER
Start Date: APR 10, 1997 End Date:
- -
Participant: MINISTRY OF SMALL BUSINESS, TOURISM, AND CULTURE (VICTORIA)
Role(s): ASSOCIATED PROVINCIAL GOVERNMENT CONTACT
Start Date: JUL 01, 1992 End Date:
Notes: BARRY CAMPBELL
- -
Participant: PATTEN, BARRY
Role(s): ALTERNATE MINISTRY CONTACT
Start Date: APR 03, 1995 End Date: MAR 31, 2003
- -
Participant: PUBLIC WORKS CANADA (CALGARY, AB)
Role(s): ASSOCIATED FEDERAL GOVERNMENT CONTACT
Start Date: MAY 04, 1992 End Date:
Notes: LIZ BAKER
- -
Participant: RB MCLEAN LUMBER CO
Role(s): FORMER OPERATOR
FORMER PROPERTY OWNER
Start Date: JAN 01, 1920 End Date: JAN 01, 1964
Notes: HISTORICAL START DATE
- -
Participant: ZENON ENVIRONMENTAL INC (BURNABY)
Role(s): ANALYTICAL LAB
Start Date: DEC 29, 1993 End Date:
= =
DOCUMENTS

Title: METAL CONTAMINATED SOIL DISPOSAL - MCLEAN MILL HISTORIC SITE

Authored: MAR 29, 1995 Submitted: APR 07, 1995

Participants	Role
ENVIROCHEM SPECIAL PROJECTS INC (NORTH VANCOUVER)	AUTHOR
CITY OF PORT ALBERNI (PORT ALBERNI)	COMMISSIONER
PATTEN, BARRY	REVIEWER

- -
Title: OIL SPILL CLEAN UP - NATIONAL HISTORIC MILL SITE, PORT ALBERNI, B.C.

Authored: APR 14, 1994 Submitted: MAY 10, 1994

Participants	Role
HBT AGRA LIMITED (VICTORIA)	AUTHOR
CITY OF PORT ALBERNI (PORT ALBERNI)	COMMISSIONER
DAVIES, ROBERT J	REVIEWER

- -

Title: INVESTIGATION OF POTENTIAL SITE CONTAMINATION AT MCLEAN MILL, PORT ALBERNI

Authored: MAY 04, 1992 Submitted: AUG 27, 1993

Participants	Role
PUBLIC WORKS CANADA (CALGARY, AB)	AUTHOR
ENVIRONMENT CANADA, CANADIAN PARKS SERVICES (VANCOUVER)	AUTHOR
CITY OF PORT ALBERNI (PORT ALBERNI)	COMMISSIONER
DAVIES, ROBERT J	REVIEWER

= =

SUSPECTED LAND USE

Description: AUTO/TRUCK/BUS/SUBWAY/OTHER VEHICLE REPAIR/SALVAGE/WRECKING
Notes:

- -

Description: BATTERY (LEAD ACID/OTHER) MANUFACTURING/WHOLSALE BULK STORAG
Notes:

- -

Description: PETRO. PROD., /PRODUCE WATER STRG ABVEGRND/UNDERGRND TANK
Notes:

- -

Description: TREATED WOOD STORAGE AT THE SITE OF TREATMENT
Notes:

- -

Description: WOOD TREATMENT (ANTISAPSTAIN OR PRESERVATION)
Notes:

= =

PARCEL DESCRIPTIONS

Date Added: NOV 23, 1995 Crown Land PIN#:
LTO PID#: 008770883 Crown Land File#:
Land Desc: DISTRICT LOT 106, ALBENRI DISTRICT, EXCEPT PARTS IN PLANS 277 RW,VIP57991 AND VIP65072

No activities were reported for this site

End of Detail Report

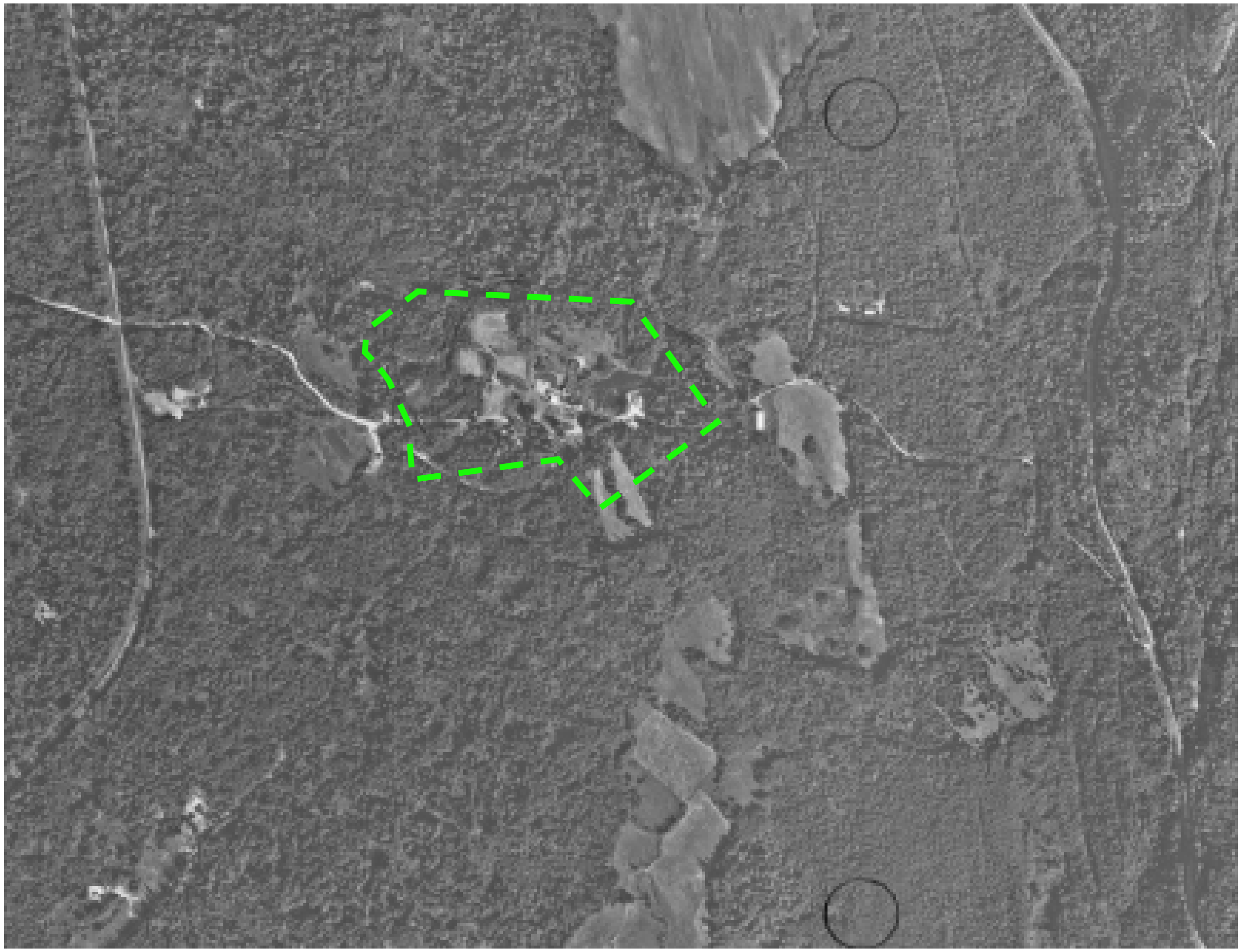
APPENDIX I.

SELECT AERIAL PHOTOGRAPH EXCERPTS

Note: Green dashed line indicates approximate property boundaries.

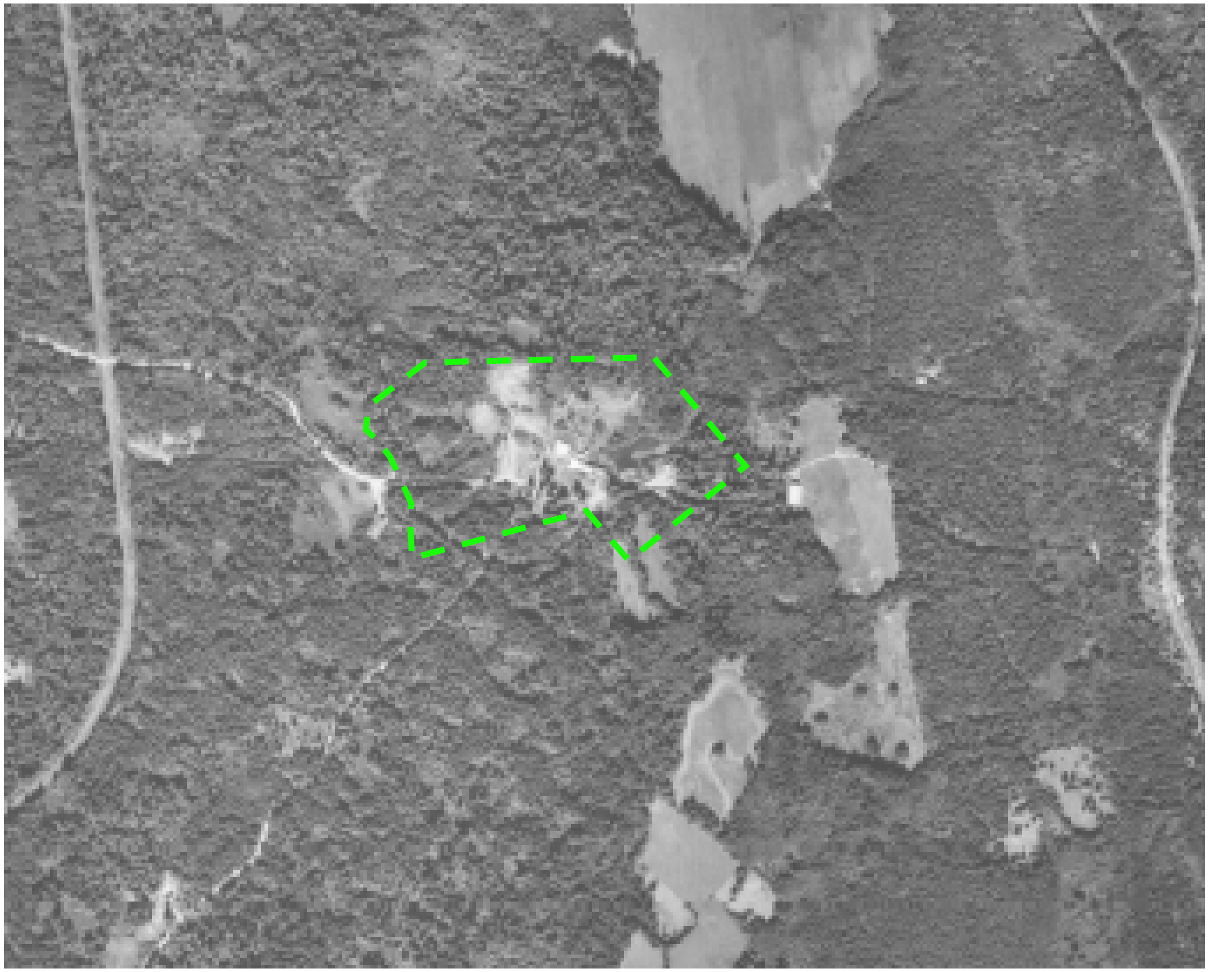
1957

Note: Green dashed line indicates approximate property boundaries.



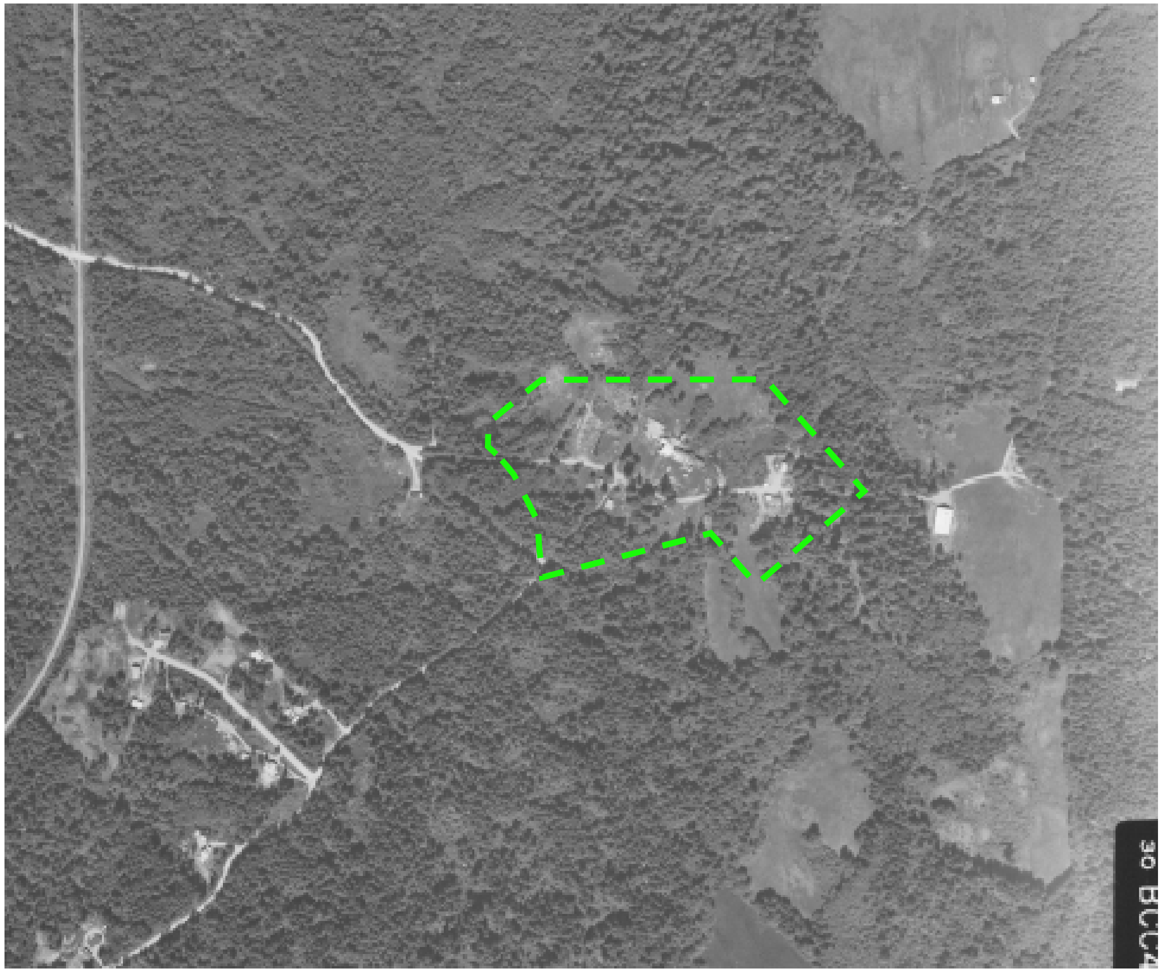
1968

Note: Green dashed line indicates approximate property boundaries.



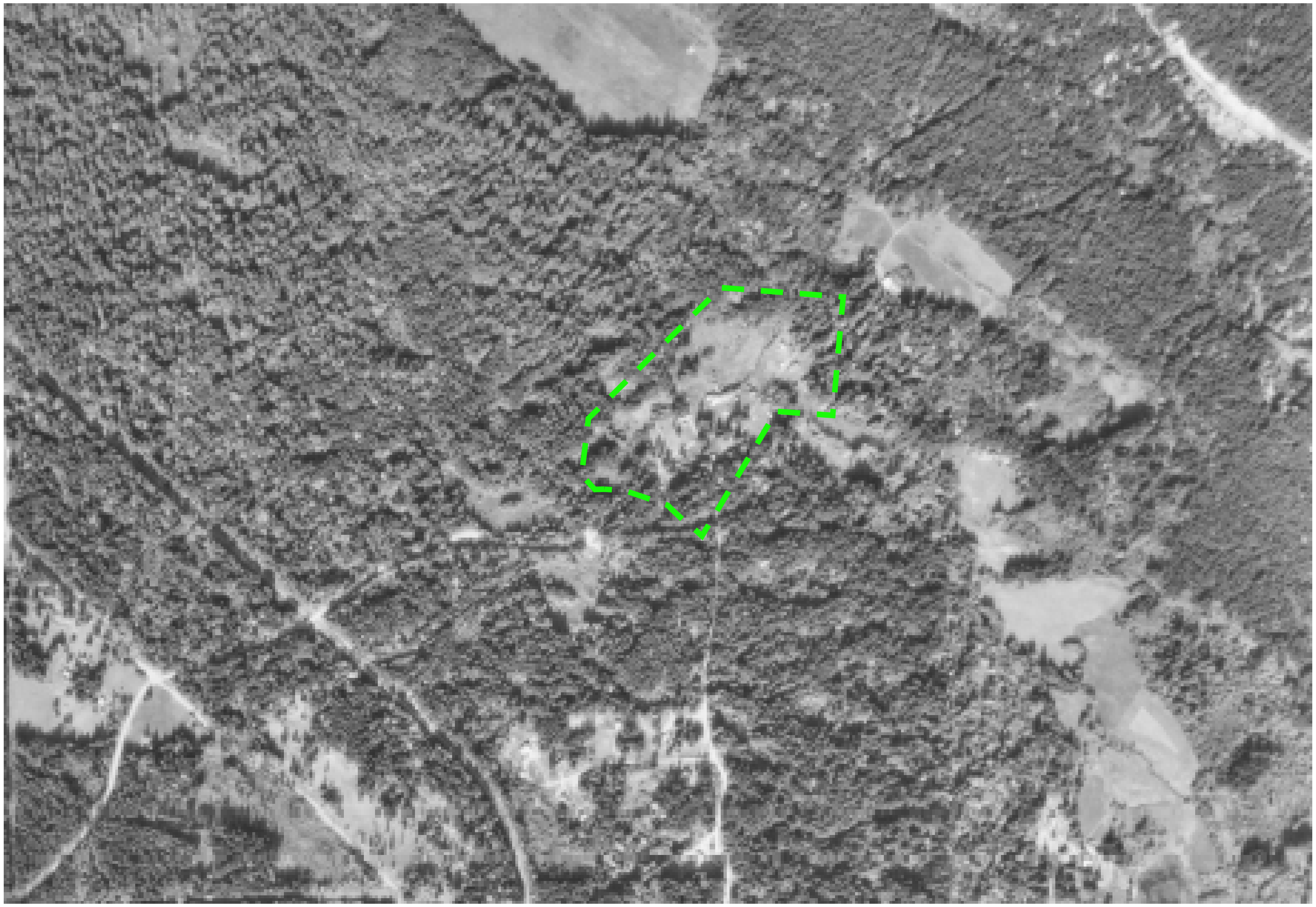
1975

Note: Green dashed line indicates approximate property boundaries.



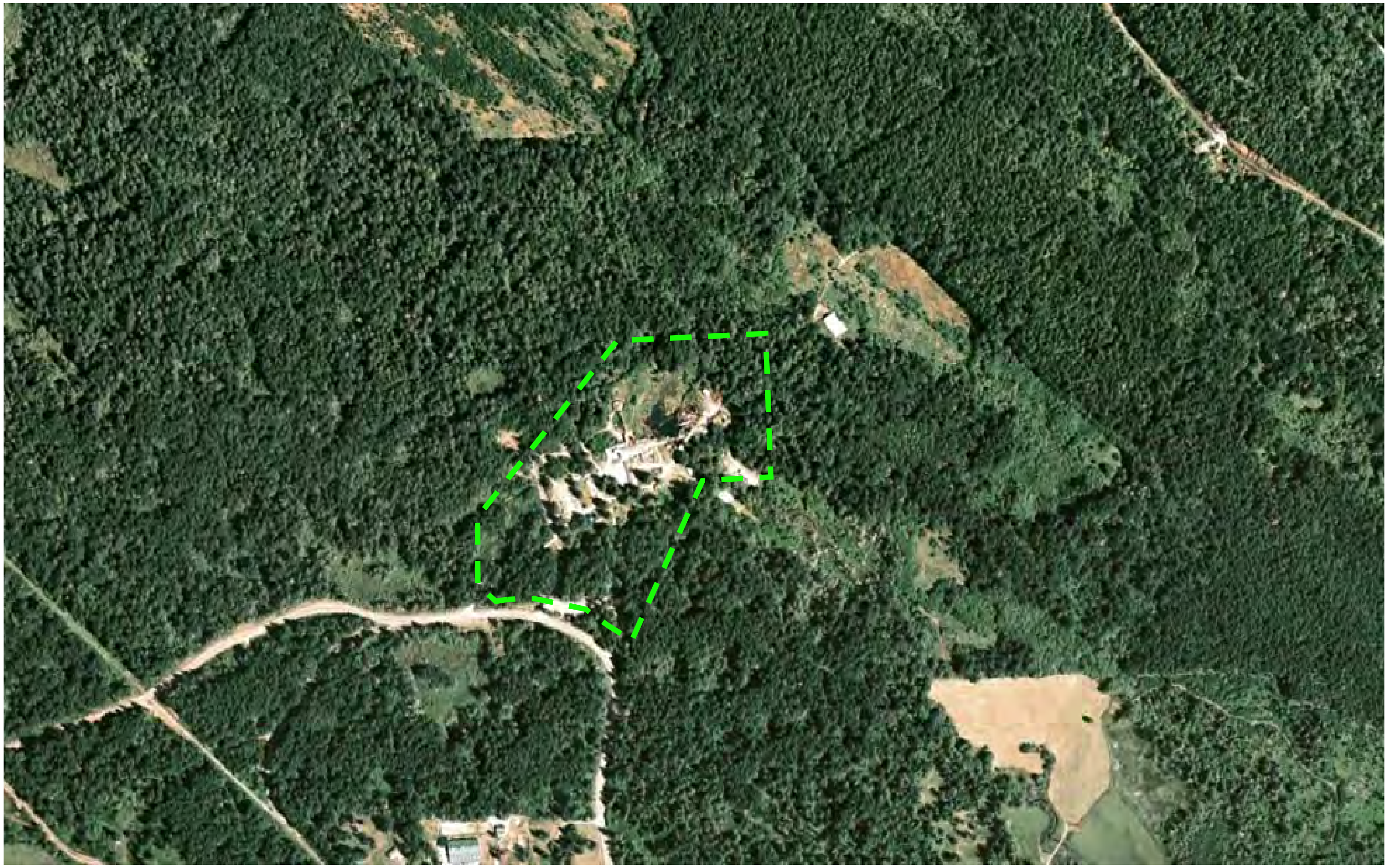
1982

Note: Green dashed line indicates approximate property boundaries.



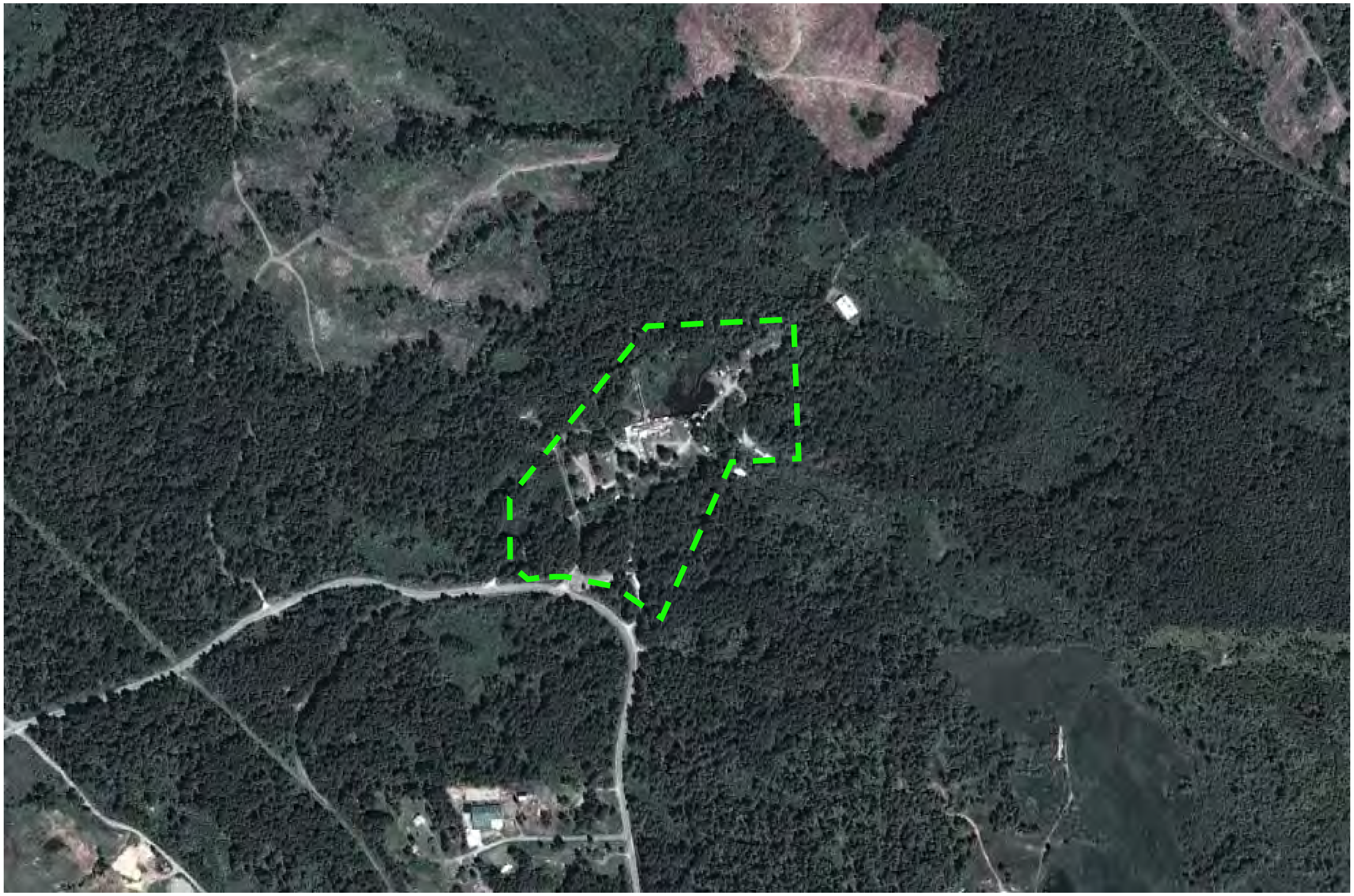
1992

Note: Green dashed line indicates approximate property boundaries.



2005

Note: Green dashed line indicates approximate property boundaries.

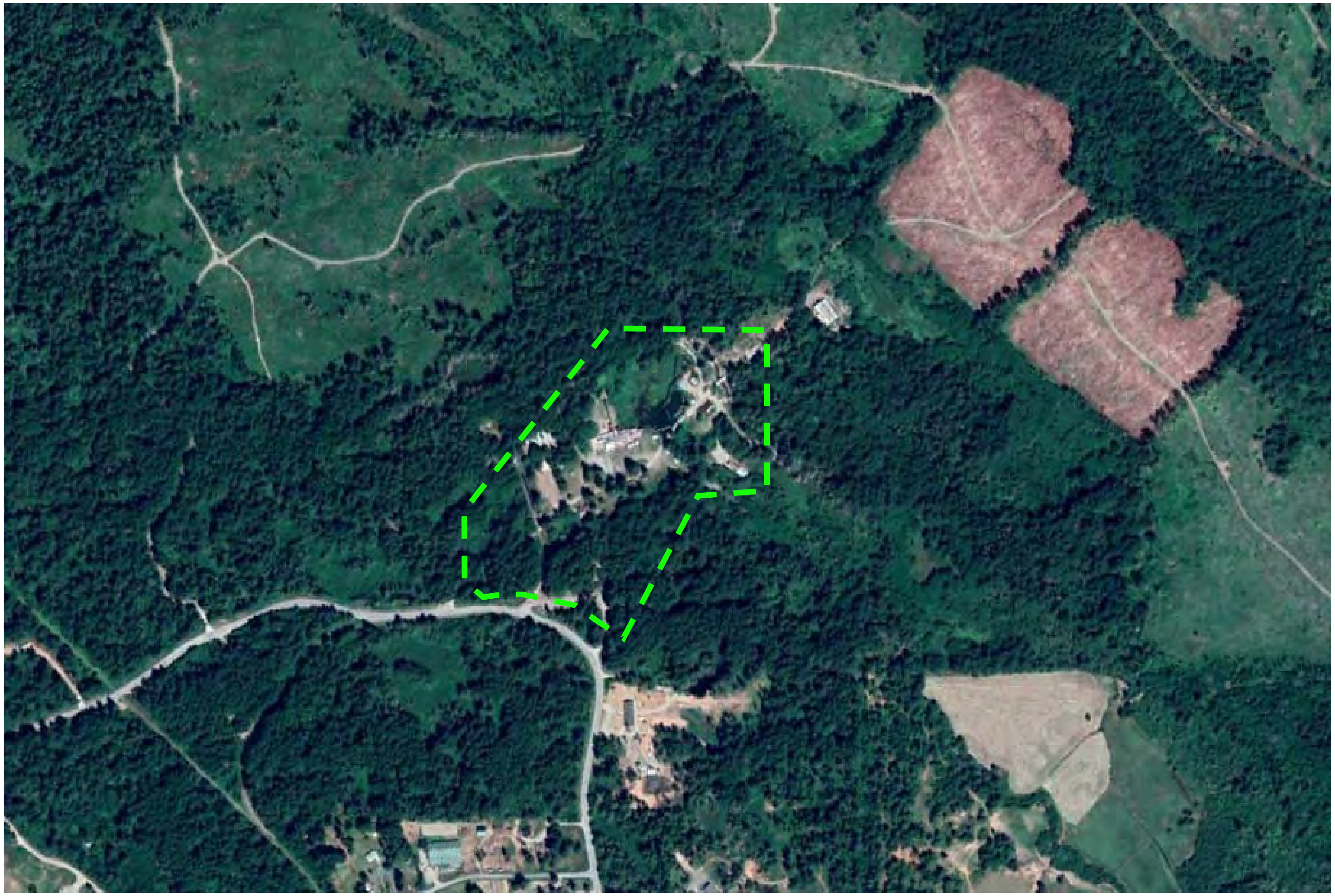


2012

Note: Green dashed line indicates approximate property boundaries.

2015

Note: Green dashed line indicates approximate property boundaries.



2018

APPENDIX J.

SITE INSPECTION PHOTOGRAPHS

Photo 1. North from parking lot area towards Visitors Centre-Hall-1 and main pedestrian entrance to the Site.

Photo 2. North towards Gift Shop former Café- 2.

Photo 3. Viewing northwest towards Waste Collection Area-5

Photo 4. Viewing southeast towards the north side of the A. McLean House-7 (AEC 16) .

Photo 5. Southwest side of A. McLean House-7 and heating oil AST (AEC16).

Photo 6. View northwest towards portion of former treated wood storage area. Locie shed and Caretaker RV visible in background.

Photo 7. View northwest towards end of rail spur.

Photo 8. Photo taken of west side of Fuel Tanker Car-18 (APEC 19).

Photo 9. Secondary containment of fuel transfer area under Fuel Tanker Car-18 (APEC 19).

Photo 10. View northwest towards the former Dip Tank-17 (AEC 8).

Photo 11. View west towards full and partially full drums within the former Loading Deck area-17 (AEC 8).

Photo 12. View north towards a Tanker- 36 located off-Site.

Photo 13. View northeast towards the Waste Burn Pile-24 (AEC 13).

Photo 14. View north towards the Green Chain-23, mill building visible in background.

Photo 15. View northwest towards the Mill-21 (AEC 3).

Photo 16. View north towards the former Transformers-26 (APEC 15).

Photo 17. View northeast towards the Blacksmith Shop-29 (AEC 1).

Photo 18. View northwest towards the Oil Shed/Pump House-28 (AEC 7).

Photo 19. View north towards the Mill Pond-37 (AEC 14).

Photo 20. View north towards the Gas and Oil Shed-31 (AEC 5).

Photo 21. View southeast towards former diesel AST located north side of Oil Shed- 31 (AEC 5).

Photo 22. View northeast towards the Garage-32 (AEC 4).

Photo 23. View northwest towards the Small Parts Shed-33, Machine Shop-34 seen in background (AEC 2).

Photo 24. View northeast towards Steam Donkey and Spar Pole-39.