



Devon Canada Corporation
1600, 324 - 8th Avenue S.W.
Calgary, Alberta T2P 2Z5
Phone: (403) 232-7100

January 29th, 2003

Northwest Territories Water Board
PO Box 1500
2nd Floor Goga Cho Building
Yellowknife, NWT
X1A 2R3

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BOARD.	6
G.W.	1
E.A.	1
W. RES.	ORIE
File-	1777

Attention: Mr. Gordon Wray - Chairman NWT Water Board

Re: Quality Assurance / Quality Control Plan Water License # N7L1-1777

Dear Mr. Wray,


Attached is a copy of Devon Canada Corporation's Quality Assurance/Quality Control Plan associated with Northwest Territories Water Board License # N7L1 - 1777.

This plan is intended to fulfill the requirement outlined in the Surveillance Network Program in Section B, subsection 6 of Water License No. N7L1-1777. However, as Devon was not assigned this license until December 13th, 2002, this QA/QC plan is being submitted prior to January 31st, 2003 as opposed to January 31st, 2002, the date identified in Water License No. N7L1-1777.

A copy of this Plan has been faxed directly to the Analyst responsible for this license (Kathleen Puznicki), as well as to the Inuvik INAC Office (Rob Walker). Any modifications made as a result of Kathleen's review will be forwarded to your office.

If there are any concerns with respect to any of the enclosed information please do not hesitate to contact me.

Sincerely,


Pete Millman
Environmental Planner
Devon Canada Corporation
Ph: (403) 232-7294
Fax (403) 232-7211
Email: peter.millman@devoncanada.com
cc: Kathleen Puznick - INAC, Rob Walker - INAC



Quality Assurance/Quality Control Plan Devon Canada Corporation

Northwest Territories Water Board License # N7L1 – 1777

Submitted by: Pete Millman
Environmental Planner, Devon Canada Corporation
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e-mail: peter.millman@devoncanada.com

Submitted To:
Kathleen Puznicki - Analyst
Indian and Northern Affairs Canada
Phone: (867) 669-2781 fax: (867) 669-2718

Date: January 29, 2003

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ATTACHMENTS

Attachment 1 Laboratory Supporting Information - Accreditation & Methods - Hydroqual

Attachment 2 Laboratory Supporting Information - Accreditation & Methods - Norwest

Attachment 3 Laboratory Supporting Information – Detection Limits- Norwest

1. INTRODUCTION AND DEFINITIONS

1.1 Introduction

The purpose of this document is to provide detailed information with respect to the sampling and analytical requirements for Water License No. N7L1-1777. The Northwest Territories Water Board assigned this license to Devon Canada Corporation on December 13th, 2002.

As indicated in the above noted water license Devon is responsible for collecting and analyzing water samples at the following locations:

Sampling Station 1777-1 – discharge from the sewage treatment facilities

Sampling Station 1777-2 - drilling waste prior to entering the drilling sump

The sampling procedures and equipment needed for each of the above sampling stations will differ. For this reason sections of this QA/QC Plan are divided into subsections corresponding to the above sampling stations.

This plan is also intended to fulfill the requirement outlined in the Surveillance Network Program in Section B, subsection 6 of Water License No. N7L1-1777. However, as Devon was not assigned this license until December 13th, 2002, this QA/QC plan is being submitted prior to January 31st, 2003 as opposed to January 31st, 2002, the date identified in Water License No. N7L1-1777.

1.2 Definitions

“Abandonment” means the clean-up and final disposition of Drilling Waste materials;

“Analyst” means an analyst as designated under the Northwest Territories Water Act;

“Average Concentration” means the running average of any four consecutive analytical results, or if less than four results, the running average of the results collected.

“Decanting” means a process by were the water phase of the Drilling Waste is separated and prepared for disposal.

“Deposition” means the resultant disposal method and/or treatment of Drilling Waste and will identify location details as well.

“Drilling Waste” means the spent materials typically mixtures of clay, water and/or additives pumped down hole and as identified under the Northwest Territories Water Act.

“Inspector” means an Inspector as designated by the Minister under the Northwest Territories Water Act;

“Licensee” Means the holder of this License;

“Minister” means the Minister of Indian Affairs and Northern Development;

“Representative” means the sampling protocol as outlined by the Water Board in its Analytical Requirements appendix;

“Sump” means an excavation with an impermeable layer for the purpose of catching or storing fluids;

2. SAMPLE COLLECTION

2.1 Location

Two sample locations have been identified in the license. These locations are:

- 1777-1 Sewage treatment system - rig camp sewage treatment discharge (F29 well)
UTM 516019.69 E 7595331.1N or Lat/Long 68° 28' 18.3" N 134° 36' 31.8" W
- 1777-2 Drilling sump (F29 well)
UTM 516019.69 E 7595331.1N or Lat/Long 68° 28' 18.3" N 134° 36' 31.8" W

1777-1

Samples are collected after the last treatment element of the sewage treatment system. Samples will be taken from the stream exiting the disinfection unit or as the stream enters the discharge tank. Periodically a sample will be taken at the end of discharge (tank loadout). The effluent stream exiting the disinfection will be identified with a sign.

1777-2

A composite sample is obtained from the drilling fluid system. The collection location will be from the last piece of processing equipment prior to the drilling fluid being deposited in the sump.

2.2 Sampling Equipment

1777-1

The following equipment is required for sample collection at the rig camp sewage treatment system. The appropriate container and preservative is outlined in the methods section of this document.

- Disposable latex or chemical resistant gloves
- Protective non-slip chemical resistant waterproof footwear
- Safety glasses
- Hearing protection if necessary
- Squirt bottle with low concentration cleaning solution to clean funnel prior to collecting sample
- Bulk sample collection container with pour spout and handle. Minimum volume of collection container is 2.5 L so that all samples required can be poured from one bulk sample collected in container, container must be plastic
- Funnel with narrow neck to transfer sample from the bulk container to sample bottles
- Two clean towels or lint free rags
- Clear packing tape
- Electrical tape

- Cold packs frozen to keep samples from getting warm during transport to lab
- Shipping cooler with carry handle – supplied by lab
- Bubble wrap or material to protect samples during transport
- Sample bottles – provided by lab
- Sample labels
- Shipping documentation (chain of custody)
- Preservative chemicals for collected samples.

1777-2

Sampling equipment for the collection of representative samples of drilling wastes will vary depending on the physical state of the waste being sampled. The table below is a list of equipment used for various situations.

<u>Equipment</u>	<u>Physical state of Drilling Waste</u>
Grab Sampling Tool	<i>Mainly liquid state, $>1200\text{kg/m}^3$</i>
PVC Sampling Device	<i>Heavy liquids/solids, $>1200\text{kg/m}^3$</i>

Grab Sampling Tool – Cylindrical tube approximately 50cm in length and available in varying diameters with a stop (floating ball) valve installed at the bottom end and a recovery strap/rope at the top, typically construction is stainless steel. As tool is lowered into waste material valve is opened and waste enters tube. As the tube is removed vertically the ball valve is forced closed and waste sample remains for collection.

PVC Sampling Tube – Cylindrical tube approximately 200cm in length and available in varying diameters with a fixed ball or butterfly valve installed at the top, typically construction is PVC. As the open end of the sampling tube is lowered into the waste material and providing the top end valve is open the waste material will flow up and into the sampling tube. When the desired volume or depth is reached the top end valve is closed and the tube can be removed from the waste material. Contained within a sample remains for collection.

Sample containers will be appropriately matched to the waste being collected and/or the analyses desired. The use of new bottles or containers will be preferred and recommended, but in the event re-use is required the appropriate procedure as outlined by the manufacture and the Water Resources Board will be followed to ensure cross-contamination is not an issue.

2.3 Sampling Methods

Log books will be used to record any sample collection and water resistant markers will be used to mark the sample information on the bottles.

1777-1

The procedures for collecting samples from the sewage treatment system are outlined below.

1. Ensure all required equipment for collection and transportation is on hand.
2. Put on personal protective gear.
3. Label all bottles appropriately, including sample location as listed in the water license and date of sample.
4. Cover bottle labels with clear packaging tape to protect label information.
5. Clean funnel with weak cleaning solution and wipe it dry with one of the clean rags.
6. Clean bulk sample collection container with weak cleaning solution. Empty cleaning solution from sample collection container into discharge tank.
7. Place the bulk sample container directly beneath treated effluent flow such that the entire stream is directed into the collection container. Collect approximately 2 L of sample.
8. Place funnel into first sample bottle and fill from bulk sample container. It is **not required** to fill sample bottles to overflowing.
9. Remove funnel from bottle. Wipe bottle dry with other clean rag, replace bottle cap and seal cap with electrical tape to prevent the cap from coming loose and spilling sample during transport.
10. Pack sample into cooler.
11. Repeat procedure until all required samples are collected.
12. Pack samples in ice packs and packing material to prevent them from damage during transport. Fill out appropriate documentation from the lab.

1777-2

Sampling methods and the use of specialized equipment to obtain representative samples has been briefly described in the previous section 2.2 Sampling Equipment. In general the plunging technique as described by the Water Resources Board will be utilized. If necessary, approximately 2% of the sample container capacity will remain as a void to provide for mixing, preservative addition and thermal expansion. Oil & grease sampling will capture the first submersion and not rinsed.

Devon will be disposing of drilling waste in the sump as indicated in Water License No. N7L1-1777. However, instead of sampling the frozen sump at the end of the drilling program, Devon will be sampling throughout the program in order to obtain a

representative sample during the operation. In response, the methodology identified in *Appendix - A Sampling and Analytical Requirements for Characterization of Sump Supernatant Fluids* has been modified. This modified methodology is outlined below. The modification has been designed to ensure that representative sampling of the sump occurs as intended. The three sections identified below (1. Surface Hole, 2. Main Hole, 3. Top/Fast Hole) represent the three sections of the well that are drilled during the drilling program, and thus are representative of the drilling waste for the drilling program. Should a second well be drilled, the drilling waste will be sampled in a similar manner.

APPENDIX A – SAMPLING AND ANALYTICAL REQUIREMENTS For CHARACTERIZATION OF SUMP SUPERNATANT FLUIDS

1. Surface Hole

-Six 1 litre samples of encapsulated surface hole drilling fluid will be collected by 'grab' sampling – (collecting fluid samples directly off the encapsulation equipment). These Six 1 litre samples will be mixed together to form a single composite sample of post encapsulated surface hole drilling fluid.

2. Top/Fast Hole

-Six 1 litre samples of encapsulated top hole drilling fluid will be collected by 'grab' sampling – (collecting fluid samples directly off the encapsulation equipment). These Six 1 litre samples will be mixed together to form a single composite sample of post encapsulated top hole drilling fluid.

3. Main Hole

-Six 1 litre samples of encapsulated main hole drilling fluid will be collected by 'grab' sampling – (collecting fluid samples directly off the encapsulation equipment). These Six 1 litre samples will be mixed together to form a single composite sample of post encapsulated main hole drilling fluid.

Each of the 3 composite samples will be analyzed for the parameters identified in *Appendix - A Sampling and Analytical Requirements for Characterization of Sump Supernatant Fluids*. In addition Devon will also test the above samples for:

- Total Chloride
- Total Reactive Chlorine
- Total Calcium
- Total Sodium
- Total Sulphur

3. SAMPLE HANDLING

3.1 Preservation

1777-1

Once collected, the samples should be immediately shipped for analysis. Samples are to be at the laboratory within 48 hrs. of being collected. The following table outlines sample size, appropriate preservative and the container to be used for each type of sample.

Test	Sample Size	Preservation	Shelf Life	Container
BOD ₅	1000 ml	Refrigerate 4°C	48 hrs.	Class-colored
TSS	500 ml	Refrigerate 4°C	N/A	Plastic-opaque
Fecal Coliforms	250 ml	Sodium Thiosulfate (white powder) Refrigerate 4°C	24 – 48 hrs.	Plastic clear
pH	500 ml	Refrigerate 4°C	72 hrs.	Plastic-opaque
Ammonia	250 ml	2 ml 1:1 H ₂ SO ₄ (25%) (liquid) Refrigerate 4°C	28 days	Plastic-opaque
Oil and Grease	1000 ml	2 ml 1:1 HCl (50%) (liquid)	N/A	Class-colored
Total Residual Chlorine	500 ml	No requirements	24 hrs.	Plastic-opaque

1777-2

In most cases preservation will not become a significant issue, as analysis will take place soon after the sample has been collected. Drilling waste analytical results will not be significantly affected provided analysis can be conducted soon after sampling. The recommended maximum elapsed time between sampling and analysis is 72 hours. The most critical preservation variable will be temperature. Temperature can be controlled by the use of sample coolers. In the event that circumstances dictate further preservation the appropriate techniques as outlined by the Water Resources Board will be followed.

Samples will be collected and stored in the appropriate containers as dictated by the required analysis they are to be subjected to. Acid washed jars with Teflon lids are required for samples that will be analyzed for organic components such as oil and grease when conducting toxicity testing. Uncolored plastic containers are required for samples that will be analyzed for inorganic components such as salinities, metals, pH and others.

3.2 Sample Identification

Sample identification will occur at the sampling station at the time of sampling by affixing a label on the sample container itself. The label will include: Company name, sample area, SNP number or location, time and date, sample description with sample type (grab or composite) and identify the individual responsible for the sampling operation.

3.3 Transportation

Samples that require transportation will be stored in a fashion that ensures their integrity from the time of collection to the time of delivery. Samples will be sealed and stored upright, and confined to provide snug immobile storage while in transit. Preservation requirements such as refrigeration or warmth due to cold will be provided with coolers, ice packs, and warm storage compartments. Samples will be stored as close to 4°C until analysis can be conducted. Samples will be sent (flown) for testing as soon as possible after sample collection.

4. LAB ANALYSIS

Lab Accreditation (Attachments 1 & 2)

Devon Canada Corporation has identified Norwest Labs and Hydroqual Laboratories Ltd. as the commercial laboratories that will be conducting analyses. Attached is a letter from both labs that identifies their respective accreditations and abilities. Hydroqual Laboratories will only be completing analytical for the 96 hour LC using rainbow trout, all other analytical will be performed by Norwest Labs. Norwest Labs currently holds accreditation by the Canadian Association for Environmental Analytical Laboratories

Methodology (Attachment 1 & 2)

All methods of analysis are outlined in the attached Scope of Accreditation.

Detection Limits (Attachment 3)

Please find attached the detection limits for Norwest Labs identified for all required analytical parameters.

Reporting Requirements

Field blanks and duplicates will be collected at SNP 1777-1 on a monthly basis, and the results will be reported in the corresponding SNP report.

ATTACHMENT 1 - HYDROQUAL LABORATORIES LTD.

SCOPE OF ACCREDITATION AND METHODS

SCOPE OF ACCREDITATION

HYDROQUAL LABORATORIES LTD.

#3, 6125 - 12th Street, S.E.

CALGARY AB T2H 2K1

Accredited Laboratory No. 202

CONTACT: Ms. Becky-Jo Unis

TEL.: (403) 253-7121

FAX.: (403) 252-9363

CLIENTS SERVED: All interested parties.

FIELD(S) OF TESTING: Biological.

PROGRAM SPECIALTY AREA: Environmental

ISSUED ON: 2000-12-07

VALID TO: 2003-03-06

ENVIRONMENTAL AND OCCUPATIONAL HEALTH AND SAFETY

Environmental:

Water (Inorganic)

(BOD (5 Day) - Water)

4.4.1.16; SM 5210 B

D.O. METER

BOD (5 day)

Water (Microbiology)

(Coliforms - Water)

4.4.1.10; SM 9222 B/ SM 9222 D

MEMBRANE FILTRATION

Fecal Coliforms

Total Coliforms

Water (Toxicology)

OFFICIAL/NON-RESTRICTED

Somers

Accredited Laboratory No. 202

(Ceriodaphnia - Water)

4.4.3.2; EPS 1/RM/21, EPA 600/4-89/001

GROWTH AND SURVIVAL
Ceriodaphnia

(Chironomus - Sediment)

4.4.3.16; EPS 1/RM/32

SURVIVAL AND GROWTH
Chironomus

(Daphnia - Water)

4.4.3.1; EPS1/RM/11, EPS1/RM/14,
based on 600/4-90-027F, based on OECD 202

ACUTE LETHALITY
Daphnia LC50 (48 h)

(Earthworm - Soil)

4.4.3.4; EPA 600/3-88-029

SURVIVAL
Eisenia foetida

(Fathead Minnow - Water)

4.4.4.6; EPS 1/RM/22, EPA 600/4-89/001

GROWTH AND SURVIVAL
Fathead minnow

(Hyalella - Sediment)

4.4.3.5; EPS 1/RM/33

SURVIVAL AND GROWTH
Hyalella

(Lemna minor - Water/Sediment)

4.4.2.3; EPS 1/RM/37

GROWTH
Lemna minor

(Marine Amphipods - Sediment)

4.4.3.10; EPS 1/RM/35

SURVIVAL
Amphiporeia virginiana
Eohaustorius estuarius
Eohaustorius washingtonianus

OFFICIAL/NON-RESTRICTED

Somers

Accredited Laboratory No. 202

Marine Amphipods
Rhepoxynius abronius

(Microtox - Water)

4.4.1.3; EPS1/RM/24

BIO LUMINESCENCE
Microtox IC50 (15 min)

(Microtox Basic and Solid Phase - Water)

4.4.1.3; EPS1/RM/24

BIO LUMINESCENCE
Vibro fischeri

(Plant Seedling - Soil)

4.4.2.1; EPA 600/3-88-029

EMERGENCE
Cultivars and native
Lettuce, radish, other
Species

(Selenastrum - Water)

4.4.2.7; EPS 1/RM/25, based on EPA 600/9-78/018,
based on OECD 201

GROWTH INHIBITION
Selenastrum

★ (Trout - Water)

4.4.4.1; EPS1/RM/9, EPS1/RM/13, based on
600/4-90-027F, based on OECD 203

ACUTE LETHALITY
Trout LC50 (96 h)

D.W. Wilson, Director, Conformity Assessment

CAEAL 2800; SCC 1003-15/282
Partner: CAEAL

OFFICIAL/NON-RESTRICTED

Somers

Page 3 of 3

ATTACHMENT 2 - NORWEST LABS
SCOPE OF ACCREDITATION AND METHODS



Standards Council of Canada
Conseil canadien des normes

200-270, rue Albert St.
Ottawa, ON (Canada)
K1P 6N7

Canada

Tel.: +1 613 238 3222

Fax.: +1 613 569 7808

E-mail/Courriel : info@scc.ca

Internet: http://www.scc.ca

SCOPE OF ACCREDITATION

Norwest Soil Research Ltd.
NORWEST LABS-EDMONTON
9938-67 Avenue
Edmonton, Alberta
T6E 0P5

Accredited Laboratory No. 18
(Conforms with requirements of ISO/IEC 17025)

CONTACT: Mr. Robert Lessard TEL.: (780) 438-5522
FAX.: (780) 434-8586
EMAIL : robert.lessard@norwestlabs.com

CLIENTS SERVED: All interested parties.

FIELD(S) OF TESTING: Biological, Chemical/Physical

PROGRAM SPECIALTY AREA: Environmental

ISSUED ON: 2002-12-24 VALID TO: 2006-06-07

ANIMALS AND PLANTS (AGRICULTURE)

Foods and Edible Products:

See the details in the non-environmental scope issued separately.

ENVIRONMENTAL AND OCCUPATIONAL HEALTH AND SAFETY

Environmental:

Compost

(Foreign Matter - Compost)

Standards Council of Canada Accredited Laboratory No. 18

WI PREP 015-10; based on CCME 106E

Foreign Matter

Oil

(Total PCB - Oil)

TO 001-90; ASTM D-4059-96

GC/ECD - EXTRACTION
Total PCB

Soil/Sediment

(Atterberg Limits)

WI SOIL 050-10; based on ASTM D454-59/D423-66

PHYSICAL
Atterberg Limits

(Available Cu/Fe/Mn/Zn - Soil)

WI SOIL 015-10; based on MSS 4.65

ICP - EXTRACTION (DPTA)
Copper
Iron
Manganese
Zinc

(Boron - Soil)

WI SOIL 009-10/ WI METAL 059-10; based on
MSS 4.6

ICP - EXTRACTION (HOT WATER)
Boron

(Bulk Density - Soil)

WI PREP 016-10; based on ALBERTA ENERGY
UTILITIES BOARD, GS0

GRAVIMETRIC
Bulk Density

(Calcium Carbonate - Soil)

WI SOIL 035-10; COM. SOIL SCI PLANT
SCI 28, 841-848, 1997

GRAVIMETRIC
Calcium Carbonate

Standards Council of Canada Accredited Laboratory No. 18

(Chloride - Soil)

WI SOIL 014-10; based on SAA #3 CH 10

AUTOCOLOR - EXTRACTION
Chloride

(Conductivity (paste) - Soil)

WI SOIL 003-10; based on MSS 4.13

CONDUCTIVITY METER
E.C. (sat. paste)

(Conductivity - Soil)

WI SOIL 001-10; based on MSS 4.12/4.13

CONDUCTIVITY METER
E.C. (1:2 water)

(Cyanide - Soil)

WI WET 051-10/ WI WET010-10; based on
LACHAT CYANIDE AND MSS 3.23

COLORIMETRIC - DISTILLATION
Cyanide, Total
Cyanide, Water Soluble

(Extractable N/P/K - Soil)

WI SOIL 016-10/ WET 029-10/ WET 018-10/
WET 024-10; ASHWORTH & MRAZEK
COMMUN. SOIL SCI. MAINT. ANAL.26

COLOR - EXTR (CaCl₂)/NH₄OAC
Nitrogen
Phosphorus
Potassium

(Extractable NH₄/NO₃ - Soil)

WI SOIL 007-10; based on MSS 4.35

COLOR - EXTR (KCL)
Ammonia
Nitrate

(Extractable Na/Ca/Mg/K/C.E.C. - Soil)

WI SOIL 013-10; based on MSS 3.3

ICP - EXTRACTION (ACETATE)
Ammonia
C.E.C.
Calcium
Magnesium
Potassium

Standards Council of Canada Accredited Laboratory No. 18

Sodium

(Extraction - Soil)

WI SOIL 129-10; based on (SSS, 1993 P. 161-166
CARTER, SOIL SAMPLING AND METHODS
OF ANALYSIS)

SALINITY - AS RECEIVED
Extract

(Fluoride - Soil)

WI WET 094-10; based on MSA, P. 850-852, SSSA SERIES 5 FLUORIDE BY FUSION
Fluoride

(Hydrocarbons - Soil)

WI OIL 027-10; based on ACOSA REF. METHOD DEAN STARK
Oil Fraction
Solids Fraction
Water Fraction

(Lime Requirement - Soil)

WI SOIL 060-10; based on SSMA 14, 1993,
TRAN VAN LEROP

SMP LIME REQ
Lime Requirement - Soil

(Mercury - Soil)

WI METAL 078-10; based on EPA 245.5

COLD VAPOUR AA - DIGESTION
Mercury

(Metals - Soil/Aqua Regia Digest)

WI METALS 079-10; based on BC MELP PBM_SOLIDSMET DEC2000 ICP - DIGESTION

Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium

Standards Council of Canada Accredited Laboratory No. 18

Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Silicon
Silver
Sodium
Strontium
Sulphur
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc
Zirconium

(Metals - Soil/Block Digestion)

WI METAL 077-10; based on EPA 3050 A/3050 B

ICP - DIGESTION

Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese

Standards Council of Canada Accredited Laboratory No. 18

Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Silicon
Silver
Sodium
Strontium
Sulphur
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc
Zirconium

(Metals - Soil/Microwave Digestion)

WI METAL 077-10; based on EPA 3051

ICP - DIGESTION

Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Silicon
Silver

Standards Council of Canada Accredited Laboratory No. 18

Sodium
Strontium
Sulphur
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc
Zirconium

(Organic Matter (LOI) - Soil)

WI SOIL 019-10; based on MSS 3.8

GRAV. COMBUSTION
LOI
Organic Matter by LOI

(Phenols, Total - Soil)

WI WET 058-10; based on LACHAT '97

AUTOCOLOR - DISTILLATION
Phenols, Total

(Saturated Paste - Soil)

WI SOIL 022-10; based on MSS 3.21

SATURATED PASTE
Saturated Paste Extract
Saturation Percentage

(Soluble Sulfate - Soil)

WI SOIL 124-10/ WI WET013; based on MSS 4.4
AND APHA 4500 SO₂ E

AUTOCOLOR
Sulfate

(Sulfur, Elemental - Soil)

WI OILS 011-10; based on CJSS 65

COLORIMETRIC - EXTRACTION
Sulfur, Elemental

(TCLP Leachate - Soil)

WI SOIL 039-10; based on EPA 1311 TCLP

TCLP LEACHATE
Leachate Preparation

Standards Council of Canada Accredited Laboratory No. 18

(Wettability - Soil)

WI SOIL 049-10; based on AB SOIL SCI WORKSHOP
YOUNG. VOL 27, P.59-64, 1990

METHANOL DROPLET TSST
Wettability

(pH (paste) - Soil)

WI SOIL 002-10; MSS 3.14

PH METER
pH (saturated paste)

(pH - Soil)

WI SOIL 021-10/030-10; based on MSS 4.12/3.14

PH METER
pH (0:01 M CaCl₂)
pH (1:2 Water/Soil)

Waste

(Flash Point - Waste)

WI OIL 025-10; based on ASTM D93

CLOSED CUP
Flash Point

(Free Liquids - Waste)

WI SOIL 130-10; based on SW846 9095

PAINT FILTER TEST
Free Liquids - Waste

Water (Inorganic)

(Alkalinity (pH 4.5) - Water)

WI WET 001-10; based on APHA 2320 B

PC TITRATE
Alkalinity (pH 4.5)

(Ammonia - Water)

WI WET 008-10; based on APHA 4500 NH₃ - G

AUTO COLOR
Ammonia

Standards Council of Canada Accredited Laboratory No. 18

(BOD (5 Day) - Water)

WI WET 044-10; based on APHA 5210 B

D.O. METER
BOD (5 day)

(C.O.D. - Water)

WI WET 050-10; based on APHA 5220 D

COLORIMETRIC
COD

(Carbon - Water)

WI WET 047-10; based on APHA 5310 C

IR COMBUSTION
Carbon-Dissolved Inorganic
Carbon-Total
Carbon-Total Inorganic
Carbon-Total Organic
DOC

(Chloride - Water)

WI WET 005-10; based on APHA 4500 Cl E

AUTO COLOR
Chloride

(Chlorine - Water)

WI WET 068-10; based on APHA 4500-CL G

COLORIMETRIC
Chlorine

(Chlorite/Chlorate - Water)

WI WET 093-10; based on EPA 300.0

ION CHROMATOGRAPHY
Chlorate
Chlorite

(Chromium -Hex - Water)

WI WET 075-10; based on APHA 3500 CR C

COLORIMETRIC
Chromium (Hexavalent)

(Color - Water)

WI WET 025-10; based on APHA 2120 B

COLOR COMPARATOR
Color

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(Conductivity (25°C) - Water)

WI WET 001-10; based on APHA 2510 B

PC TITRATE
Conductivity (25°C)

(Cyanate - Water)

WI WET 095-10; based on APHA 4500 CNL

AUTO COLOR
Cyanate - Water

(Cyanide - Water)

WI WET 053-10/ 051-10/ 011-10/ 097-10;
based on ALBERTA ENVIRONMENT
06608L/ EPA 335.3/ LACHAT MANUAL
MD21, 1997/ APHA 4500-CN C.

AUTO COLOR - DISTILLATION
CN (Dissolved)
CN (Total)
CN (WAD)
Cyanide (SAD)

(Dissolved Metals - Water)

WI METAL 080-10/ WI METAL 055-10;
based on APHA 3120 B

ICP
Dissolved Aluminum
Dissolved Antimony
Dissolved Arsenic
Dissolved Barium
Dissolved Beryllium
Dissolved Bismuth
Dissolved Boron
Dissolved Cadmium
Dissolved Calcium
Dissolved Chromium
Dissolved Cobalt
Dissolved Copper
Dissolved Iron
Dissolved Lead
Dissolved Lithium
Dissolved Magnesium
Dissolved Manganese
Dissolved Molybdenum
Dissolved Nickel
Dissolved Phosphorus

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Dissolved Selenium
Dissolved Silicon
Dissolved Silver
Dissolved Strontium
Dissolved Sulphur
Dissolved Thallium
Dissolved Tin
Dissolved Titanium
Dissolved Uranium
Dissolved Vanadium
Dissolved Zinc
Dissolved Zirconium
Potassium
Sodium
Sodium Absorption Ratio - Calculation
Sulfate

(Dissolved Metals - Water)

TM METALS 081-10; based on EPA 200.8

ICP/MS
Dissolved Aluminum
Dissolved Antimony
Dissolved Arsenic
Dissolved Barium
Dissolved Beryllium
Dissolved Bismuth
Dissolved Boron
Dissolved Cadmium
Dissolved Chromium
Dissolved Cobalt
Dissolved Copper
Dissolved Iron
Dissolved Lead
Dissolved Lithium
Dissolved Molybdenum
Dissolved Nickel
Dissolved Selenium
Dissolved Silver
Dissolved Strontium
Dissolved Thallium
Dissolved Tin
Dissolved Titanium
Dissolved Uranium
Dissolved Vanadium
Dissolved Zirconium

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(Extractable Metals - Water)

WI METAL 080-10; based on APHA 3120 B

ICP

Extractable Aluminum
Extractable Antimony
Extractable Arsenic
Extractable Barium
Extractable Beryllium
Extractable Bismuth
Extractable Boron
Extractable Cadmium
Extractable Calcium
Extractable Chromium
Extractable Cobalt
Extractable Copper
Extractable Iron
Extractable Lead
Extractable Lithium
Extractable Magnesium
Extractable Manganese
Extractable Molybdenum
Extractable Nickel
Extractable Phosphorus
Extractable Selenium
Extractable Silver
Extractable Sulphur
Extractable Thallium
Extractable Tin
Extractable Titanium
Extractable Uranium
Extractable Vanadium
Extractable Zinc
Extractable Zirconium

(Extractable Metals - Water)

TM METALS 081-10; based on EPA 200.8

ICP/MS

Extractable Aluminum
Extractable Barium
Extractable Beryllium
Extractable Boron
Extractable Cadmium
Extractable Chromium
Extractable Cobalt

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Extractable Copper
Extractable Iron
Extractable Lead
Extractable Molybdenum
Extractable Nickel
Extractable Silver
Extractable Strontium
Extractable Thallium
Extractable Tin
Extractable Titanium
Extractable Uranium
Extractable Vanadium
Extractable Zinc
Extractable Zirconium

(Fluoride - Water)

WI WET 028-10; based on APHA 4500 F C

SELECTIVE ION ELECTRODE
Fluoride

(Hydride Metals - Water)

WI METAL 046-10; based on APHA 3114 C

HYDRIDE AA - DIGESTION
Total Antimony
Total Arsenic
Total Selenium

(Ions - Water/IC)

WI WET 012-10; based on APHA 4110 B

ION CHROMATOGRAPHY
Bromide
Chloride
Iodide
Nitrate
Nitrite
Phosphate
Sulfate

(MBAS - Water)

WI WET 069-10; based on APHA 5540 C

COLORIMETRIC
MBAS

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(Mercury - Water)

WI METAL 063-10; based on APHA 3112B

COLD VAPOUR AA - DIGESTION
Mercury

(Nitrogen Kjeldahl - Water)

WI WET 045-10; based on QUICKCHEM METHOD
13-107-06-2-D AND based on ALBERTA
RESEARCH COUNCIL, METHOD 235

AUTO COLOR - DIGESTION
Dissolved Kjeldahl Nitrogen
Total Kjeldahl Nitrogen

(Oil and Grease - Water)

WI OILS 065-10; based on EPA 1664
HEXANE

GRAVIMETRIC - EXTRACTION -

Mineral Oil and Grease
Total Oil and Grease

(Phenols - Water)

WI WET 058-10; based on APHA 5530 D

AUTO COLOR - DISTILLATION
Phenols

(Phosphorus - Water)

WI WET 073-10; based on APHA 4500 P F

AUTO COLOR - DIGESTION
Orthophosphate
Total Dissolved Phosphorus
Total Phosphorus

(Reactive Silica - Water)

WI WET 091-10; based on APHA 4500 SIO2 C

COLORIMETRIC
Reactive Silica

(Solids - Water)

WI WET 055-10; based on APHA 2540 C

GRAVIMETRIC
Total Dissolved Solids

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(Sulphide - Water)

WI WET 057-10; based on APHA 4500 S2-E

COLORIMETRIC
Sulphide

(Suspended Solids - Water)

WI WET 056-10; based on APHA 2540 D,E

GRAVIMETRIC
Fixed Suspended Solids
Fixed Volatile Suspended Solids
Total Suspended Solids

(Tannin and Lignin - Water)

WI WET 061-10; based on APHA 5550 B

COLORIMETRIC
Tannin and Lignin

(Thiocyanate - Water)

WI WET 096-10; based on APHA 4500 CN- M

COLORIMETRIC
Thiocyanate

(Total Metals - Water)

WI METAL 080-10; based on APHA 3120 B; EPA 3015 ICP

Total Aluminum
Total Antimony
Total Arsenic
Total Barium
Total Beryllium
Total Bismuth
Total Boron
Total Cadmium
Total Calcium
Total Chromium
Total Cobalt
Total Copper
Total Iron
Total Lead
Total Lithium
Total Magnesium
Total Manganese
Total Molybdenum
Total Nickel
Total Phosphorus

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Total Selenium
Total Silver
Total Sulphur
Total Thallium
Total Tin
Total Titanium
Total Uranium
Total Vanadium
Total Zinc
Total Zirconium

(Total Metals - Water)

TM METALS 081-10; based on EPA 200.8

ICP/MS - DIGESTION

Total Aluminum
Total Antimony
Total Arsenic
Total Barium
Total Beryllium
Total Boron
Total Cadmium
Total Chromium
Total Cobalt
Total Copper
Total Iron
Total Lead
Total Molybdenum
Total Nickel
Total Selenium
Total Silver
Total Strontium
Total Thallium
Total Tin
Total Titanium
Total Uranium
Total Vanadium
Total Zinc
Total Zirconium

(Turbidity - Water)

WI WET 064-10; based on APHA 2130 B

TURBIDIMETRIC
Turbidity

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(pH - Water)

WI WET 001-10; based on APHA 4500 H+

PC TITRATE
pH

Water (Toxicology)

(Microtox - Water)

TM BIO 037-10/073-10; based on EPS1/RM/24

BIO LUMINESCENCE
Microtox EC 50 (15min.)
Microtox IC50 (15 min)

P. Paladino, P. Eng., Director Conformity Assessment

Date: 2002-12-24

CAEAL 2662, SCC 1003-15/31
Partner: CAEAL-SCC

Contact: Mr. Robert Lessard

Signature

Title

Date



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SCOPE OF ACCREDITATION

Norwest Soil Research Ltd.
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Bay 6, 2712 - 37th Avenue N.E.
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Accredited Laboratory No. 272
(Conforms with requirements of ISO/IEC 17025)

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FAX: (403) 291-2021
E-MAIL: chriss@norwestlabs.com

CLIENTS SERVED: All interested parties.

FIELDS OF TESTING: Biological, Chemical/Physical

PROGRAM SPECIALTY AREA: Environmental

ISSUED ON: 2002-10-28 VALID TO: 2006-07-02

ANIMALS AND PLANTS (AGRICULTURE)

Please see details in non-environmental scope issued separately.

ENVIRONMENTAL AND OCCUPATIONAL HEALTH AND SAFETY

Environmental:

Oil

(PCB - Oil)

PCB002-50; EPA 3580 A/8082

GC/ECD - EXTRACTION
Total PCB

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Soil/Sediment

(Amines and Glycols - Soil)

GLAM-001 - 50; IN HOUSE

GC/FID - EXTRACTION

Diethanolamine
Diethylene glycol
Diisopropanolamine
Ethanolamine
Ethylene glycol
Methyldiethanolamine
Propylene glycol
Sulfolane
Tetraethylene glycol
Triethanolamine
Triethylene glycol

(BTEX - Soil)

BTX002-50; EPA METHOD 5030/8020

GC/FID/PID - PURGE AND TRAP

Benzene
Ethyl Benzene
o-xylene
p-xylene
Toluene

(Coliforms - Soil, Sludges)

MICR-070-50; APHA 922

MPN
Escherichia Coli
Fecal Coliforms
Total Coliforms

(Escherichia Coli. - Soil, Sludges - MPN/API)

MICR-070-50; APHA 9221/9222

MPN/API
Escherichia Coli

(Escherichia coli - Soil, Sludges - MPN/EC-MUG)

MICR-070-50; APHA 9221,9222

MPN/EC-MUG
Escherichia Coli

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(Heterotropic Plate Count - Soil, Sludges - POUR PLATE)

MICR-086-50; APHA 9215

Pour Plate Method
Heterotrophic Plate Count

(PAH - Soil)

PAH002-50; EPA 3540/3545 C/EPA 8270 C

GC/MS - EXTRACTION
Benzo (a) anthracene
Benzo (a) pyrene
Benzo (b) fluoranthene
Benzo (g,h,i) perylene
Benzo (k) fluoranthene
Dibenzo (a,h) anthracene
Fluoranthene
Indeno (1,2,3 - cd) pyrene
Phenanthrene
Pyrene

(PCB - Soil)

PCB003-50; EPA 3540/3545/8082

GC/ECD - EXTRACTION
Total PCB

(Petroleum Hydrocarbons - Soil)

CCME 001-50; CCME-CWS-PHCS-TIER 1

GC/FID - EXTRACTION
Petroleum Hydrocarbons

(Salmonella - Soil, Sludges - ENRICHMENT/PLATING)

MICR 087-50; APHA 9620 B

ENRICHMENT & PLATING
Salmonella

(Salmonella - Soil, Sludges - MSRV)

MICR 125-50; MFLP-75

MSRV Method
Salmonella

(Staphylococcus aureus - Soil, Sludges - DIRECT PLATE COUNT)

MICR-091-50; MF HPB-21

Direct Plate Count
Staphylococcus Aureus

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(Sulphur Reducing Bacteria - Soil, Sludges - MPN)

MICR-101-50; based on APHA 9240 D3a

MOST PROBABLE NUMBER
Sulphur Reducing Bacteria

(Total Extractable Hydrocarbons (TEH) - Soil)

TEH001-50; based on ALTA EN. G108.0

GC/FID - EXTRACTION
Total Extractable Hydrocarbons

(Yeast & Mold - Soil, Sludges - PETRIFILM)

MICR-077-50; MFHPB-32

Petrifilm Method
Mold Count
Yeast & Mold Count
Yeast Count

(Yeast & Mold - Soil, Sludges - POUR PLATE)

MICR-076-50; APHA 9610 B

Pour Plate Method
Mold Count
Yeast & Mold Count
Yeast Count

Soil/Sludge

(Iron Related Bacteria - Soil/Sludge)

MICR-095 - 50; BART METHOD

PRESENCE/ABSENCE
Iron Related Bacteria

Waste

(Leachate - Waste)

EXT -001-50; EPA 1311

EXTRACTION
TCLP Leachate Prep
Zero Headspace Leachate Prep

Water (Microbiology)

(Coliforms - Water)

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MICR-092-50; APHA 9222

MEMBRANE FILTRATION
Escherichia Coli (E. coli)
Fecal Coliforms
Total Coliforms

(Coliforms - Water - COLILERT)

MICR-068-50; APHA 9223 B

COLILERT TEST KIT
Escherichia Coli (E. coli)
Total Coliforms

(Escherichia Coli - Water - MPN)

MICR 070-50; APHA 9221

MOST PROBABLE NUMBER
Escherichia Coli (E. coli)

(Fecal streptococci - Water/Wastewater)

MICR 111 - 50; APHA 9230 C

MEMBRANE FILTRATION
Escherichia Coli (E. coli)
Fecal Coliforms
Total Coliforms

(Heterotrophic Plate Count - Water - MF)

MICR-085-50; APHA 9215 D

MEMBRANE FILTRATION
Heterotrophic Plate Count (HPC)

(Heterotrophic Plate Count - Water - POUR PLATE)

MICR-086-50; APHA 9215

POUR PLATE METHOD
Heterotrophic Plate Count (HPC)

(Iron Related Bacteria - Water)

MICR-095 - 50; BART METHOD

PRESENCE/ABSENCE
Iron Related Bacteria

(Pseudomonas aeruginosa - Water)

MICR 100 - 50; APHA 9213 E

MEMBRANE FILTRATION
Pseudomonas aeruginosa

(Salmonella - Water - ENRICHMENT/PLATING)

MICR 087-50; APHA 9620 B

ENRICHMENT & PLATING

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Salmonella

(Salmonella - Water - MSRV)

MICR 125-50; MFLP-75

MSRV Method
Salmonella

(Staphylococcus aureus - Water - DIRECT PLATE COUNT)

MICR-091-50; APHA 9213 B

Direct Plate Count
Staphylococcus Aureus

(Sulphur Reducing Bacteria - Water - MPN)

MICR-101-50; based on APHA 9240 D3a

MOST PROBABLE NUMBER
Sulphur Reducing Bacteria

(Yeast & Mold - Water - MF)

MICR-098-50; APHA 9610 D

Membrane Filtration
Mold Count
Yeast & Mold Count
Yeast Count

(Yeast & Mold - Water - PETRIFILM)

MICR-077-50; MFHPB-32

Petrifilm Method
Mold Count
Yeast & Mold Count
Yeast Count

(Yeast & Mold - Water - POUR PLATE)

MICR-076-50; APHA 9610 B

Pour Plate Method
Mold Count
Yeast & Mold Count
Yeast Count

Water (Organic)

(Amines and Glycols - Water)

GLAM-001-50; IN HOUSE

GC/FID - EXTRACTION
Diethanolamine
Diethylene glycol

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Diisopropanolamine
Ethanolamine
Ethylene glycol
Methyldiethanolamine
Propylene glycol
Sulfolane
Tetraethylene glycol
Triethanolamine
Triethylene glycol

(BTEX - Water)

BTX001-50; EPA 5030/8020/15

GC/PID/FID - PURGE AND TRAP
Benzene
Ethylbenzene
m/p-xylene
o-xylene
Toluene

(PAH - Water)

PAH001-50; EPA 3510 C/8270 C

GC/MS - EXTRACTION
Benzo (a) anthracene
Benzo (a) pyrene
Benzo (b) fluoranthene
Benzo (g,h,i) perylene
Benzo (k) fluoranthene
Dibenzo (a,h) anthracene
Fluoranthene
Indeno (1,2,3 - cd) pyrene
Phenanthrene
Pyrene

(PCB - Water)

PCB001-50; EPA 3150 (EXTRACTION),
EPA 8082 (ANALYSIS)

GC/ECD - EXTRACTION
Total PCB

(Phenols - Water)

PCP001-50; based on EPA 8041/1653/8270

GC/MS - EXTRACTION
2,3,4,5-Tetrachlorophenol
2,3,4,6-Tetrachlorophenol
2,3,5,6-Tetrachlorophenol
2,4,5-Trichlorophenol

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2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,6-Dichlorophenol
2-Chlorophenol
2-Methyl-4,6-dinitrophenol
2-Methylphenol (o-Cresol)
2-Nitrophenol
3-Methylphenol (m-Cresol)
4-Chloro-3-methylphenol
4-Methylphenol (p-Cresol)
4-Nitrophenol
Pentachlorophenol
Phenol

(Total Extractable Hydrocarbons (TEH) - Water)

TEH002-50; based on ALTA EN. A108.0

GC/FID - EXTRACTION
Total Extractable Hydrocarbons

(VOC - Water)

VOC001-50; EPA 5030 B/8260 B

GC/MS - PURGE AND TRAP
1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-dichloroethylene
1,1-Dichloropropene
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
1,2-dichlorobenzene
1,2-dichloroethane
1,2-Dichloropropane
1,3,5-Trimethylbenzene
1,3-Dichlorobenzene
1,3-Dichloropropane
1,4-dichlorobenzene
2,2-Dichloropropane
2-Butanone (MEK)

2-Chloroethyl Vinyl Ether
2-Chlorotoluene
2-Hexanone
4-Chlorotoluene
4-Methyl-2-Pentanone (MIBK)
Acetone
Acetonitrile
Acrylonitrile
Allyl Chloride
Benzene
Bromobenzene
Bromochloromethane
Bromodichloromethane
Bromoform
Bromomethane
Carbon disulphide
Carbon Tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane
Chloroform
Chloromethane
cis-1,2-Dichloroethene
cis-1,3-Dichloropropene
cis-1,4-Dichloro-2-butene
Dibromofluoromethane
Dibromomethane
Dichlorodifluoromethane
Dichloromethane
Ethyl Methacrylate
Ethylbenzene
hexachlorobutadiene
Hexachloroethane
Iodomethane
Isopropyl Benzene
m/p-xylene
Methacrylonitrile
Methyl methacrylate
Methyl Tertbutyl Ether
n-Butylbenzene
n-Propylbenzene
Naphthalene
o-xylene
p-Isopropyltoluene
Pentachloroethane
Propionitrile

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sec-Butylbenzene
Styrene
tert-Butylbenzene
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene
trans-1,4-Dichloro-2-butene
Trichloroethylene
Trichlorofluoromethane
Vinyl acetate
Vinyl Chloride

P. Paladino, P. Eng., Director Conformity Assessment

Date: 2002-10-28

CAEAL 2763; SCC 1003-15/352
Partner: CAEAL-SCC

Contact: Dr. C. Swyngedouw

Signature

Title

Date

ATTACHMENT 3 - NORWEST LABS

DETECTION LIMITS

Norwest Code	Parameter	Method	Detection Limit (mg/L)
W10	Sulphate	USEPA 200.8	0.2
	Conductivity	APHA 2510 B	1 uS/cm at 25 °C
	pH	APHA 4500-H+-	—
	Chloride	APHA 4500-Cl-E	0.5
	Sodium	USEPA 200.8	0.4
	Potassium	USEPA 200.8	0.4
	Calcium	USEPA 200.8	0.2
	Magnesium	USEPA 200.8	0.2
TW22 – Total Metals	Copper	USEPA 200.8	0.001
	Cadium	USEPA 200.8	0.0005
	Iron	USEPA 200.8	0.1
	Nickel	USEPA 200.8	0.001
	Lead	USEPA 200.8	0.002
	Zinc	USEPA 200.8	0.0006
	Chromium	USEPA 200.8	0.0007
	Sulphur	USEPA 200.8	0.05
	Calcium	USEPA 200.8	0.2
	Sodium	USEPA 200.8	0.4
TW21 – Dissolved Metals	Copper	USEPA 200.8	0.001
	Cadium	USEPA 200.8	0.0005
	Iron	USEPA 200.8	0.1
	Nickel	USEPA 200.8	0.001
	Lead	USEPA 200.8	0.002
	Zinc	USEPA 200.8	0.0006
	Chromium	USEPA 200.8	0.0007
O/G	Oil and Grease	USEPA 1664	5
W50	BOD	APHA 5210 B	4
	TSS	APHA 2540 D,E	5
	pH	APHA 4500-H+	—
NH4	Ammonia	APHA 4500-NH3-G	0.05
CL2	Total Residual (Reactive) Chlorine	APHA 4500-CL-G	0.1
DW3	Faecal Coliforms	APHA 9222D	1

C

C

C